IGCSE Edexcel Syllabus

Worksheets

Questions and Answers Interleaved

Grades 1 to 9

Instructions for use

Clicking on something like this Grade 4 will take you to the Grade 4 clip numbers and titles.

Clicking on something like this Compound Units. . . . . 142 will take you to Worksheet 142.

Clicking on something like this ©MathsWatch | Clip 142 / *Grade 4 questions* will take you back to the contents page.

MathsWatch

Take me to . . .

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Grade 1 Foundation and Higher

MathsWatch

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Grade 6 | Grade 7 | Grade 8 | Grade 9

Grade 2 Foundation and Higher

Grade 2 continued →

MathsWatch

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Grade 2 Foundation and Higher

MathsWatch

Take me to . . .

Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5

Grade 6 | Grade 7 | Grade 8 | Grade 9

Grade 3 Foundation and Higher

Grade 3 continued

MathsWatch

Take me to . . .

Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5

Grade 6 | Grade 7 | Grade 8 | Grade 9

Grade 3 Foundation and Higher

MathsWatch

Take me to . . .

Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5

Grade 6 | Grade 7 | Grade 8 | Grade 9

Grade 4 Foundation and Higher

Grade 4 continued

MathsWatch

Take me to . . .

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Grade 4 Foundation and Higher

MathsWatch

Take me to . . .

Grade 1 Grade 2 Grade 3 Grade 4 Grade 5

Grade 6 Grade 7 Grade 8 Grade 9

Grade 5 Foundation and Higher

MathsWatch

Take me to . . .

Grade 1 | Grade 2 | Grade 3 | Grade 4 | Grade 5

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Grade 6 Higher

MathsWatch

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Grade 7 Higher

Grade 8 Grade 9 Higher

Place Value

1) a) Write the number forty five thousand, two hundred and seventy three in figures.

b) Write the number five thousand, one hundred and three in figures.

c) Write the number three hundred thousand, seven hundred and ninety one in figures.

d) Write the number two and a half million in figures.

e) Write the number one and three quarter million in figures.

2) Write the following numbers in words

a) 1 250

b) 3 502

c) 72 067

d) 192 040

e) 30 000 000

3) a) Write down the value of the 7 in the number 3 752.

b) Write down the value of the 6 in the number 56 025.

c) Write down the value of the 2 in the number 99 723.

d) Write down the value of the 5 in the number 258 610.

e) Write down the value of the 2 in the number 1 253 549.

4) What is the value of the digit 7 in 38.1472?

Choose, and circle, the correct answer from the following:

$\frac{7}{10}$ $\frac{7}{100}$ $\frac{7}{1000}$ $\frac{7}{10000}$

Place Value

1) a) Write the number forty five thousand, two hundred and seventy three in figures. 45 273

b) Write the number five thousand, one hundred and three in figures. 5 103

c) Write the number three hundred thousand, seven hundred and ninety one in figures. 300 791

d) Write the number two and a half million in figures. 2 500 000

e) Write the number one and three quarter million in figures. 1 750 000

2) Write the following numbers in words

a) 1 250 One thousand, two hundred and fifty

b) 3 502 Three thousand, five hundred and two

c) 72 067 Seventy two thousand and sixty seven

d) 192 040 One hundred and ninety two thousand and forty

e) 30 000 000 Thirty million

3) a) Write down the value of the 7 in the number 3 752. 700 or seven hundred

b) Write down the value of the 6 in the number 56 025. 6 000 or six thousand

c) Write down the value of the 2 in the number 99 723. 20 or twenty

d) Write down the value of the 5 in the number 258 610. 50 000 or fifty thousand

e) Write down the value of the 2 in the number 1 253 549. 200 000 or two hundred thousand

4) What is the value of the digit 7 in 38.1472?

Choose, and circle, the correct answer from the following:

$\frac{7}{10}$ $\frac{7}{100}$ $\frac{7}{1000}$ $\frac{7}{10000}$

Ordering Integers

Put these numbers in order, starting with the smallest:

1) 74, 57, 38, 8, 61

2) 39, 84, 11, 128, 24

3) 76, 102, 12, 140, 73

4) 3, –2, –7, 10, –1

5) –3, –11, 1, –5, 7

6) –4, 6, 0, –6, –1

7) 205, 2005, 105, 55, 5005

8) 83, –61, –42, 65, –14

Ordering Integers

Put these numbers in order, starting with the smallest:

1) 74, 57, 38, 8, 61 8, 38, 57, 61, 74

2) 39, 84, 11, 128, 24 11, 24, 39, 84, 128

3) 76, 102, 12, 140, 73 12, 73, 76, 102, 140

4) 3, –2, –7, 10, –1 −7, −2, −1, 3, 10

5) –3, –11, 1, –5, 7 −11, −5, −3, 1, 7

6) –4, 6, 0, –6, –1 −6, −4, −1, 0, 6

7) 205, 2005, 105, 55, 5005 55, 105, 205, 2005, 5005

8) 83, –61, –42, 65, –14 −61, −42, −14, 65, 83

Ordering Decimals

1) Put these amounts of money in order, starting with the smallest:

a) £4.50, £3.82, £4.05, £3.99, £3.54

b) £1.25, £2.41, £1.24, £2.04, £1.99

c) £15.83, £24.18, £13.99, £46.01, £46.10

2) Circle the smallest number: 0.1, 0.09, 0.99, 0.15, 0.11

3) Put these numbers in order, starting with the smallest:

2.01, 2.45, 2.14, 2.006, 2.405

4) Put these numbers in order, starting with the smallest:

0.76, 0.668, 0.608, 0.099, 0.909

5) Put these numbers in order, starting with the smallest:

5.004, 4.889, 4.099, 5.002, 4.095

Ordering Decimals

1) Put these amounts of money in order, starting with the smallest:

a) £4.50, £3.82, £4.05, £3.99, £3.54 £3.54, £3.82, £3.99, £4.05, £4.50

b) £1.25, £2.41, £1.24, £2.04, £1.99 £1.24, £1.25, £1.99, £2.04, £2.41

c) £15.83, £24.18, £13.99, £46.01, £46.10 £13.99, £15.83, £24.18, £46.01, £46.10

2) Circle the smallest number: 0.1, 0.09, 0.99, 0.15, 0.11

3) Put these numbers in order, starting with the smallest:

2.01, 2.45, 2.14, 2.006, 2.405 2.006, 2.01, 2.14, 2.405, 2.45

4) Put these numbers in order, starting with the smallest:

0.76, 0.668, 0.608, 0.099, 0.909 0.099, 0.608, 0.668, 0.76, 0.909

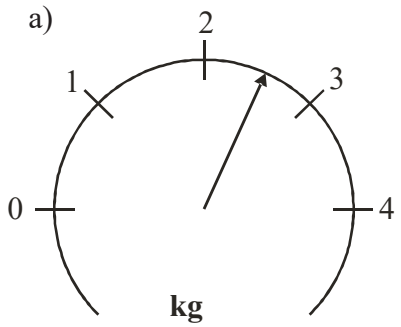
5) Put these numbers in order, starting with the smallest:

5.004, 4.889, 4.099, 5.002, 4.095 4.095, 4.099, 4.889, 5.002, 5.004

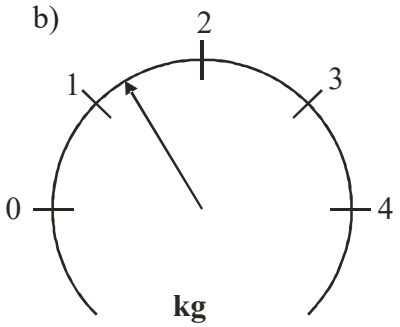
Reading Scales

1) Estimate the reading on each of these scales:

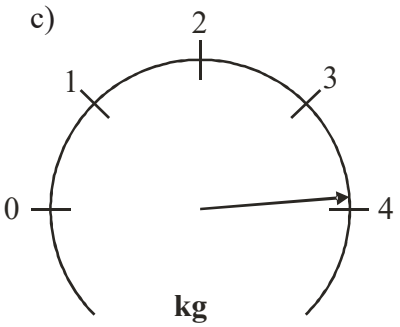
a)



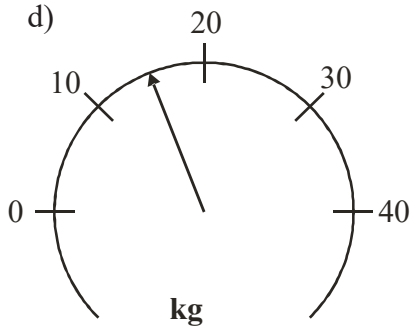
b)



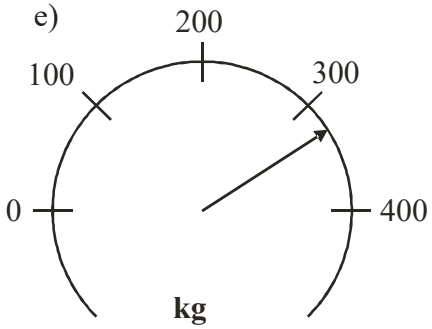
c)



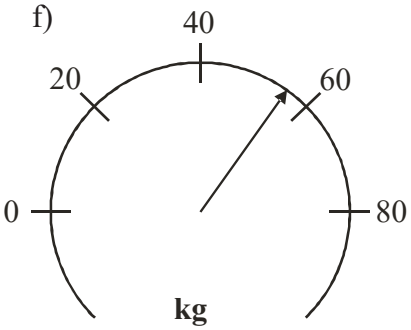
d)



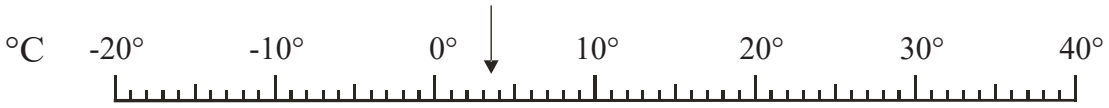
e)



f)



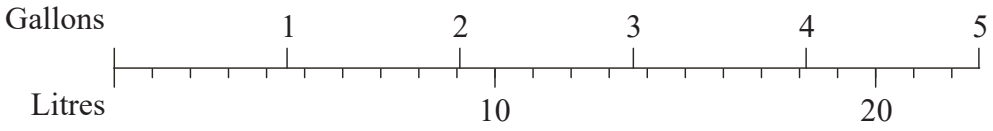
2) This scale shows degrees Centigrade.



a) What temperature is the arrow pointing to?

b) Draw an arrow which points to -17°C.

3) This is a diagram for converting between gallons and litres.



Use the diagram to convert

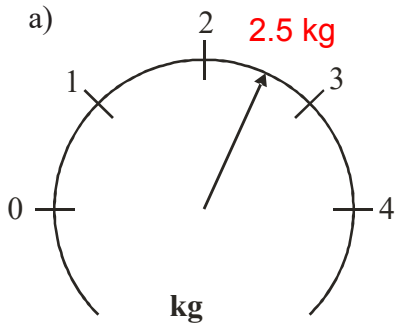
a) 3 gallons to litres.

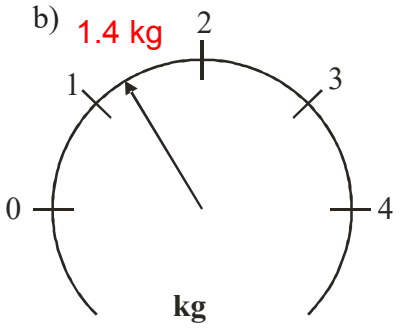
b) 4.5 gallons to litres.

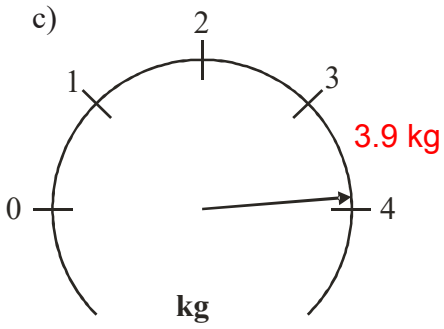
c) 6 litres to gallons.

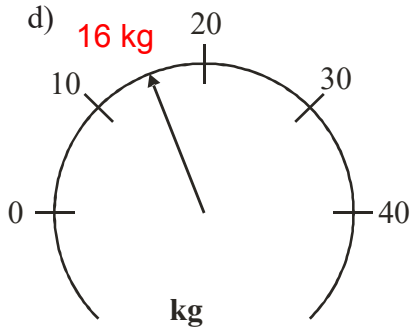
Reading Scales

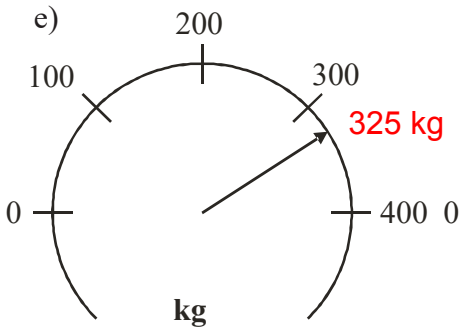
1) Estimate the reading on each of these scales:

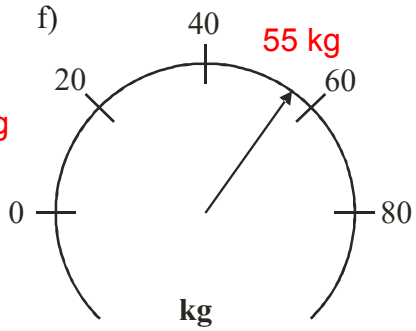
a) 

b) 

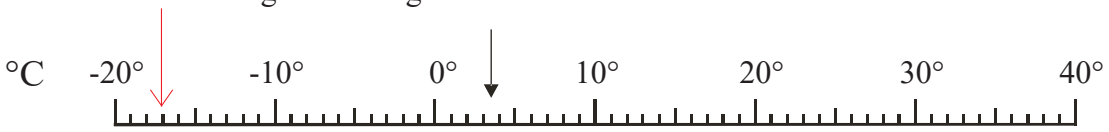
c) 

d) 

e) 

f) 

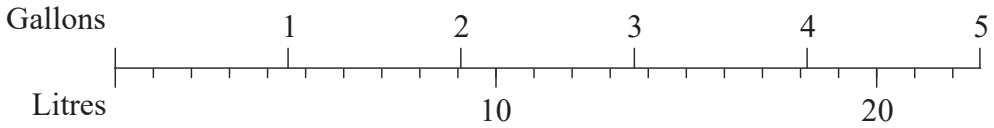
2) This scale shows degrees Centigrade.



a) What temperature is the arrow pointing to? 3.5°C

b) Draw an arrow which points to -17°C.

3) This is a diagram for converting between gallons and litres.



Use the diagram to convert

a) 3 gallons to litres. 13.7 litres

b) 4.5 gallons to litres. 20.5 litres

c) 6 litres to gallons. 1.3 gallons

Simple Mathematical Notation

1) For each mathematical sign, below, write a brief description of the sign.
The first one has already been done.

a) < less than

b) ≥ _____

c) > _____

d) ≤ _____

e) ≠ _____

2) Insert one of the two symbols < or > to make the following statements true:

a) 8 5

b) -4 .... -6

c) 2.08 .... 2.8

d) 8 + 3 .... 2 + 7

e) 2 ?7 .... 5 ?8

3) You must be at least 1.6 m tall to ride on a rollercoaster at Romy Park.
Circle the correct description of this out of the following:

Height < 1.6 m

Height ≤ 1.6 m

Height = 1.6 m

Height ≥ 1.6 m

Height > 1.6 m

Simple Mathematical Notation

1) For each mathematical sign, below, write a brief description of the sign.
The first one has already been done.

a) < less than

b) ≥ more than or equal to

c) > more than

d) ≤ less than or equal to

e) ≠ not equal to

2) Insert one of the two symbols < or > to make the following statements true:

a) 8 > 5

b) -4 > -6

c) 2.08 < 2.8

d) 8 + 3 > 2 + 7

e) 2 ?7 < 5 ?8

3) You must be at least 1.6 m tall to ride on a rollercoaster at Romy Park.
Circle the correct description of this out of the following:

Height < 1.6 m

Height ≤ 1.6 m

Height = 1.6 m

Height ≥ 1.6 m

Height > 1.6 m

Interpreting Real-Life Tables

1) Calculate the difference in hours and minutes between 9.30 am and 2.45 pm.

2) Calculate the difference in hours and minutes between 11 35 and 13 25.

3) The table shows the distances in kilometres between some cities in the USA.

San Francisco	New York	Miami	Los Angeles	Chicago
4827				
4990	2132			
668	4541	4375		
3493	1352	2183	3366	

a) Write down the distance between San Francisco and Miami.

One of the cities in the table is 4541 km from Los Angeles.

b) Write down the name of this city.

c) Write down the name of the city which is furthest from Chicago.

4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

a) Tim catches the 06 06 train from Manchester.

At what time should he expect to arrive at Euston?

b) Jenny arrives at the Stockport train station at 07 00

(i) How long should she expect to wait for a train to Stoke?

(ii) How long should her train journey take?

c) Sarah needs to travel to Euston from Macclesfield.

She has to arrive at Euston before 09 30.

What is the departure time of the latest train she can catch to get there on time?

Interpreting Real-Life Tables

1) Calculate the difference in hours and minutes between 9.30 am and 2.45 pm. 5 hours 15 minutes

2) Calculate the difference in hours and minutes between 11 35 and 13 25. 1 hour 50 minutes

3) The table shows the distances in kilometres between some cities in the USA.

San Francisco				
4827	New York			
4990	2132	Miami		
668	4541	4375	Los Angeles	
3493	1352	2183	3366	Chicago

a) Write down the distance between San Francisco and Miami. 4990 km

One of the cities in the table is 4541 km from Los Angeles.

b) Write down the name of this city. New York

c) Write down the name of the city which is furthest from Chicago. San Francisco

4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

a) Tim catches the 06 06 train from Manchester.

At what time should he expect to arrive at Euston? 08 26

b) Jenny arrives at the Stockport train station at 07 00

(i) How long should she expect to wait for a train to Stoke? 25 minutes

(ii) How long should her train journey take? 29 minutes

c) Sarah needs to travel to Euston from Macclesfield.

She has to arrive at Euston before 09 30.

What is the departure time of the latest train she can catch to get there on time? 07 08

Introduction to Algebraic Conventions

1) Write the following in their simplest forms using algebraic notation:

   a) $r \times 5$

   b) $c \div 4$

   c) $x + x + x + x$

   d) $e \times 1$

2) Write the following using algebraic notation:

   a) I think of a number
   and multiply it by 4.

   b) I think of a number,
   multiply it by 6
   and then add 5.

   c) I think of a number,
   triple it
   and then subtract 7.

3) Write the following using algebraic notation:

   a) I think of a number,
   add 2
   and then multiply the result by 3.

   b) I think of a number,
   subtract 6
   and then divide the result by 2.

4) Write the following using algebraic notation:

   a) I think of a number,
   add 9,
   multiply the result by 4
   and then divide everything by 2.

   b) I think of a number,
   take away 5,
   divide the result by 3
   and then multiply the result by 2.

Introduction to Algebraic Conventions

1) Write the following in their simplest forms using algebraic notation:

a) $r \times 5$ $5r$

b) $c \div 4$ $\frac{c}{4}$

c) $x + x + x + x$ $4x$

d) $e \times 1$ e

2) Write the following using algebraic notation:

a) I think of a number and multiply it by 4. $4x$

b) I think of a number, multiply it by 6 and then add 5. $6x + 5$

c) I think of a number, triple it and then subtract 7. $3x - 7$

3) Write the following using algebraic notation:

a) I think of a number, add 2 and then multiply the result by 3. $3(x + 2)$ or $3x + 6$

b) I think of a number, subtract 6 and then divide the result by 2. $\frac{x - 6}{2}$

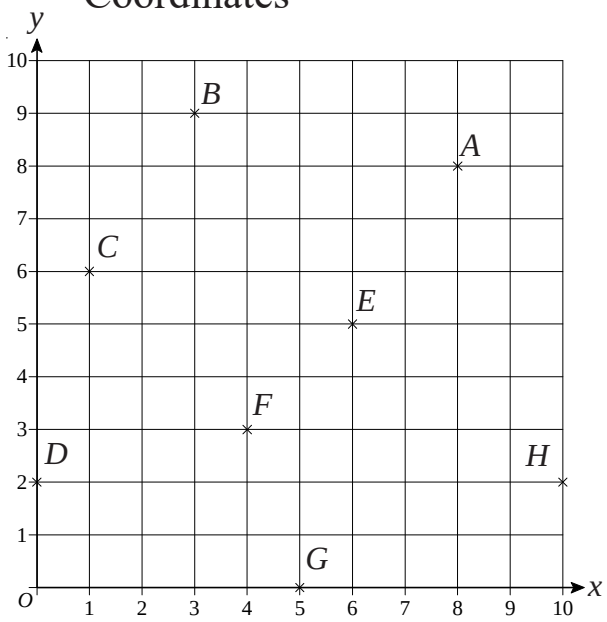
4) Write the following using algebraic notation:

a) I think of a number, add 9, multiply the result by 4 and then divide everything by 2. $\frac{4(x + 9)}{2}$ or $\frac{4x + 36}{2}$

b) I think of a number, take away 5, divide the result by 3 and then multiply the result by 2. $2\left(\frac{x - 5}{3}\right)$

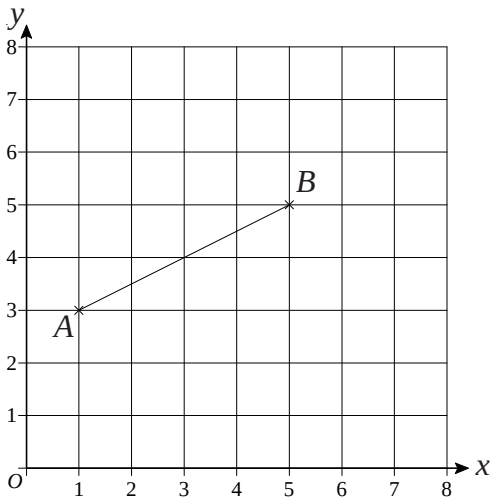
Coordinates

1) Write down the coordinates of the points *A* to *H*.



2) a) Write down the coordinates of: (i) *A* (ii) *B*

b) Write down the coordinates of the midpoint of the line *AB*.



3) Using the pair of axes,

a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

b) Join the points in order, to form a shape and name the shape.

M is the midpoint of the line segment *AC*.

c) Find the coordinates of *M*.

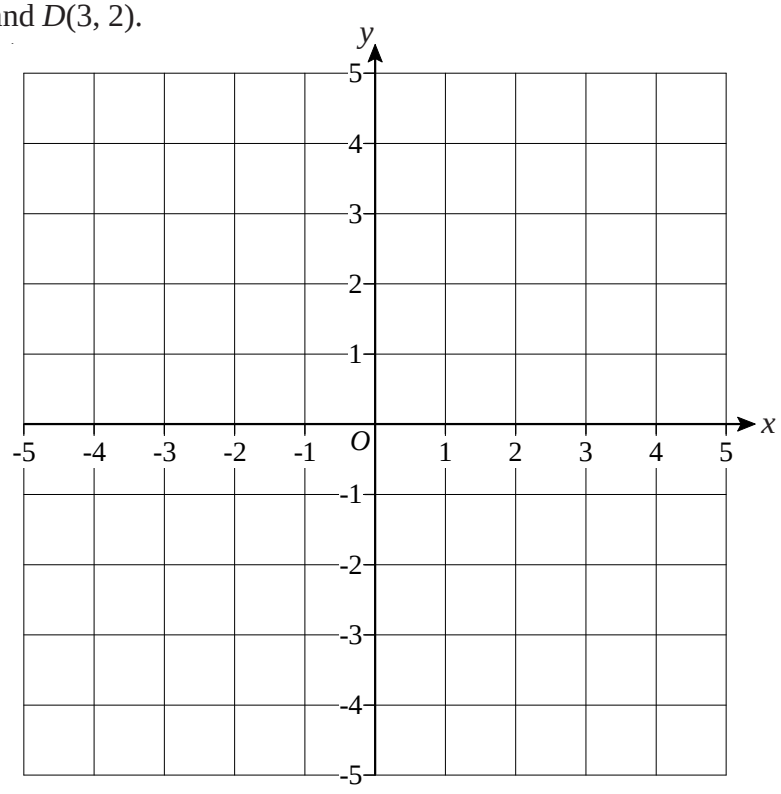
4) Using the same pair of axes,

a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).

b) Join *R* to *S* and *S* to *T*.

RSTU is a kite.

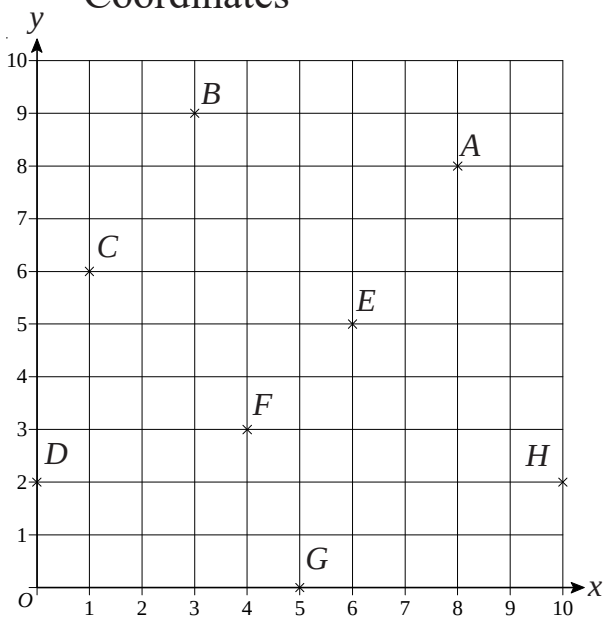
c) Write the coordinates of point *U*.



Coordinates

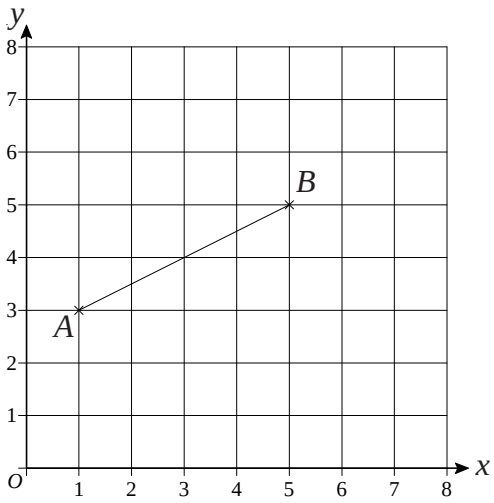
1) Write down the coordinates of the points *A* to *H*.

A (8, 8)
B (3, 9)
C (1, 6)
D (0, 2)
E (6, 5)
F (4, 3)
G (5, 0)
H (10, 2)



2) a) Write down the coordinates of: (i) *A* (1, 3) (ii) *B* (5, 5)

b) Write down the coordinates of the midpoint of the line *AB*. (3, 4)



3) Using the pair of axes,

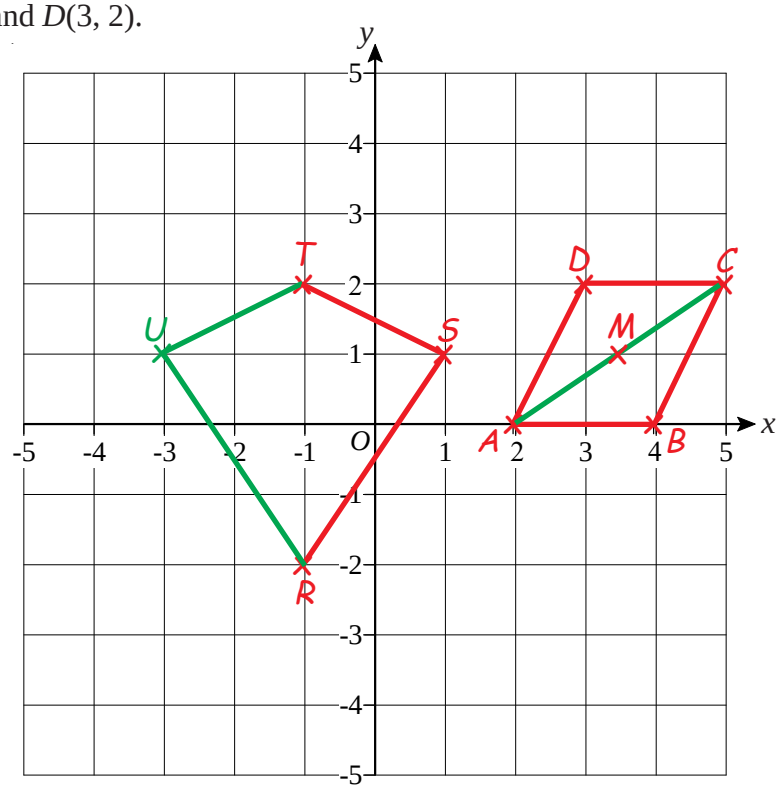
a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

b) Join the points in order, to form a shape and name the shape.

Parallelogram

M is the midpoint of the line segment *AC*.

c) Find the coordinates of *M*. (3.5, 1)



4) Using the same pair of axes,

a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).

b) Join *R* to *S* and *S* to *T*.

RSTU is a kite.

c) Write the coordinates of point *U*.

(-3, 1)

Simple Geometric Definitions

1) Write one or two short sentences which say what the special features are of the triangles listed, below.
The first one has been done for you.

a) An equilateral triangle All the sides are the same length.
All three angles are 60°

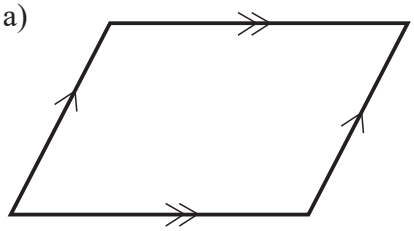
b) A right-angled triangle

c) A scalene triangle

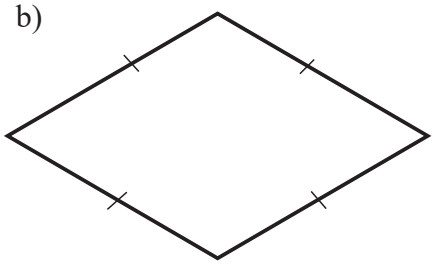
d) An isosceles triangle

2) Next to each of the quadrilaterals, write down its special name.

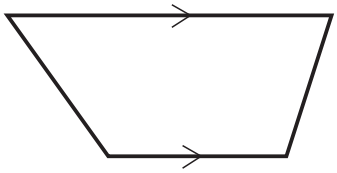
a)



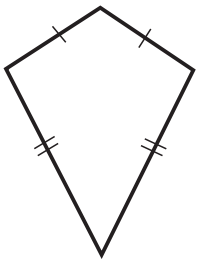
b)



c)



d)



Simple Geometric Definitions

1) Write one or two short sentences which say what the special features are of the triangles listed, below.
The first one has been done for you.

a) An equilateral triangle All the sides are the same length.
All three angles are 60°

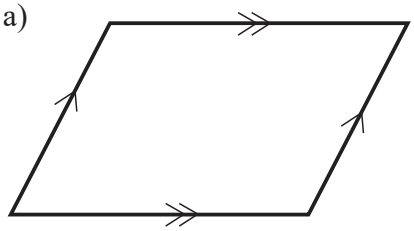
b) A right-angled triangle Has one angle of 90°

c) A scalene triangle All the sides are different lengths.
All the angles are different sizes.

d) An isosceles triangle Two sides are the same length.
Two angles are the same size.

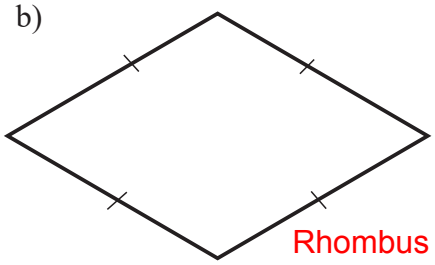
2) Next to each of the quadrilaterals, write down its special name.

a)



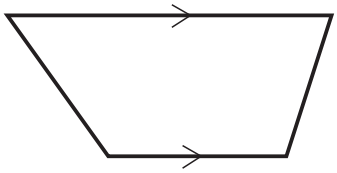
Parallelogram

b)



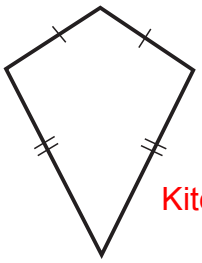
Rhombus

c)



Trapezium

d)

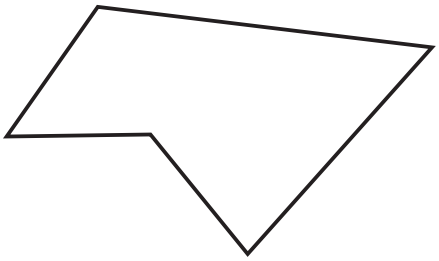


Kite

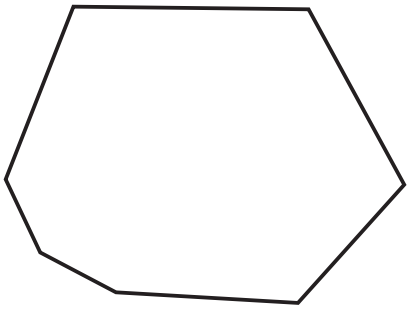
Polygons

1) Next to each of the shapes, write down its name.

a)



b)



2) a) What is the name given to a 10-sided shape?

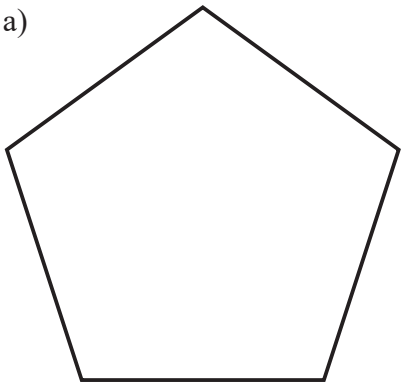
b) What is the name given to an 8-sided shape?

3) To be a regular polygon the shape must have equal _____ and equal _____.

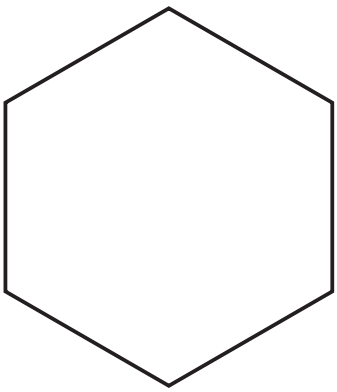
Fill in the blanks.

4) What are the names of these regular polygons?

a)



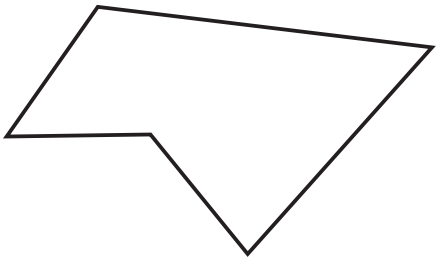
b)



Polygons

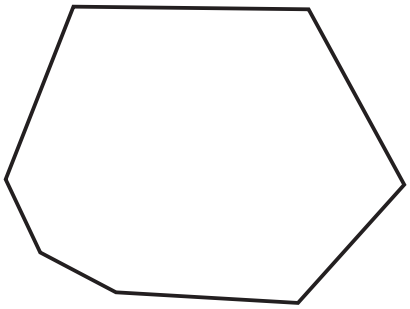
1) Next to each of the shapes, write down its name.

a)



(Irregular) pentagon

b)



(Irregular) heptagon or septagon

2) a) What is the name given to a 10-sided shape? Decagon

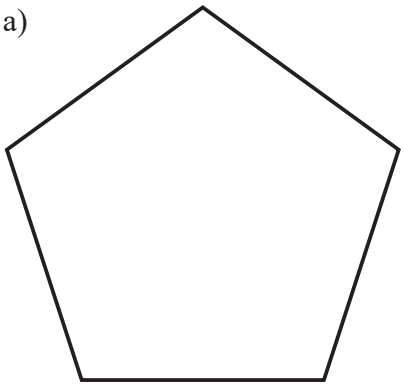
b) What is the name given to an 8-sided shape? Octagon

3) To be a regular polygon the shape must have equal sides and equal angles.

Fill in the blanks.

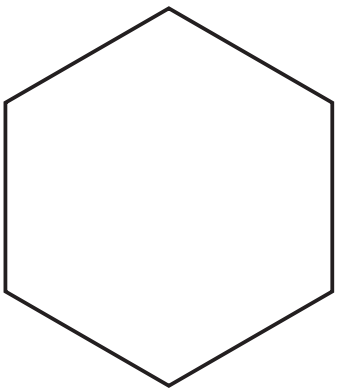
4) What are the names of these regular polygons?

a)



Pentagon

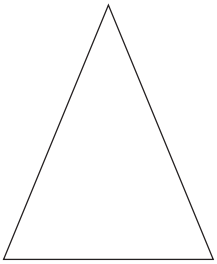
b)

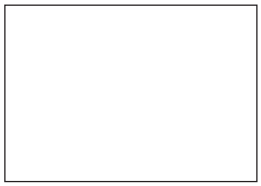


Hexagon

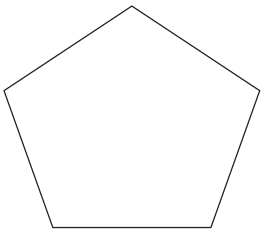
Symmetries

1) Draw all the lines of symmetry on the triangle and the rectangle.

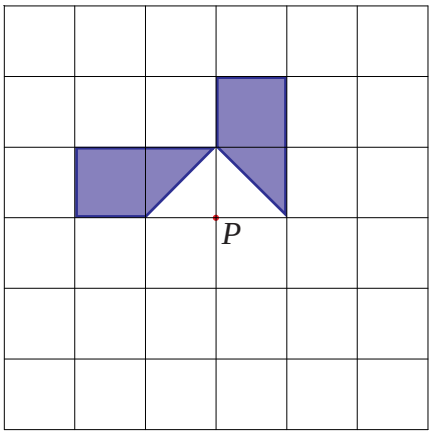




2) What is the order of rotational symmetry of the two shapes below?



3) The diagram below, shows part of a shape.

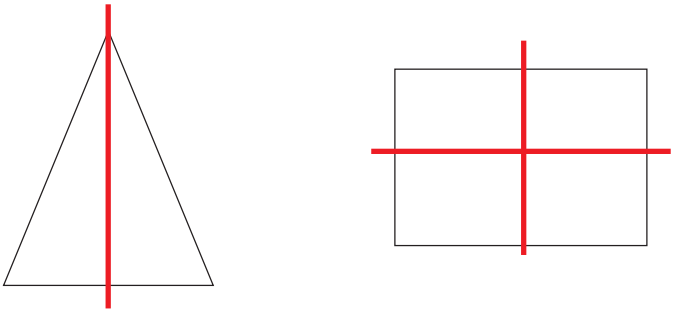


The shape has rotational symmetry of order 4 about point *P*.

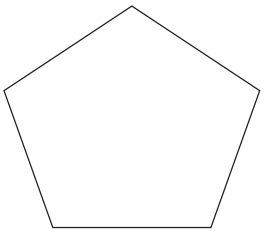
Complete the shape.

Symmetries

1) Draw all the lines of symmetry on the triangle and the rectangle.



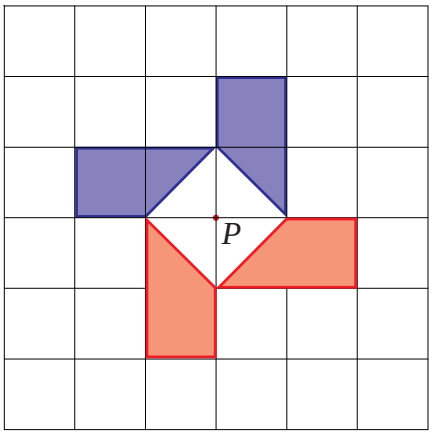
2) What is the order of rotational symmetry of the two shapes below?



5

2

3) The diagram below, shows part of a shape.



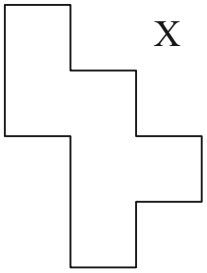
The shape has rotational symmetry of order 4 about point *P*.

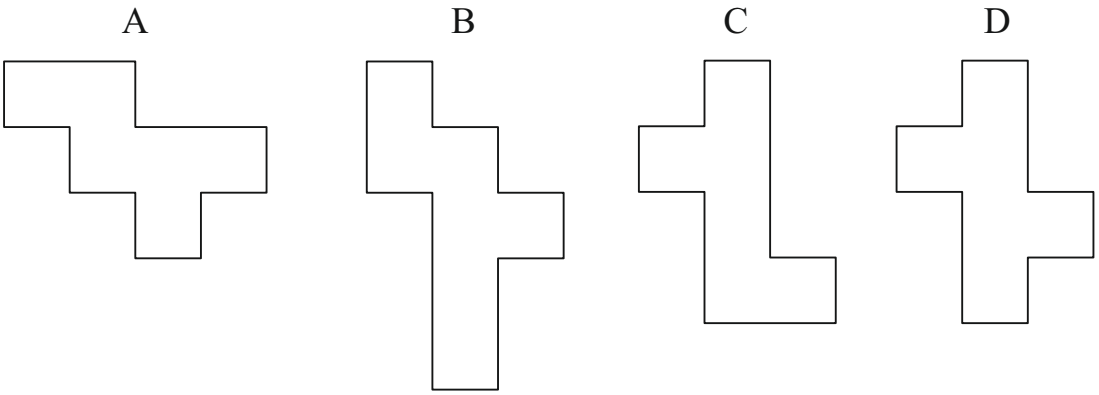
Complete the shape.

Congruent Shapes

1) Which shape is congruent to shape X?

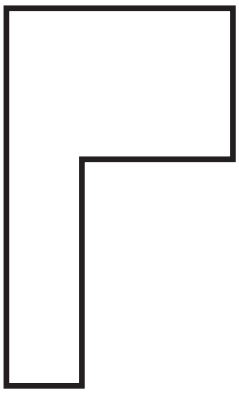
Circle your answer.



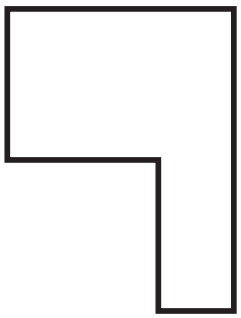


2) Two of these shapes are congruent.
Which are they?

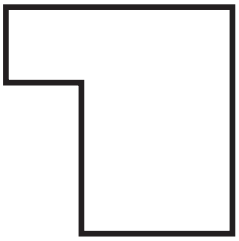
a)



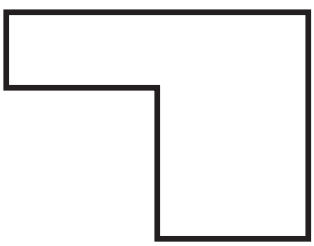
b)



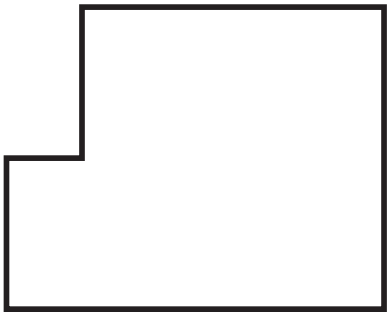
c)



d)



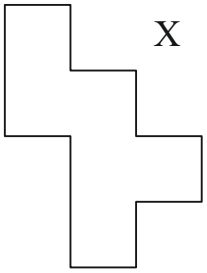
e)

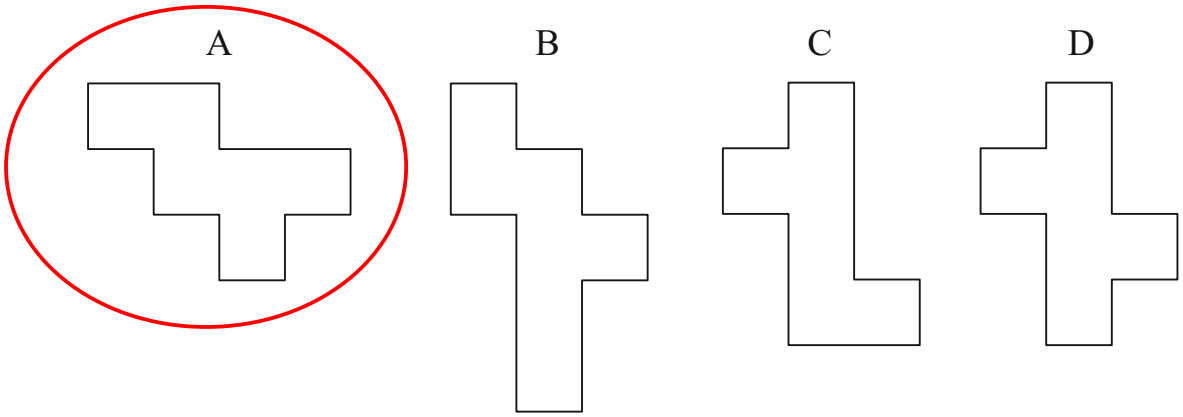


Congruent Shapes

1) Which shape is congruent to shape X?

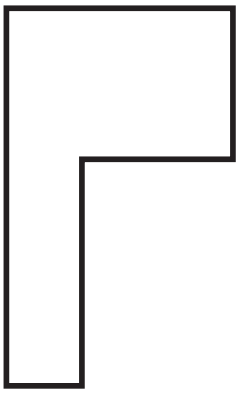
Circle your answer.



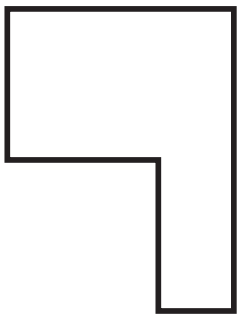


2) Two of these shapes are congruent.
Which are they? b and d

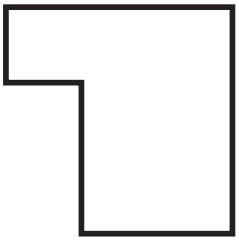
a)



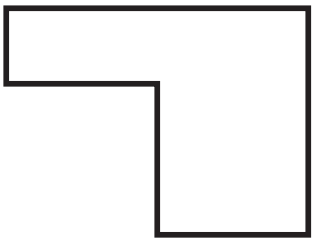
b)



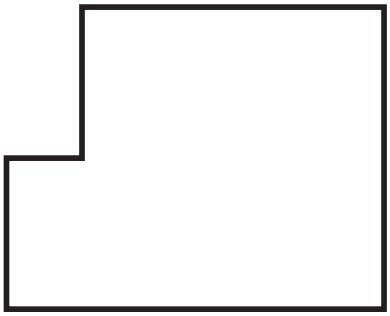
c)



d)



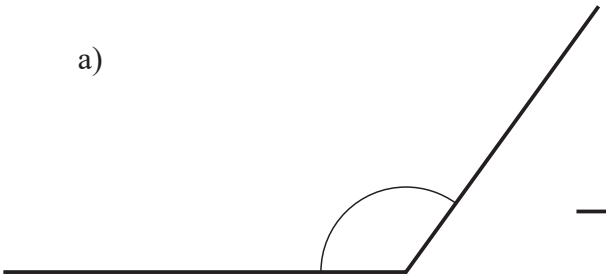
e)



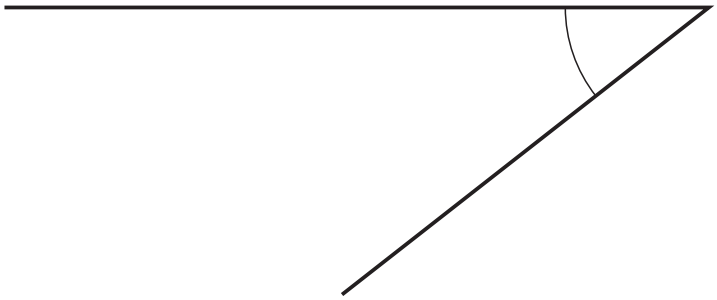
Names of Angles

1) Write the name of each angle, below.

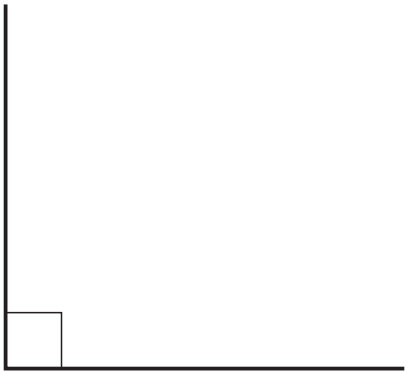
a)



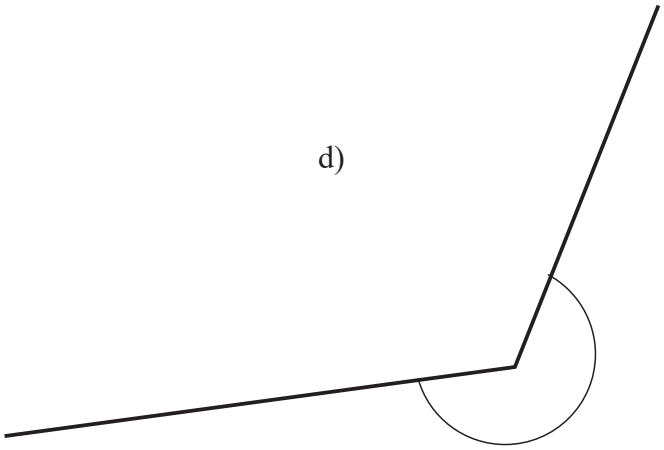
b)



c)



d)



2) Draw a triangle which contains:

a) Three acute angles.

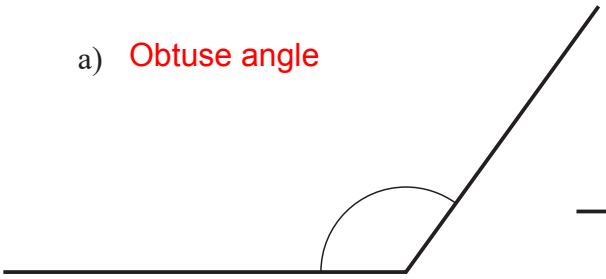
b) One obtuse angle and two acute angles.

c) A right angle.

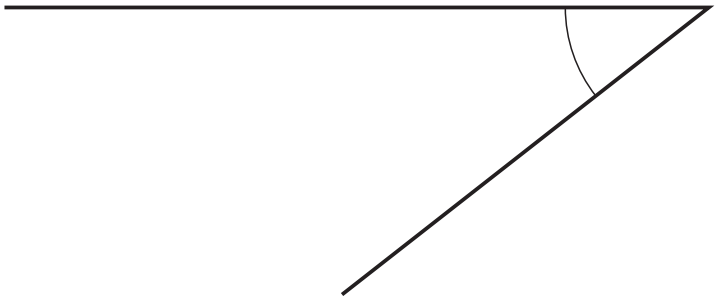
Names of Angles

1) Write the name of each angle, below.

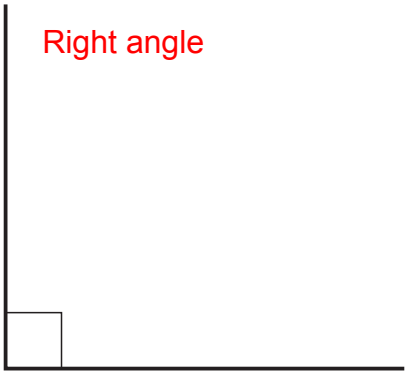
a) Obtuse angle



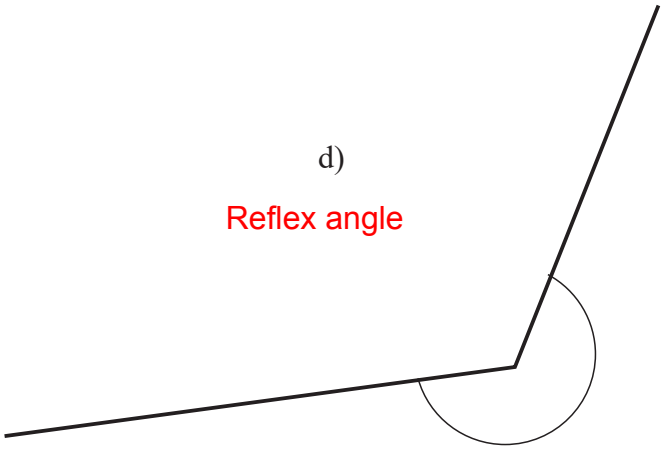
b) Acute angle



c) Right angle



d) Reflex angle



2) Draw a triangle which contains:

a) Three acute angles.

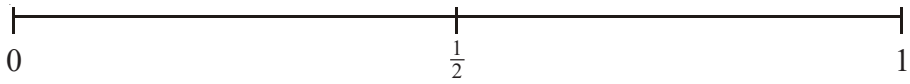
b) One obtuse angle and two acute angles.

c) A right angle.

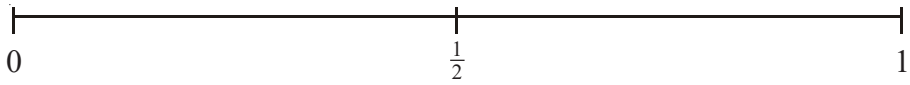
Other triangles are possible

The Probability Scale

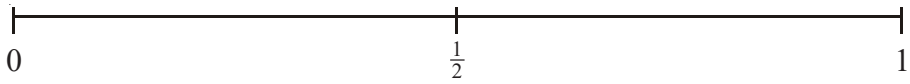
1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.



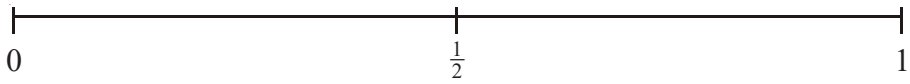
b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.



c) On the probability scale below, mark with a cross (×) the probability that you will get a tail when you flip a fair coin.



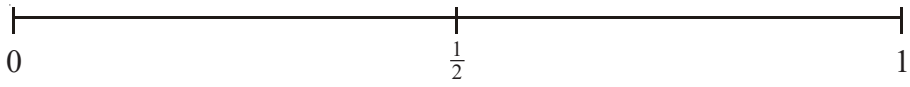
d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.



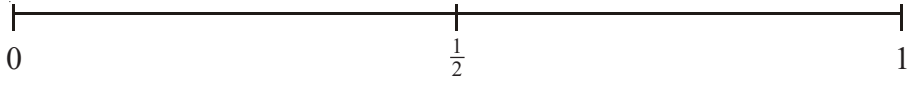
2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

Without looking in the bag, a jelly baby is taken out.

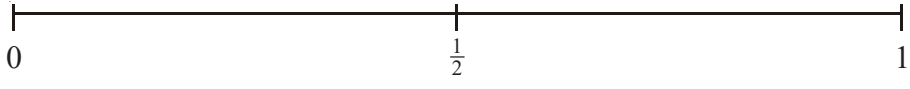
a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.



b) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green or black.

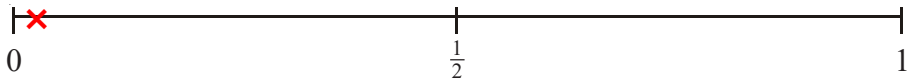


c) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is red or black.

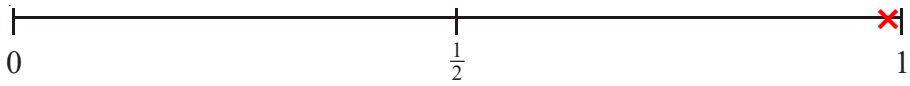


The Probability Scale

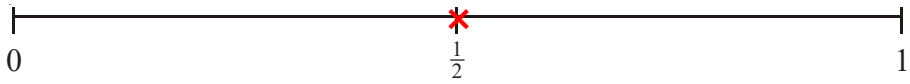
1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.



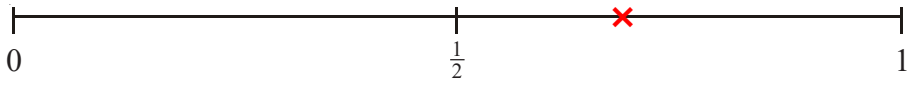
b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.



c) On the probability scale below, mark with a cross (×) the probability that you will get a tail when you flip a fair coin.



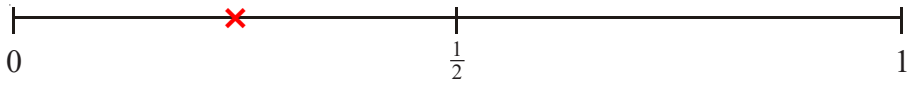
d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.



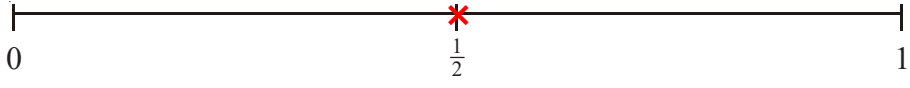
2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

Without looking in the bag, a jelly baby is taken out.

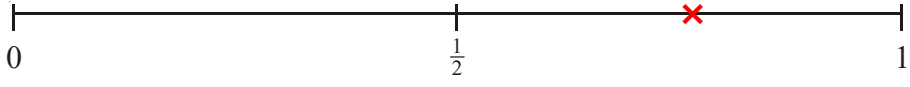
a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.



b) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green or black.



c) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is red or black.



Tally Charts and Bar Charts

1) Here is a list of coins in Yvonne's purse.

5p £1 20p 1p 50p

10p £1 5p 50p 2p

5p 5p £1 1p 5p

£1 2p 5p 5p 2p

Complete the table for this information.

Coin	Tally	Frequency

2) Tim made a note of how many minutes he spent on the internet over the period of a week. His results are as follows:

Monday 20 mins

Tuesday 30 mins

Wednesday 60 mins

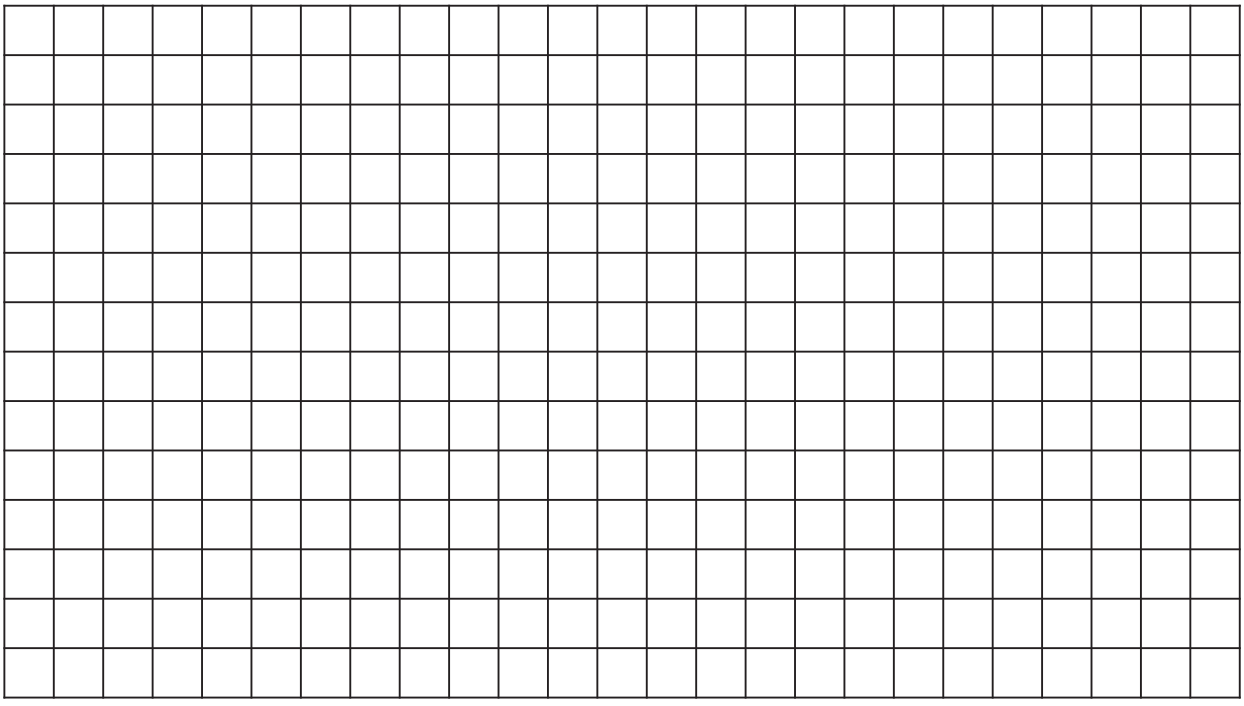
Thursday 40 mins

Friday 20 mins

Saturday 50 mins

Sunday 40 mins

Draw a bar chart to show this information.



Tally Charts and Bar Charts

1) Here is a list of coins in Yvonne's purse.

5p £1 20p 1p 50p

10p £1 5p 50p 2p

5p 5p £1 1p 5p

£1 2p 5p 5p 2p

Complete the table for this information.

Coin	Tally	Frequency
1p	||	2
2p	|||	3
5p	~~||||~~ ||	7
10p	|	1
20p	|	1
50p	||	2
£1	||||	4

2) Tim made a note of how many minutes he spent on the internet over the period of a week. His results are as follows:

Monday 20 mins

Tuesday 30 mins

Wednesday 60 mins

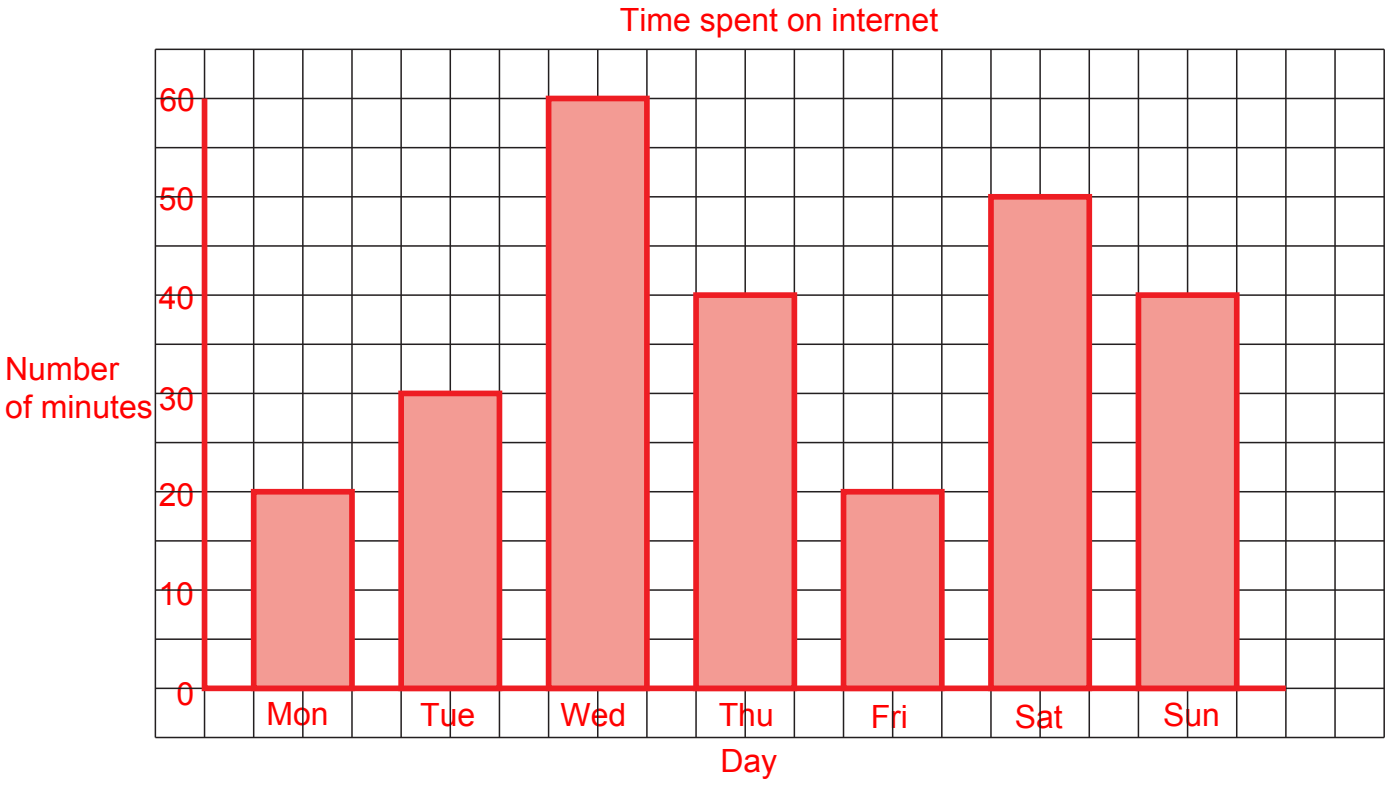
Thursday 40 mins

Friday 20 mins

Saturday 50 mins

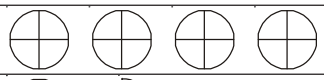
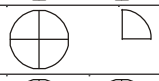
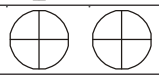
Sunday 40 mins

Draw a bar chart to show this information.



Pictograms

1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	
February	
March	
April	
May	

Key  represents 4 watches.

a) How many watches were sold in January?

b) How many **more** watches were sold in March than in February?

19 watches were sold in April.
14 watches were sold in May.

c) Use this information to complete the pictogram.

2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	
Tuesday	
Wednesday	
Thursday	

Key  represents 10 DVDs.

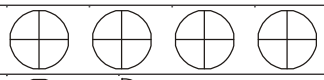
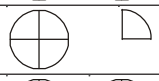
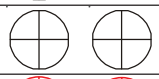
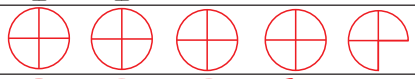
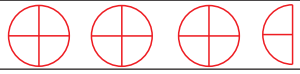
a) How many DVDs were borrowed on
   (i) Monday?
   (ii) Tuesday?

On Wednesday, 50 DVDs were borrowed.
On Thursday, 15 DVDs were borrowed.

b) Show this information in the pictogram.

Pictograms

1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	
February	
March	
April	
May	

Key  represents 4 watches.

a) How many watches were sold in January? 16

b) How many **more** watches were sold in March than in February? 3

19 watches were sold in April.
14 watches were sold in May.

c) Use this information to complete the pictogram.

2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	
Tuesday	
Wednesday	
Thursday	

Key  represents 10 DVDs.

a) How many DVDs were borrowed on
   (i) Monday? 40
   (ii) Tuesday? 25

On Wednesday, 50 DVDs were borrowed.
On Thursday, 15 DVDs were borrowed.

b) Show this information in the pictogram.

Adding Integers and Decimals

1) a) $\begin{array}{r} 42 \\ +26 \\ \hline \end{array}$ b) $\begin{array}{r} 57 \\ +38 \\ \hline \end{array}$ c) $\begin{array}{r} 96 \\ +75 \\ \hline \end{array}$

2) a) $\begin{array}{r} 637 \\ +961 \\ \hline \end{array}$ b) $\begin{array}{r} 983 \\ +442 \\ \hline \end{array}$ c) $\begin{array}{r} 969 \\ +758 \\ \hline \end{array}$

3) a) 452 + 38 b) 147 + 763 c) 813 + 431 + 38

4) There were two exhibitions at the NEC one Sunday.
3816 people went to one of the exhibitions and 13427 people went to the other exhibition.
How many people went to the NEC, in total, on the Sunday?

5) a) 2.6 + 1.2 b) 2.74 + 6.81 c) 45.36 + 6.81

6) a) 23 + 1.5 b) 13.6 + 38 c) 13.2 + 17.82

Adding Integers and Decimals

1) a) $\begin{array}{r} 42 \\ +26 \\ \hline 68 \end{array}$ b) $\begin{array}{r} 57 \\ +38 \\ \hline 95 \end{array}$ c) $\begin{array}{r} 96 \\ +75 \\ \hline 171 \end{array}$

2) a) $\begin{array}{r} 637 \\ +961 \\ \hline 1598 \end{array}$ b) $\begin{array}{r} 983 \\ +442 \\ \hline 1425 \end{array}$ c) $\begin{array}{r} 969 \\ +758 \\ \hline 1727 \end{array}$

3) a) 452 + 38
490
b) 147 + 763
910
c) 813 + 431 + 38
1282

4) There were two exhibitions at the NEC one Sunday.
3816 people went to one of the exhibitions and 13427 people went to the other exhibition.
How many people went to the NEC, in total, on the Sunday? 17243

5) a) 2.6 + 1.2
3.8
b) 2.74 + 6.81
9.55
c) 45.36 + 6.81
52.17

6) a) 23 + 1.5
24.5
b) 13.6 + 38
51.6
c) 13.2 + 17.82
31.02

Subtracting Integers and Decimals

1) a) $\begin{array}{r} 78 \\ -\,42 \\ \hline \end{array}$ b) $\begin{array}{r} 74 \\ -\,26 \\ \hline \end{array}$ c) $\begin{array}{r} 62 \\ -\,39 \\ \hline \end{array}$

2) a) $\begin{array}{r} 485 \\ -\,291 \\ \hline \end{array}$ b) $\begin{array}{r} 773 \\ -\,486 \\ \hline \end{array}$ c) $\begin{array}{r} 100 \\ -\,\;34 \\ \hline \end{array}$

3) a) 653 – 48 b) 362 – 183 c) 2000 – 461

4) There were two films showing at a cinema one Saturday.
One of the films was shown in a large room and the other was in a smaller room.
The film in the larger room was watched by a total of 3562 people.
The film in the smaller room was watched by 1671 people.
How many more people saw the film in the larger room?

5) a) 782 + 426 – 278 b) 8162 + 1149 – 799

Subtracting Integers and Decimals

1) a) $\begin{array}{r} 78 \\ -\,42 \\ \hline 36 \end{array}$ b) $\begin{array}{r} 74 \\ -\,26 \\ \hline 48 \end{array}$ c) $\begin{array}{r} 62 \\ -\,39 \\ \hline 23 \end{array}$

2) a) $\begin{array}{r} 485 \\ -\,291 \\ \hline 194 \end{array}$ b) $\begin{array}{r} 773 \\ -\,486 \\ \hline 287 \end{array}$ c) $\begin{array}{r} 100 \\ -\,\;34 \\ \hline 66 \end{array}$

3) a) 653 – 48
605

b) 362 – 183
179

c) 2000 – 461
1539

4) There were two films showing at a cinema one Saturday.
One of the films was shown in a large room and the other was in a smaller room.
The film in the larger room was watched by a total of 3562 people.
The film in the smaller room was watched by 1671 people.
How many more people saw the film in the larger room? 1891

5) a) 782 + 426 – 278
930

b) 8162 + 1149 – 799
8512

Multiplying Integers

1) Work out

a) 13×18

b) 135×27

c) 116×41

d) 264×43

e) 326×24

f) 281×59

g) 286×48

h) 428×34

i) 461×45

2) "MathsWatch Travel" has 36 coaches.
Each of these coaches can carry 53 passengers.
How many passengers in total can all the coaches carry?

3) "MathsWatch Tours" has a plane that will carry 47 passengers.
To fly from Manchester to Lyon, each passenger pays £65
Work out the total amount that the passengers pay.

4) A Science textbook costs £13.
Mr Jones buys a class set of 34 books.
How much do they cost him?

5) A graphical calculator costs £18.
How much would 43 calculators cost?

Multiplying Integers

1) Work out

a) 13 × 18 234

b) 135 × 27 3645

c) 116 × 41 4756

d) 264 × 43 11352

e) 326 × 24 7824

f) 281 × 59 16579

g) 286 × 48 13728

h) 428 × 34 14552

i) 461 × 45 20745

2) "MathsWatch Travel" has 36 coaches.
Each of these coaches can carry 53 passengers.
How many passengers in total can all the coaches carry? 1908

3) "MathsWatch Tours" has a plane that will carry 47 passengers.
To fly from Manchester to Lyon, each passenger pays £65
Work out the total amount that the passengers pay. £3055

4) A Science textbook costs £13.
Mr Jones buys a class set of 34 books.
How much do they cost him? £442

5) A graphical calculator costs £18.
How much would 43 calculators cost? £774

Dividing Integers

1) Work out

a) 325 ÷ 5

b) 448 ÷ 8

c) 221 ÷ 13

d) 377 ÷ 29

e) 27 ÷ 6

f) 123 ÷ 15

g) 75 ÷ 4

h) 135 ÷ 20

i) 381 ÷ 12

2) A box can hold 19 books.
Work out how many boxes will be needed to hold 646 books.

3) The distance from Glasgow to Paris is 1290 km.
A flight from Glasgow to Paris lasts 3 hours.
Given that

$$\textit{Average speed} = \frac{\textit{Distance}}{\textit{Time}}$$

Work out the average speed of the aeroplane in km/h.

4) Pencils cost 25p each.
Mr Smith spends £15 on pencils.
Work out the number of pencils he gets.

5) Yesterday, Gino was paid £19.61 for delivering pizzas.
He is paid 53p for each pizza he delivers.
Work out how many pizzas Gino delivered yesterday.

6) Emma sold 38 teddy bears for a total of £513
She sold each teddy bear for the same price.
Work out the price at which Emma sold each teddy bear.

7)

Canal boat for hire
£1855.00
for 14 days

Work out the cost per day of hiring the canal boat.

8) A teacher has £539 to spend on books.
Each book costs £26
How many books can the teacher buy?

9) John delivers large wooden crates with his van.
The weight of each crate is 68 kg.
The greatest weight the van can hold is 980 kg.
Work out the greatest number of crates that the van can hold.

Dividing Integers

1) Work out

a) 325 ÷ 5 65

b) 448 ÷ 8 56

c) 221 ÷ 13 17

d) 377 ÷ 29 13

e) 27 ÷ 6 4.5

f) 123 ÷ 15 8.2

g) 75 ÷ 4 18.75

h) 135 ÷ 20 6.75

i) 381 ÷ 12 31.75

2) A box can hold 19 books.
Work out how many boxes will be needed to hold 646 books. 34

3) The distance from Glasgow to Paris is 1290 km.
A flight from Glasgow to Paris lasts 3 hours.
Given that

$$\textit{Average speed} = \frac{\textit{Distance}}{\textit{Time}}$$

Work out the average speed of the aeroplane in km/h. 430 km/h

4) Pencils cost 25p each.
Mr Smith spends £15 on pencils.
Work out the number of pencils he gets. 60

5) Yesterday, Gino was paid £19.61 for delivering pizzas.
He is paid 53p for each pizza he delivers.
Work out how many pizzas Gino delivered yesterday. 37

6) Emma sold 38 teddy bears for a total of £513
She sold each teddy bear for the same price.
Work out the price at which Emma sold each teddy bear. £13.50

7)

Canal boat for hire
£1855.00
for 14 days

Work out the cost per day of hiring the canal boat. £132.50

8) A teacher has £539 to spend on books.
Each book costs £26
How many books can the teacher buy? 20

9) John delivers large wooden crates with his van.
The weight of each crate is 68 kg.
The greatest weight the van can hold is 980 kg.
Work out the greatest number of crates that the van can hold. 14

Inverse Operations

1) a) Which operation is the inverse of 'add'?

b) Which operation is the inverse of 'divide'?

2) Use inverse operations to complete the second equation each time.

a) $12 + 6 = 18 \longrightarrow \square \ ? \ \square = 12$

b) $28 \ ? 13 = 15 \longrightarrow \square + \square = 28$

3) Use inverse operations to complete the second equation each time.

a) $14 \times 2 = 28 \longrightarrow \square \div \square = 14$

b) $60 \div 12 = 5 \longrightarrow \square \times \square = 60$

4) Use inverse operations to complete the second equation each time.

a) $19 + 13 = 32 \longrightarrow \square \ \square = 19$

b) $46 \ ? 13 = 33 \longrightarrow \square \ \square = 46$

5) Use inverse operations to complete the second equation each time.

a) $28 \div 7 = 4 \longrightarrow \square \ \square = 28$

b) $16 \times 3 = 48 \longrightarrow \square \ \square = 3$

Inverse Operations

1) a) Which operation is the inverse of 'add'? Subtract

b) Which operation is the inverse of 'divide'? Multiply

2) Use inverse operations to complete the second equation each time.

a) $12 + 6 = 18 \longrightarrow \boxed{18} \; ? \; \boxed{6} = 12$

b) $28 \; ?13 = 15 \longrightarrow \boxed{15} + \boxed{13} = 28$

3) Use inverse operations to complete the second equation each time.

a) $14 \times 2 = 28 \longrightarrow \boxed{28} \div \boxed{2} = 14$

b) $60 \div 12 = 5 \longrightarrow \boxed{5} \times \boxed{12} = 60$

4) Use inverse operations to complete the second equation each time.

a) $19 + 13 = 32 \longrightarrow \boxed{32} - \boxed{13} = 19$

b) $46 \; ?13 = 33 \longrightarrow \boxed{33} + \boxed{13} = 46$

5) Use inverse operations to complete the second equation each time.

a) $28 \div 7 = 4 \longrightarrow \boxed{4} \times \boxed{7} = 28$

b) $16 \times 3 = 48 \longrightarrow \boxed{48} \div \boxed{16} = 3$

Negatives in Real Life

1) At midnight, the temperature was -7°C.
By 7am the next morning, the temperature had increased by 6°C.
a) Work out the temperature at 7am the next morning.

At midday, the temperature was 3°C.
b) Work out the difference between the temperature at midday and the temperature at midnight.

c) Work out the temperature which is halfway between -7°C and 3°C.

2) The table below gives the temperature recorded on 25th December in 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6 °C	0 °C	-15 °C	-23 °C	3 °C	5 °C	18 °C

a) Which city recorded the lowest temperature?

b) What is the difference in temperature between New York and Paris?

c) What is the difference in temperature between Cairo and Edinburgh?

d) The temperature in Madrid was 9°C lower than in Rome.
What was the temperature in Madrid?

e) The temperature in Mexico City was 6°C higher than in New York.
What was the temperature in Mexico City?

3) The table shows the temperature on the surface of each of five planets.

Planet	**Temperature**
Venus	210 °C
Jupiter	-150 °C
Saturn	-180 °C
Neptune	-210 °C
Pluto	-230 °C

a) Work out the difference in temperature between Jupiter and Pluto.

b) Work out the difference in temperature between Venus and Saturn.

c) Which planet has a temperature 30°C lower than Saturn?

The temperature on Mars is 90°C higher than the temperature on Jupiter.
d) Work out the temperature on Mars.

Negatives in Real Life

1) At midnight, the temperature was -7°C.
By 7am the next morning, the temperature had increased by 6°C.
a) Work out the temperature at 7am the next morning. -1°C

At midday, the temperature was 3°C.
b) Work out the difference between the temperature at midday and the temperature at midnight. 10°C

c) Work out the temperature which is halfway between -7°C and 3°C. -2°C

2) The table below gives the temperature recorded on 25th December in 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6 °C	0 °C	-15 °C	-23 °C	3 °C	5 °C	18 °C

a) Which city recorded the lowest temperature? Moscow

b) What is the difference in temperature between New York and Paris? 18°C

c) What is the difference in temperature between Cairo and Edinburgh? 24°C

d) The temperature in Madrid was 9°C lower than in Rome.
What was the temperature in Madrid? -4°C

e) The temperature in Mexico City was 6°C higher than in New York.
What was the temperature in Mexico City? -9°C

3) The table shows the temperature on the surface of each of five planets.

Planet	**Temperature**
Venus	210 °C
Jupiter	-150 °C
Saturn	-180 °C
Neptune	-210 °C
Pluto	-230 °C

a) Work out the difference in temperature between Jupiter and Pluto. 80°C

b) Work out the difference in temperature between Venus and Saturn. 390°C

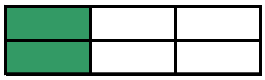
c) Which planet has a temperature 30°C lower than Saturn? Neptune

The temperature on Mars is 90°C higher than the temperature on Jupiter.
d) Work out the temperature on Mars. -60°C

Introduction to Fractions

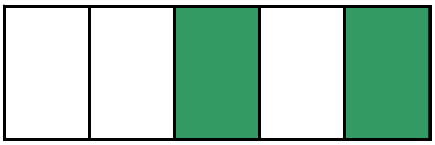
1) What fraction of each of the following shapes is shaded?

a)

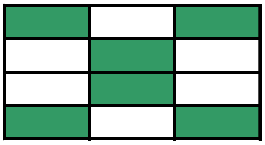


b)

c)

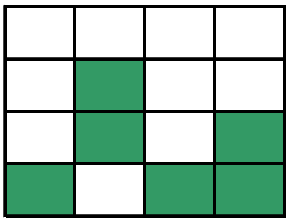


d)



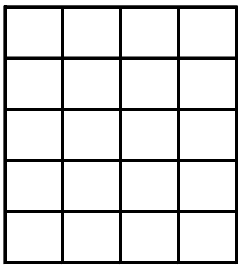
e)

f)

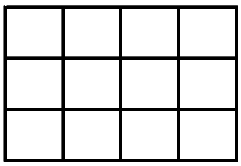


2) Shade the given fraction in the following grids.

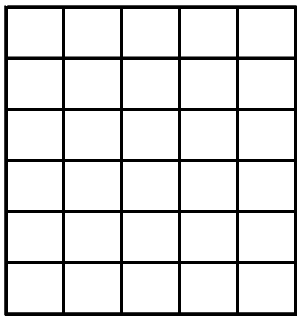
$\frac{3}{5}$



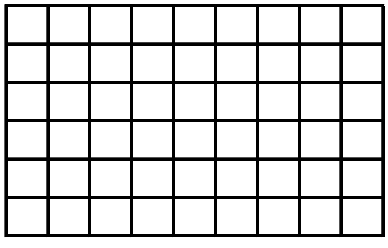
$\frac{1}{4}$

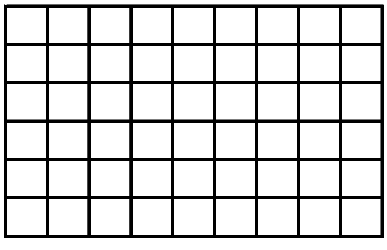


$\frac{4}{6}$



3) Which of these fractions is the smallest? $\frac{5}{6}$ *or* $\frac{7}{9}$ *(use the grids to help)*

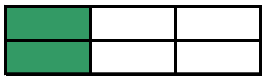




Introduction to Fractions

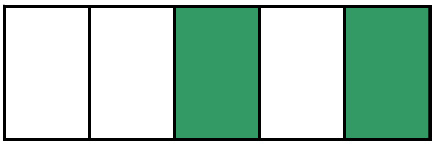
1) What fraction of each of the following shapes is shaded?

a) $\frac{1}{3}$

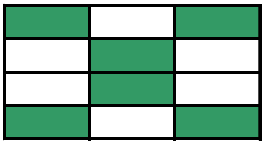


b) $\frac{1}{3}$

c) $\frac{2}{5}$

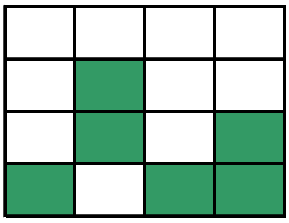


d) $\frac{1}{2}$



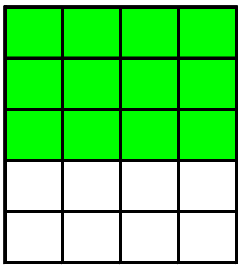
e) $\frac{3}{5}$

f) $\frac{3}{8}$

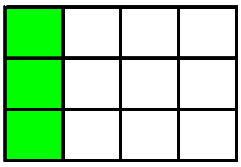


2) Shade the given fraction in the following grids.

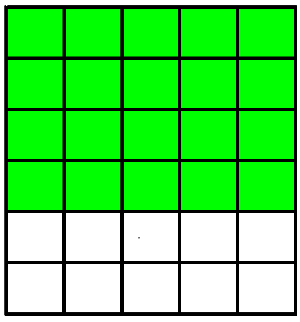
$\frac{3}{5}$



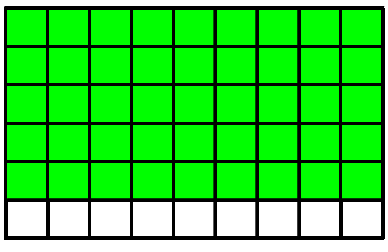
$\frac{1}{4}$

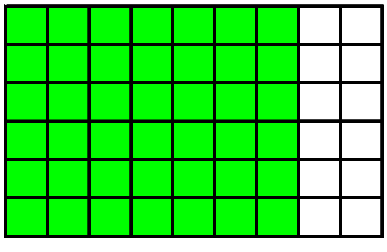


$\frac{4}{6}$



3) Which of these fractions is the smallest? $\frac{5}{6}$ *or* $\frac{7}{9}$ *(use the grids to help)*





Introduction to Fractions
Mixed Numbers

1) Write the following as improper fractions in their simplest form.

a) $3\frac{1}{4}$

b) $1\frac{2}{5}$

c) $5\frac{2}{3}$

d) $4\frac{5}{8}$

2) Write the following as mixed numbers in their simplest form.

a) $\frac{8}{5}$

b) $\frac{11}{4}$

c) $\frac{16}{5}$

d) $\frac{73}{10}$

3) Write the following as improper fractions in their simplest form.

a) $7\frac{1}{13}$

b) $15\frac{2}{5}$

c) $23\frac{3}{4}$

d) $9\frac{5}{12}$

4) Write the following as mixed numbers in their simplest form.

a) $\frac{66}{5}$

b) $\frac{87}{4}$

c) $\frac{54}{11}$

d) $\frac{98}{13}$

Introduction to Fractions
Mixed Numbers

1) Write the following as improper fractions in their simplest form.

a) $3\frac{1}{4}$ $\frac{13}{4}$

b) $1\frac{2}{5}$ $\frac{7}{5}$

c) $5\frac{2}{3}$ $\frac{17}{3}$

d) $4\frac{5}{8}$ $\frac{37}{8}$

2) Write the following as mixed numbers in their simplest form.

a) $\frac{8}{5}$ $1\frac{3}{5}$

b) $\frac{11}{4}$ $2\frac{3}{4}$

c) $\frac{16}{5}$ $3\frac{1}{5}$

d) $\frac{73}{10}$ $7\frac{3}{10}$

3) Write the following as improper fractions in their simplest form.

a) $7\frac{1}{13}$ $\frac{92}{13}$

b) $15\frac{2}{5}$ $\frac{77}{5}$

c) $23\frac{3}{4}$ $\frac{95}{4}$

d) $9\frac{5}{12}$ $\frac{113}{12}$

4) Write the following as mixed numbers in their simplest form.

a) $\frac{66}{5}$ $13\frac{1}{5}$

b) $\frac{87}{4}$ $21\frac{3}{4}$

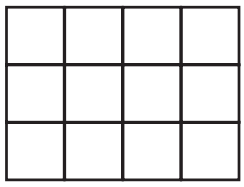
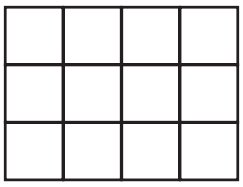
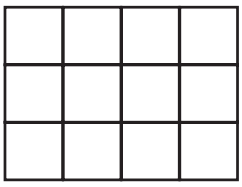
c) $\frac{54}{11}$ $4\frac{10}{11}$

d) $\frac{98}{13}$ $7\frac{7}{13}$

Equivalent Fractions

1) Each of the grids below has a fraction written at the side of it.

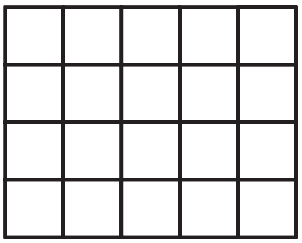
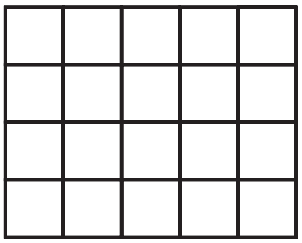
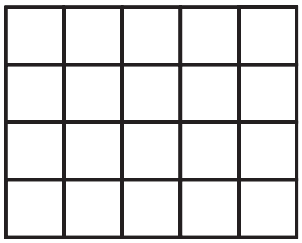
a) Shade the grids to show these fractions.

$\frac{8}{12}$  $\frac{4}{6}$  $\frac{2}{3}$ 

b) What do you notice about how many little squares are shaded in each grid?

2) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\frac{2}{5}$  $\frac{4}{10}$  $\frac{8}{20}$ 

b) What do you notice about how many little squares are shaded in each grid?

3) Find the missing values in these equivalent fractions.

$$\frac{1}{2} = \frac{2}{\square} = \frac{3}{\square} = \frac{4}{\square}$$

4) Find the missing values in these equivalent fractions.

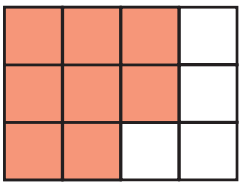
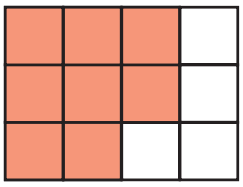
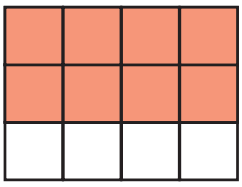
$$\frac{2}{5} = \frac{6}{\square} = \frac{\square}{30} = \frac{14}{\square}$$

5) How do you know that $\frac{3}{7}$ is not equivalent to $\frac{25}{56}$?

Equivalent Fractions

1) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

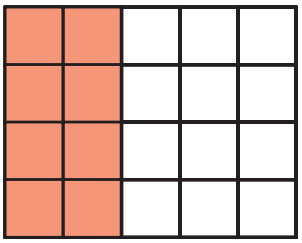
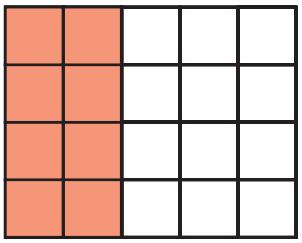
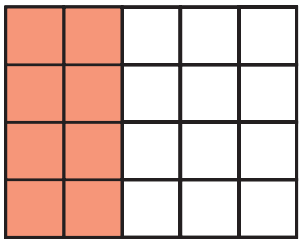
$\frac{8}{12}$  $\frac{4}{6}$  $\frac{2}{3}$ 

b) What do you notice about how many little squares are shaded in each grid?

It is always the same - 8 squares.

2) Each of the grids below has a fraction written at the side of it.

a) Shade the grids to show these fractions.

$\frac{2}{5}$  $\frac{4}{10}$  $\frac{8}{20}$ 

b) What do you notice about how many little squares are shaded in each grid?

It is always the same - 8 squares.

3) Find the missing values in these equivalent fractions.

$$\frac{1}{2} = \frac{2}{\boxed{4}} = \frac{3}{\boxed{6}} = \frac{4}{\boxed{8}}$$

4) Find the missing values in these equivalent fractions.

$$\frac{2}{5} = \frac{6}{\boxed{15}} = \frac{\boxed{12}}{30} = \frac{14}{\boxed{35}}$$

5) How do you know that $\frac{3}{7}$ is not equivalent to $\frac{25}{56}$?

You have to multiply 7 by 8 to get 56, but when you mulitply 3 by 8 you get 24, not 25.

Simplification of Fractions

1) Write the following fractions in their simplest forms

a) $\frac{2}{4}$

b) $\frac{5}{10}$

c) $\frac{4}{6}$

d) $\frac{6}{9}$

e) $\frac{12}{15}$

f) $\frac{8}{12}$

g) $\frac{15}{20}$

2) Write the following fractions in their simplest forms

a) $\frac{9}{30}$

b) $\frac{14}{18}$

c) $\frac{7}{49}$

d) $\frac{48}{72}$

e) $\frac{60}{75}$

f) $\frac{15}{27}$

g) $\frac{72}{96}$

Simplification of Fractions

1) Write the following fractions in their simplest forms

a) $\frac{2}{4}$ $\frac{1}{2}$

b) $\frac{5}{10}$ $\frac{1}{2}$

c) $\frac{4}{6}$ $\frac{2}{3}$

d) $\frac{6}{9}$ $\frac{2}{3}$

e) $\frac{12}{15}$ $\frac{4}{5}$

f) $\frac{8}{12}$ $\frac{2}{3}$

g) $\frac{15}{20}$ $\frac{3}{4}$

2) Write the following fractions in their simplest forms

a) $\frac{9}{30}$ $\frac{3}{10}$

b) $\frac{14}{18}$ $\frac{7}{9}$

c) $\frac{7}{49}$ $\frac{1}{7}$

d) $\frac{48}{72}$ $\frac{2}{3}$

e) $\frac{60}{75}$ $\frac{4}{5}$

f) $\frac{15}{27}$ $\frac{5}{9}$

g) $\frac{72}{96}$ $\frac{3}{4}$

Half-Way Values

1) Write down the number which is in the middle of:

a) 3 and 9

b) 12 and 28

c) 11 and 22

d) 17 and 32

e) 72 and 108

f) 1 and 100

g) –6 and 2

2) Write down the number which is in the middle of:

a) 2.4 and 6.8

b) 5.9 and 12.5

c) -5 and 7.8

3) a) 7 is in the middle of 3 and which other number?

b) 16 is in the middle of 9 and which other number?

c) 2.4 is in the middle of 1.1 and which other number?

Half-Way Values

1) Write down the number which is in the middle of:

a) 3 and 9 6

b) 12 and 28 20

c) 11 and 22 16.5

d) 17 and 32 24.5

e) 72 and 108 90

f) 1 and 100 50.5

g) –6 and 2 −2

2) Write down the number which is in the middle of:

a) 2.4 and 6.8 4.6

b) 5.9 and 12.5 9.2

c) -5 and 7.8 1.4

3) a) 7 is in the middle of 3 and which other number? 11

b) 16 is in the middle of 9 and which other number? 23

c) 2.4 is in the middle of 1.1 and which other number? 3.7

Factors, Multiples and Primes

1) Write the factors of

a) 6 b) 16 c) 18 d) 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 5 12

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

4) Write the first four multiples of

a) 3 b) 5 c) 10 d) 15

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 22 32 40 48 54

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

7) List the first five prime numbers

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

a) The prime numbers

b) The factors of 18

c) The multiples of 3

Factors, Multiples and Primes

1) Write the factors of

a) 6 — 1, 2, 3, 6

b) 16 — 1, 2, 4, 8, 16

c) 18 — 1, 2, 3, 6, 9, 18

d) 30 — 1, 2, 3, 5, 6, 10, 15, 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 ~~8~~ 6 12

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30
40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

1, 2, 5, 10

4) Write the first four multiples of

a) 3 — 3, 6, 9, 12

b) 5 — 5, 10, 15, 20

c) 10 — 10, 20, 30, 40

d) 15 — 15, 30, 45, 60

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 ~~22~~ 24 32 40 48 ~~54~~ 56

The above list contains 2 mistakes.
Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20
10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

20

7) List the first five prime numbers

2, 3, 5, 7, 11

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

a) The prime numbers 11, 3, 2, 19

b) The factors of 18 18, 1, 9, 3, 2

c) The multiples of 3 18, 21, 24, 9, 3, 12

Introduction to Powers/Indices

1) Write the following using indices:
eg. $3 \times 3 \times 3 \times 3 = 3^4$

a) $2 \times 2 \times 2 \times 2$

b) $4 \times 4 \times 4$

c) $5 \times 5 \times 5 \times 5 \times 5 \times 5$

d) $12 \times 12 \times 12 \times 12 \times 12$

e) 3.6×3.6

f) $5.2 \times 5.2 \times 5.2$

2) Write each of the following as a single power:
eg. $5^2 \times 5^4 = 5^6$

a) $6^2 \times 6^3$

b) $7^4 \times 7^2$

c) $9^3 \times 9^6$

d) $5^3 \times 5$

e) $2^9 \times 2^3$

f) $7.2^3 \times 7.2^2$

3) Write each of the following as a single power:
eg. $7^5 \div 7^2 = 7^3$

a) $9^5 \div 9^3$

b) $6^9 \div 6^5$

c) $11^7 \div 11^2$

d) $\dfrac{7^8}{7^3}$

e) $\dfrac{3^6}{3}$

f) $\dfrac{8^{15}}{8^4}$

4) Write each of the following as a single power:

eg. $\dfrac{7^3 \times 7^8}{7^6} = \dfrac{7^{11}}{7^6} = 7^5$

a) $\dfrac{4^7 \times 4^3}{4^6}$

b) $\dfrac{9^2 \times 9^6}{9^4}$

5) Match together cards with the same answer

5^7	$5^{10} \div 5^6$	$5^6 \times 5^2$	5^3	5^2
5^8	5×5	$\dfrac{5^2 \times 5^4}{5^3}$	$5^2 \times 5^5$	5^4

Introduction to Powers/Indices

1) Write the following using indices:
eg. $3 \times 3 \times 3 \times 3 = 3^4$

a) $2 \times 2 \times 2 \times 2$ 2^4

b) $4 \times 4 \times 4$ 4^3

c) $5 \times 5 \times 5 \times 5 \times 5 \times 5$ 5^6

d) $12 \times 12 \times 12 \times 12 \times 12$ 12^5

e) 3.6×3.6 3.6^2

f) $5.2 \times 5.2 \times 5.2$ 5.2^3

2) Write each of the following as a single power:
eg. $5^2 \times 5^4 = 5^6$

a) $6^2 \times 6^3$ 6^5

b) $7^4 \times 7^2$ 7^6

c) $9^3 \times 9^6$ 9^9

d) $5^3 \times 5$ 5^4

e) $2^9 \times 2^3$ 2^{12}

f) $7.2^3 \times 7.2^2$ 7.2^5

3) Write each of the following as a single power:
eg. $7^5 \div 7^2 = 7^3$

a) $9^5 \div 9^3$ 9^2

b) $6^9 \div 6^5$ 6^4

c) $11^7 \div 11^2$ 11^5

d) $\dfrac{7^8}{7^3}$ 7^5

e) $\dfrac{3^6}{3}$ 3^5

f) $\dfrac{8^{15}}{8^4}$ 8^{11}

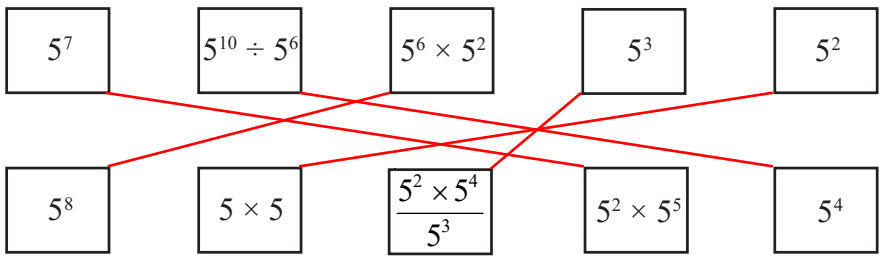
4) Write each of the following as a single power:

eg. $\dfrac{7^3 \times 7^8}{7^6} = \dfrac{7^{11}}{7^6} = 7^5$

a) $\dfrac{4^7 \times 4^3}{4^6}$ 4^4

b) $\dfrac{9^2 \times 9^6}{9^4}$ 9^4

5) Match together cards with the same answer



Multiply and Divide by Powers of 10

1) Multiply the following numbers by 10, 100 and 1000:

		×10	**×100**	**×1000**
e.g.	*21*	*210*	*2100*	*21000*
	9			
	63			
	845			
	3.65			
	0.4			
	1.324			

---

2) Divide the following numbers by 10, 100 and 1000:

		÷10	**÷100**	**÷1000**
e.g.	*21*	*2.1*	*0.21*	*0.021*
	9			
	63			
	845			
	3.65			
	0.4			
	1.324			

---

3) Work out the following:

3 × 100 =

65 × 10 =

17 ÷ 10 =

359 × 10 =

0.5 ÷ 100 =

2.3 × 1000 =

42 ÷ 100 =

3582 ÷ 100 =

0.9 × 10 =

3.645 × 100 =

88 ÷ 1000 =

39.62 × 1000 =

Multiply and Divide by Powers of 10

1) Multiply the following numbers by 10, 100 and 1000:

		×10	**×100**	**×1000**
e.g.	*21*	*210*	*2100*	*21000*
	9	90	900	9 000
	63	630	6 300	63 000
	845	8 450	84 500	845 000
	3.65	36.5	365	3 650
	0.4	4	40	400
	1.324	13.24	132.4	1 324

---

2) Divide the following numbers by 10, 100 and 1000:

		÷10	**÷100**	**÷1000**
e.g.	*21*	*2.1*	*0.21*	*0.021*
	9	0.9	0.09	0.009
	63	6.3	0.63	0.063
	845	84.5	8.45	0.845
	3.65	0.365	0.0365	0.00365
	0.4	0.04	0.004	0.0004
	1.324	0.1324	0.01324	0.001324

---

3) Work out the following:

$3 \times 100 =$ 300

$65 \times 10 =$ 650

$17 \div 10 =$ 1.7

$359 \times 10 =$ 3 590

$0.5 \div 100 =$ 0.005

$2.3 \times 1000 =$ 2 300

$42 \div 100 =$ 0.42

$3582 \div 100 =$ 35.82

$0.9 \times 10 =$ 9

$3.645 \times 100 =$ 364.5

$88 \div 1000 =$ 0.088

$39.62 \times 1000 =$ 39 620

Rounding to the Nearest 10, 100, etc

1) Round these numbers to the nearest 10:

   a) 26

   b) 62

   c) 75

   d) 231

   e) 797

   f) 5 842

   g) 9 875

   h) 13 758

2) Round these numbers to the nearest 100:

   a) 78

   b) 223

   c) 549

   d) 1 450

   e) 1 382

   f) 4 537

   g) 9 193

   h) 17 625

3) Round these numbers to the nearest 1000:

   a) 850

   b) 1 455

   c) 3 230

   d) 7 500

   e) 8 455

   f) 9 690

   g) 12 390

   h) 28 910

Rounding to the Nearest 10, 100, etc

1) Round these numbers to the nearest 10:

a) 26 30

b) 62 60

c) 75 80

d) 231 230

e) 797 800

f) 5 842 5 840

g) 9 875 9 880

h) 13 758 13 760

2) Round these numbers to the nearest 100:

a) 78 100

b) 223 200

c) 549 500

d) 1 450 1 500

e) 1 382 1 400

f) 4 537 4 500

g) 9 193 9 200

h) 17 625 17 600

3) Round these numbers to the nearest 1000:

a) 850 1 000

b) 1 455 1 000

c) 3 230 3 000

d) 7 500 8 000

e) 8 455 8 000

f) 9 690 10 000

g) 12 390 12 000

h) 28 910 29 000

Rounding to Decimal Places

1) Round the following numbers to 1 decimal place

a) 13.681 b) 344.7234 c) 0.76133

2) Round the following numbers to 2 decimal places

a) 58.8136 b) 14.22731 c) 203.86884

3) Round the following numbers to 1 decimal place

a) 48.9732 b) 163.9299 c) 19.952

4) Round the following numbers to 2 decimal places

a) 10.697 b) 8.993 c) 14.9964

5) Work out the answer to 2.6882×14.71728 and give your answer correct to 2 decimal places.

6) Work out the answer to $64.2 \div 5.7$ and give your answer correct to 1 decimal place.

7) Work out the answer to 4.74^2 giving your answer correct to 2 decimal places.

8) Find the answer to $\sqrt{17.3}$ giving your answer correct to 1 decimal place.

Rounding to Decimal Places

1) Round the following numbers to 1 decimal place

a) 13.681
13.7

b) 344.7234
344.7

c) 0.76133
0.8

2) Round the following numbers to 2 decimal places

a) 58.8136
58.81

b) 14.22731
14.23

c) 203.86884
203.87

3) Round the following numbers to 1 decimal place

a) 48.9732
49.0

b) 163.9299
163.9

c) 19.952
20.0

4) Round the following numbers to 2 decimal places

a) 10.697
10.70

b) 8.993
8.99

c) 14.9964
15.00

5) Work out the answer to 2.6882×14.71728 and give your answer correct to 2 decimal places. 39.56

6) Work out the answer to $64.2 \div 5.7$ and give your answer correct to 1 decimal place. 11.3

7) Work out the answer to 4.74^2 giving your answer correct to 2 decimal places. 22.47

8) Find the answer to $\sqrt{17.3}$ giving your answer correct to 1 decimal place. 4.2

Introduction to Ratio

1) Write the following ratios in their simplest form:

a) 6 : 9

b) 10 : 5

c) 7 : 21

d) 4 : 24

e) 12 : 40

f) 4 : 2 : 8

g) 18 : 63 : 9

2) Write the missing value in these equivalent ratios:

a) 3 : 5 = 12 : ☐

b) 4 : 9 = ☐ : 27

c) ☐ : 7 = 16 : 14

3) The ratio of girls to boys in a class is 4 : 5.

What fraction of the class are girls?

4) A model of a plane is made using a scale of 1 : 5.

a) If the real length of the plane is 20 m, what is the length of the model?

b) If the wings of the model are 1.2 m long, what is the actual length of the wings on the plane?

Introduction to Ratio

1) Write the following ratios in their simplest form:

a) 6 : 9 — 2 : 3

b) 10 : 5 — 2 : 1

c) 7 : 21 — 1 : 3

d) 4 : 24 — 1 : 6

e) 12 : 40 — 3 : 10

f) 4 : 2 : 8 — 2 : 1 : 4

g) 18 : 63 : 9 — 2 : 7 : 1

2) Write the missing value in these equivalent ratios:

a) 3 : 5 = 12 : 20

b) 4 : 9 = 12 : 27

c) 8 : 7 = 16 : 14

3) The ratio of girls to boys in a class is 4 : 5.

What fraction of the class are girls? $\frac{4}{9}$

4) A model of a plane is made using a scale of 1 : 5.

a) If the real length of the plane is 20 m, what is the length of the model? 4 m

b) If the wings of the model are 1.2 m long, what is the actual length of the wings on the plane? 6 m

Using Ratio for Recipe Questions

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes
250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs.

Kate makes 12 pancakes.

b) Work out how much flour she needs.

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people
180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs.

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs.

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people
800 g of pineapple
4 egg whites
½ lemon
100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

a) Work out how much caster sugar he uses.

Sid makes a pineapple sorbet.
He uses 2 lemons.

b) Work out how many people he makes pineapple sorbet for.

Using Ratio for Recipe Questions

1) Here are the ingredients needed to make 8 pancakes.
James makes 24 pancakes.

Pancakes
Ingredients to make **8** pancakes
250 ml milk
1 egg
140 g flour
5 g butter

a) Work out how much milk he needs. 750 ml

Kate makes 12 pancakes.

b) Work out how much flour she needs. 210 g

2) Here are the ingredients for making fish pie for 6 people.

Fish pie for 6 people
180 g flour
240 g fish
80 g butter
4 eggs
180 ml milk

Jill makes a fish pie for 3 people.
a) Work out how much flour she needs. 90 g

Tim makes a fish pie for 15 people.

b) Work out how much milk he needs. 450 ml

3) Here are the ingredients for making pineapple sorbet for **6** people.

Pineapple sorbet for 6 people
800 g of pineapple
4 egg whites
½ lemon
100 g caster sugar

Trevor makes pineapple sorbet for 18 people.

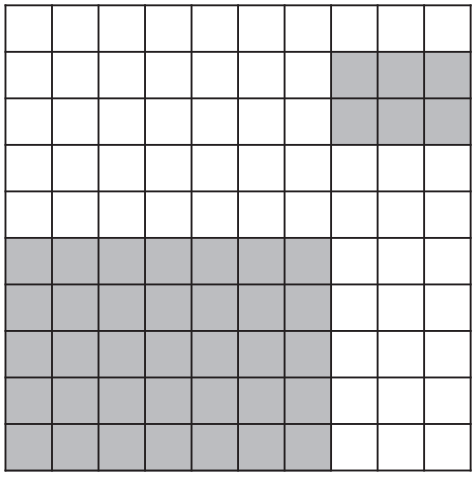
a) Work out how much caster sugar he uses. 300 g

Sid makes a pineapple sorbet.
He uses 2 lemons.

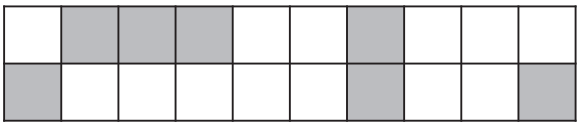
b) Work out how many people he makes pineapple sorbet for. 24 people

Introduction to Percentages

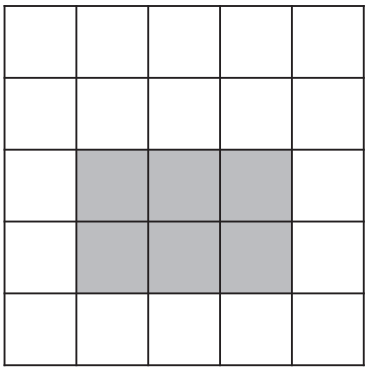
1) What percentage of this grid is shaded?



2) What percentage of this grid is shaded?

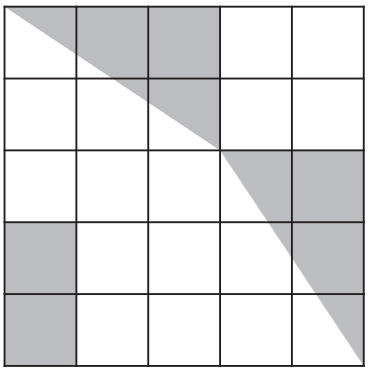


3) a) What percentage of this grid is shaded?



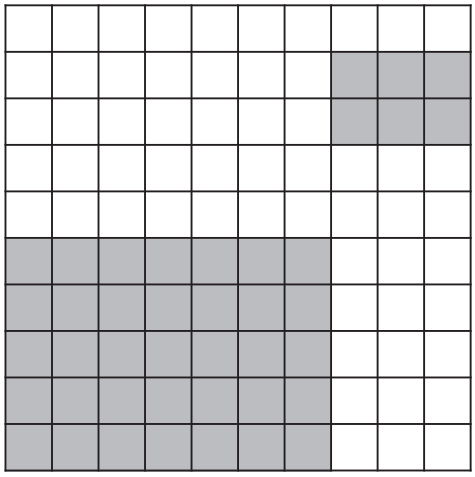
b) How many more squares should be shaded to make 80% of the grid shaded?

4) What percentage of this grid is shaded?



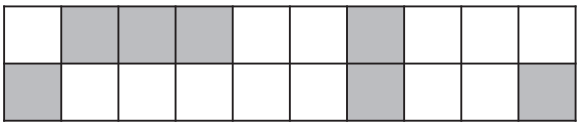
Introduction to Percentages

1) What percentage of this grid is shaded?



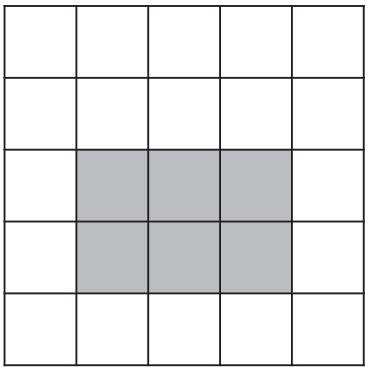
41%

2) What percentage of this grid is shaded?



35%

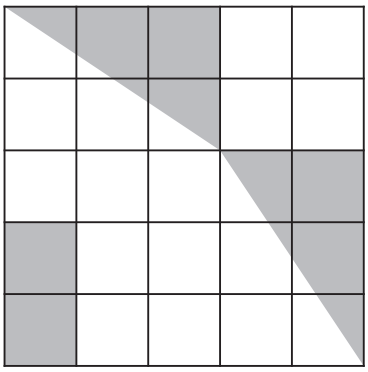
3) a) What percentage of this grid is shaded?



24%

b) How many more squares should be shaded to make 80% of the grid shaded? 14

4) What percentage of this grid is shaded?



32%

Direct Proportion - Introduction

1) 8 bananas cost £4
Work out the cost of 5 bananas.

2) Emily bought 4 identical pairs of socks for £3.60
Work out the cost of 9 pairs of these socks.

3) The price of 36 chocolates is £7.20
Work out the cost of 8 chocolates.

4) Theresa bought 5 theatre tickets for £60
Work out the cost of 9 theatre tickets.

5) Jenny buys 4 folders.
The total cost of these 4 folders is £6.40
Work out the total cost of 7 of these folders.

6) The cost of 15 litres of petrol is £12
Work out the cost of 20 litres of petrol.

7) 3 maths books cost £7.47
Work out the cost of 5 of these.

Direct Proportion - Introduction

1) 8 bananas cost £4
Work out the cost of 5 bananas. £2.50

2) Emily bought 4 identical pairs of socks for £3.60
Work out the cost of 9 pairs of these socks. £8.10

3) The price of 36 chocolates is £7.20
Work out the cost of 8 chocolates. £1.60

4) Theresa bought 5 theatre tickets for £60
Work out the cost of 9 theatre tickets. £108

5) Jenny buys 4 folders.
The total cost of these 4 folders is £6.40
Work out the total cost of 7 of these folders. £11.20

6) The cost of 15 litres of petrol is £12
Work out the cost of 20 litres of petrol. £16

7) 3 maths books cost £7.47
Work out the cost of 5 of these. £12.45

Value for Money

1) Which of the following offer better value for money?
Working must be shown

a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

b) 600g of bananas for 70p or 200g of bananas for 22p

c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

d) 60 teabags for £1.62 or 40 teabags for £0.96

2) Which of these is the best buy?

20 exercise books for £4.00	35 exercise books for £7.80

3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

a) Work out which of these would be the best buy for Hamza.

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

You must show all your working.

4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g.
A large pot costs 80p and weighs 850g.

Which pot of honey is better value for money?
You must show all your working.

Value for Money

1) Which of the following offer better value for money?
Working must be shown

a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

50 ÷ 200 = 0.25 90 ÷ 400 = 0.225

b) 600g of bananas for 70p or 200g of bananas for 22p

70 ÷ 600 = 0.1167 22 ÷ 200 = 0.11

c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

1.60 ÷ 2 = 0.8 3.50 ÷ 5 = 0.7

d) 60 teabags for £1.62 or 40 teabags for £0.96

1.62 ÷ 60 = 0.027 0.96 ÷ 40 = 0.049

2) Which of these is the best buy?

20 exercise books for £4.00	35 exercise books for £7.80
400 ÷ 20 = 20 20p per book	780 ÷ 35 = 22.3 22p per book

3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

2.55 ÷ 500 = 0.0051 4.79 ÷ 1000 = 0.00479

a) Work out which of these would be the best buy for Hamza.

1 litre of paint for £4.79

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'?

£0.62 or 62p

You must show all your working.

4 × 2.55 = 10.20 10.20 − 9.58 = 0.62

2 × 4.79 = 9.58

4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g. 45 ÷ 450 = 0.1p per g

A large pot costs 80p and weighs 850g. 80 ÷ 850 = 0.09p per g

Which pot of honey is better value for money?
You must show all your working.

Large pot at 80p for 850g

Simplifying - Addition and Subtraction

1) Simplify the following

a) $x + x$

b) $2x + 3x$

c) $5t - 3t$

d) $7y - 6y$

e) $x + 2x + 3x$

f) $3g - g + 6g$

g) $2x - 7x + 8x$

h) $y - 2y - 3y + 6y$

2) Simplify the following

a) $xy + 3xy$

b) $5xy - 2xy$

c) $4x^2y + x^2y$

d) $3xy^2 - 2xy^2$

e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$

f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$

3) Simplify the following

a) $x + y + x + y$

b) $2x + 3y + x + 4y$

c) $2a + 4b - a + 2b$

d) $3x + 4y - x - 2y$

e) $6x - 2y + 2x + 5y$

f) $4x - 3y - 2x - 5y$

g) $3t + 4u + 2t - 7u$

h) $2xy + 3t - xy - 4t$

Simplifying - Addition and Subtraction

1) Simplify the following

a) $x + x$ $2x$

b) $2x + 3x$ $5x$

c) $5t - 3t$ $2t$

d) $7y - 6y$ y

e) $x + 2x + 3x$ $6x$

f) $3g - g + 6g$ $8g$

g) $2x - 7x + 8x$ $3x$

h) $y - 2y - 3y + 6y$ $2y$

2) Simplify the following

a) $xy + 3xy$ $4xy$

b) $5xy - 2xy$ $3xy$

c) $4x^2y + x^2y$ $5x^2y$

d) $3xy^2 - 2xy^2$ xy^2

e) $2x^2y^3 + 4x^2y^3 - 3x^2y^3$ $3x^2y^3$

f) $6a^2bc^4 + 5a^2bc^4 - 2a^2bc^4$ $9a^2bc^4$

3) Simplify the following

a) $x + y + x + y$ $2x + 2y$

b) $2x + 3y + x + 4y$ $3x + 7y$

c) $2a + 4b - a + 2b$ $a + 6b$

d) $3x + 4y - x - 2y$ $2x + 2y$

e) $6x - 2y + 2x + 5y$ $8x + 3y$

f) $4x - 3y - 2x - 5y$ $2x - 8y$

g) $3t + 4u + 2t - 7u$ $5t - 3u$

h) $2xy + 3t - xy - 4t$ $xy - t$

Simplifying - Multiplication

1) Simplify the following

a) $x \times x$

b) $x \times x \times x \times x \times x$

c) $y \times y \times y$

2) Simplify the following

a) $x^2 \times x^4$

b) $x^3 \times x^5$

c) $y \times y^3$

d) $x^2 \times x \times x^4$

e) $y^2 \times y^3 \times y^4$

3) Simplify the following

a) $2x \times x$

b) $4x \times 3x$

c) $3t^2 \times 2t$

d) $4y^2 \times 3y^3$

e) $x \times 2x^2 \times 3x^3$

4) Simplify the following

a) $x \times y$

b) $2x \times 3y$

c) $5r \times 2s \times 3t$

d) $6x \times 2y \times z$

5) Simplify the following

a) $3x \times y$

b) $4x^2y \times 2x$

c) $3xy^2 \times 2xy^3$

d) $6xy \times x^2y^3 \times 2y$

e) $2x^2y^3 \times 5x^4y^2$

f) $tu^2 \times t^2u \times 4tu$

Simplifying - Multiplication

1) Simplify the following

a) $x \times x$ x^2

b) $x \times x \times x \times x \times x$ x^5

c) $y \times y \times y$ y^3

2) Simplify the following

a) $x^2 \times x^4$ x^6

b) $x^3 \times x^5$ x^8

c) $y \times y^3$ y^4

d) $x^2 \times x \times x^4$ x^7

e) $y^2 \times y^3 \times y^4$ y^9

3) Simplify the following

a) $2x \times x$ $2x^2$

b) $4x \times 3x$ $12x^2$

c) $3t^2 \times 2t$ $6t^3$

d) $4y^2 \times 3y^3$ $12y^5$

e) $x \times 2x^2 \times 3x^3$ $6x^6$

4) Simplify the following

a) $x \times y$ xy

b) $2x \times 3y$ $6xy$

c) $5r \times 2s \times 3t$ $30rst$

d) $6x \times 2y \times z$ $12xyz$

5) Simplify the following

a) $3x \times y$ $3xy$

b) $4x^2y \times 2x$ $8x^3y$

c) $3xy^2 \times 2xy^3$ $6x^2y^5$

d) $6xy \times x^2y^3 \times 2y$ $12x^3y^5$

e) $2x^2y^3 \times 5x^4y^2$ $10x^6y^5$

f) $tu^2 \times t^2u \times 4tu$ $4t^4u^4$

Simplifying - Division

1) Simplify the following

a) $x^5 \div x$

b) $y^4 \div y^3$

c) $g^8 \div g^5$

d) $y^4 \div y^2$

e) $x^3 \div x^3$

2) Simplify the following

a) $6x^4 \div x$

b) $12y^5 \div 3y^2$

c) $10g^7 \div 2g^5$

3) Simplify the following

a) $\frac{x^6}{x^2}$

b) $\frac{x^9}{x^4}$

c) $\frac{6x^8}{2x^6}$

4) Simplify the following

a) $\frac{x^6 \times x^3}{x^4}$

b) $\frac{x^3 \times x^4}{x^2 \times x}$

c) $\frac{(x+5)^5}{(x+5)^2}$

5) Simplify the following

a) $20x^6 \div 5x^2$

b) $\frac{14x^7}{2x^2}$

c) $\frac{8x \times 2x^3}{4x^2}$

Simplifying - Division

1) Simplify the following

a) $x^5 \div x$ x^4

b) $y^4 \div y^3$ y

c) $g^8 \div g^5$ g^3

d) $y^4 \div y^2$ y^2

e) $x^3 \div x^3$ 1

2) Simplify the following

a) $6x^4 \div x$ $6x^3$

b) $12y^5 \div 3y^2$ $4y^3$

c) $10g^7 \div 2g^5$ $5g^2$

3) Simplify the following

a) $\frac{x^6}{x^2}$ x^4

b) $\frac{x^9}{x^4}$ x^5

c) $\frac{6x^8}{2x^6}$ $3x^2$

4) Simplify the following

a) $\frac{x^6 \times x^3}{x^4}$ x^5

b) $\frac{x^3 \times x^4}{x^2 \times x}$ x^4

c) $\frac{(x+5)^5}{(x+5)^2}$ $(x+5)^3$

5) Simplify the following

a) $20x^6 \div 5x^2$ $4x^4$

b) $\frac{14x^7}{2x^2}$ $7x^5$

c) $\frac{8x \times 2x^3}{4x^2}$ $4x^2$

Simplifying

1) a) Simplify $4p \times 6q$

b) Simplify $d \times d \times d \times d$

c) Simplify $t^9 \div t^4$

2) a) Simplify $4a + 3c - 2a + c$

b) Simplify $2x - 6c - x + 2c$

3) a) Simplify $5xt + 2xt - 4xt$

b) Simplify $4x + 3y - 2x + 4y$

c) Simplify $m \times m \times m$

d) Simplify $3n \times 2t$

4) Simplify $3x^2 \times 4x^5y^4$

5) Simplify $4x + 3y - 2x + 6y$

6) a) Simplify $t^4 \times t^5$

b) Simplify $a \times a \times a$

7) a) Simplify $x^6 \times x^2$

b) Simplify $10x^2y^4 \div 2xy^2$

8) a) Simplify $3a + 5c - a + 3c$

b) Simplify $x^3 \times x^4$

c) Simplify $4x^2y^4 \times 5xy^2$

9) Simplify $6x + 8y + 2x - 10y$

10) a) Simplify $x \times x \times x \times x$

b) Simplify $2x \times 3y$

11) a) Simplify $pq + 2pq$

b) Simplify $5x + 3y - x - 4y$

12) a) Simplify $6a + 5b - 3b + a$

b) Simplify $x^4 + x^4$

13) a) Simplify $x + y + x + y + x$

b) Simplify $t^2 + t^2 + t^2$

14) a) Simplify $a^3 \times a^3$

b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$

15) a) Simplify $3d + e - d + 4e$

b) Simplify $3x^2 - x^2$

c) Simplify $5t + 8d - 2t - 3d$

d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$

Simplifying

1) a) Simplify $4p \times 6q$ $24pq$

b) Simplify $d \times d \times d \times d$ d^4

c) Simplify $t^9 \div t^4$ t^5

2) a) Simplify $4a + 3c - 2a + c$ $2a + 4c$

b) Simplify $2x - 6c - x + 2c$ $x - 4c$

3) a) Simplify $5xt + 2xt - 4xt$ $3xt$

b) Simplify $4x + 3y - 2x + 4y$ $2x + 7y$

c) Simplify $m \times m \times m$ m^3

d) Simplify $3n \times 2t$ $6nt$

4) Simplify $3x^2 \times 4x^5y^4$ $12x^7y^4$

5) Simplify $4x + 3y - 2x + 6y$ $2x + 9y$

6) a) Simplify $t^4 \times t^5$ t^9

b) Simplify $a \times a \times a$ a^3

7) a) Simplify $x^6 \times x^2$ x^8

b) Simplify $10x^2y^4 \div 2xy^2$ $5xy^2$

8) a) Simplify $3a + 5c - a + 3c$ $2a + 8c$

b) Simplify $x^3 \times x^4$ x^7

c) Simplify $4x^2y^4 \times 5xy^2$ $20x^3y^6$

9) Simplify $6x + 8y + 2x - 10y$ $8x - 2y$

10) a) Simplify $x \times x \times x \times x$ x^4

b) Simplify $2x \times 3y$ $6xy$

11) a) Simplify $pq + 2pq$ $3pq$

b) Simplify $5x + 3y - x - 4y$ $4x - y$

12) a) Simplify $6a + 5b - 3b + a$ $7a + 2b$

b) Simplify $x^4 + x^4$ $2x^4$

13) a) Simplify $x + y + x + y + x$ $3x + 2y$

b) Simplify $t^2 + t^2 + t^2$ $3t^2$

14) a) Simplify $a^3 \times a^3$ a^6

b) Simplify $\dfrac{3x^2y \times 4xy^3}{2xy^2}$ $6x^2y^2$

15) a) Simplify $3d + e - d + 4e$ $2d + 5e$

b) Simplify $3x^2 - x^2$ $2x^2$

c) Simplify $5t + 8d - 2t - 3d$ $3t + 5d$

d) Simplify $\dfrac{(3x + 1)^3}{(3x + 1)}$ $(3x + 1)^2$

Function Machines

1) Complete the table for the function machine.

In	Out
4	
7	
	48
	73

2) Complete the table for the function machine.

In	Out
-2	
1	
	17
x	

3) Complete the table for the function machine.

In	Out
-3	
0	
	66
x	

Function Machines

1) Complete the table for the function machine.

In	Out
4	23
7	38
9	48
14	73

2) Complete the table for the function machine.

In	Out
-2	-15
1	-3
6	17
x	$4x - 7$

3) Complete the table for the function machine.

In	Out
-3	-6
0	12
9	66
x	$6(x + 2)$

Generating a Sequence - Term to Term

1) Write the first 5 terms of each of these sequences.

a) Start at 2 and add 6.

b) Start at 14 and subtract 3.

c) Start at 4 and subtract 7.

d) Start at 2 and multiply by 3.

e) Start at 64 and divide by 2.

f) Start at 600 and divide by 10.

2) Find the term to term rule for each of these sequences.

a) 4, 7, 10, 13, 16

b) 15, 13, 11, 9, 7

c) 2, -3, -8, -13, -18

d) 7, 14, 28, 56, 112

e) 100, 10, 1, 0.1, 0.01

Generating a Sequence - Term to Term

1) Write the first 5 terms of each of these sequences.

a) Start at 2 and add 6. 2, 8, 14, 20, 26

b) Start at 14 and subtract 3. 14, 11, 8, 5, 2

c) Start at 4 and subtract 7. 4, -3, -10, -17, -24

d) Start at 2 and multiply by 3. 2, 6, 18, 54,162

e) Start at 64 and divide by 2. 64, 32, 16, 8, 4

f) Start at 600 and divide by 10. 600, 60, 6, 0.6, 0.06

2) Find the term to term rule for each of these sequences.

a) 4, 7, 10, 13, 16 Add 3

b) 15, 13, 11, 9, 7 Subtract 2

c) 2, -3, -8, -13, -18 Subtract 5

d) 7, 14, 28, 56, 112 Multiply by 2

e) 100, 10, 1, 0.1, 0.01 Divide by 10

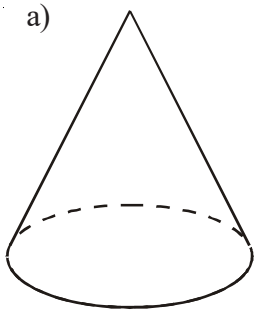
Properties of Solids

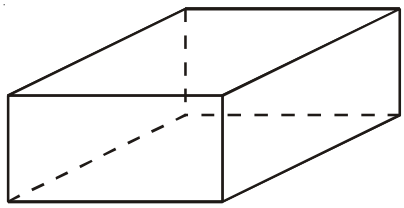
1) Draw a sketch of each of the following solids:

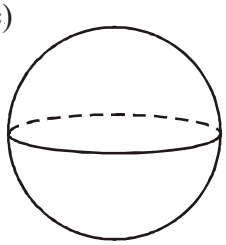
   a) A cube.

   b) A cylinder.

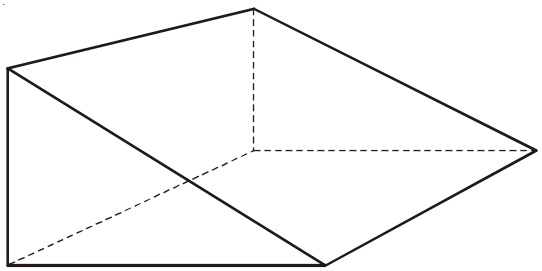
2) Write down the mathematical name of each of these 3-D shapes.

a) 

b) 

c) 

3) Look at this solid.



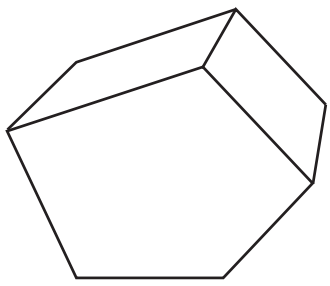
   a) What is its name?

   b) How many vertices does it have?

   c) How many edges are there?

   d) How many faces does it have?

4) This is a picture of a pentagonal prism.



   a) How many faces does it have?

   b) How many edges does it have?

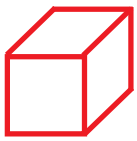
   c) How many vertices does it have?

Properties of Solids

1) Draw a sketch of each of the following solids:

a) A cube.

b) A cylinder.

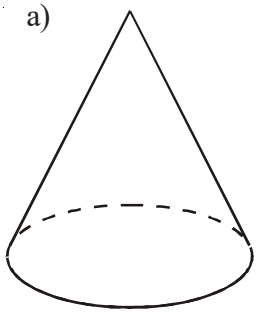


Cube

Cylinder

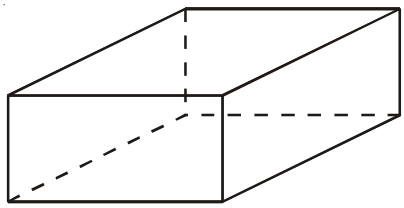
2) Write down the mathematical name of each of these 3-D shapes.

a)



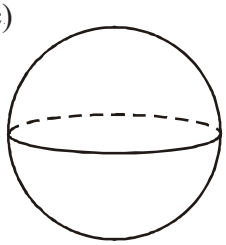
Cone

b)



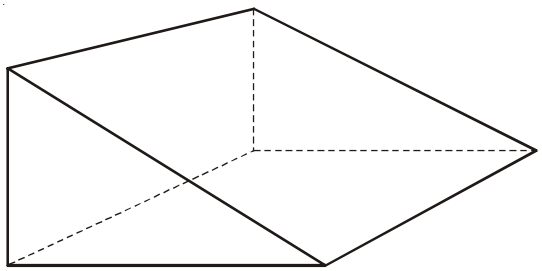
Cuboid

c)



Sphere

3) Look at this solid.



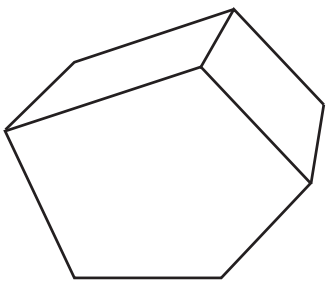
a) What is its name? Triangular prism

b) How many vertices does it have? 6

c) How many edges are there? 9

d) How many faces does it have? 5

4) This is a picture of a pentagonal prism.



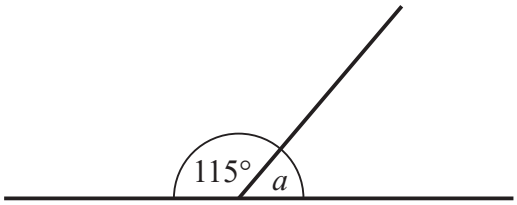
a) How many faces does it have? 7

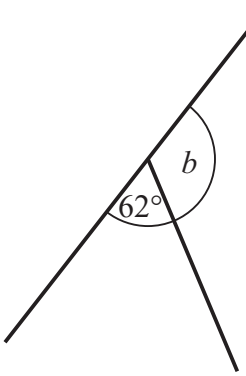
b) How many edges does it have? 15

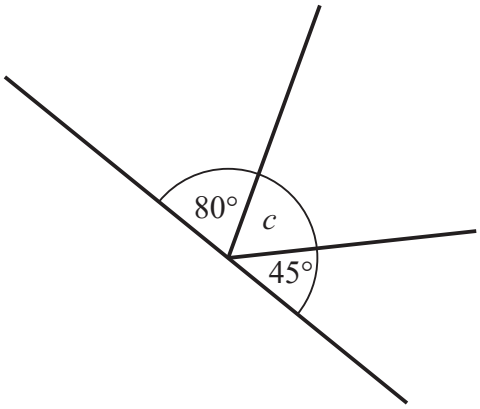
c) How many vertices does it have? 10

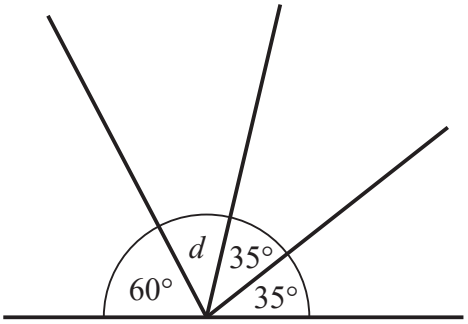
Angles on a Line and at a Point

1) Work out the values of the unknown angles.

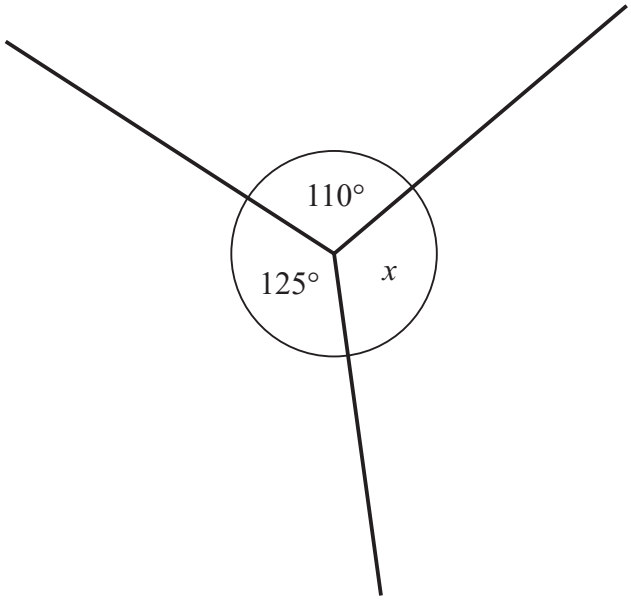


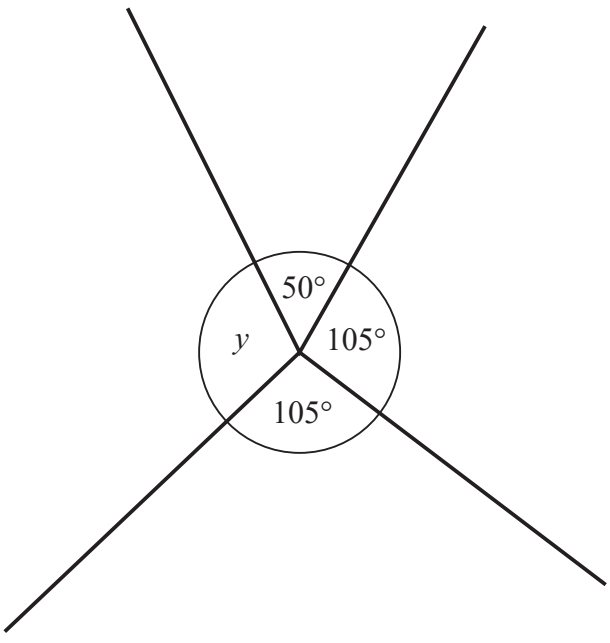






2) Work out the values of the unknown angles.





Angles on a Line and at a Point

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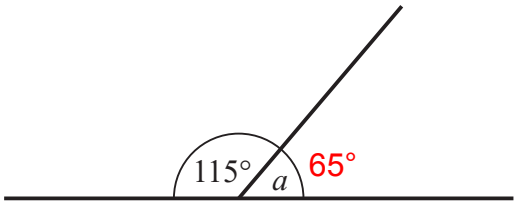

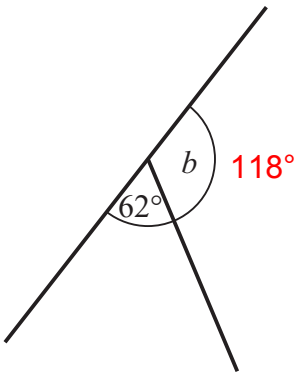

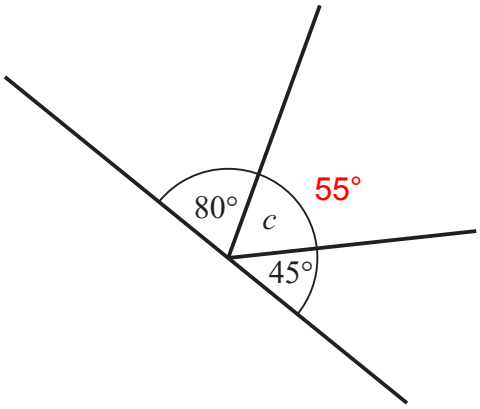

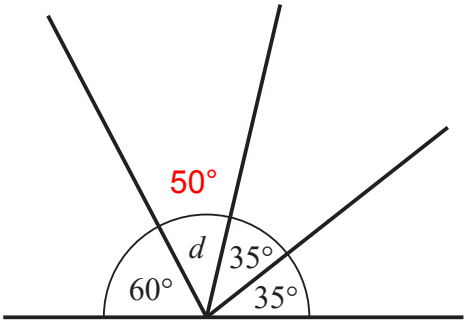

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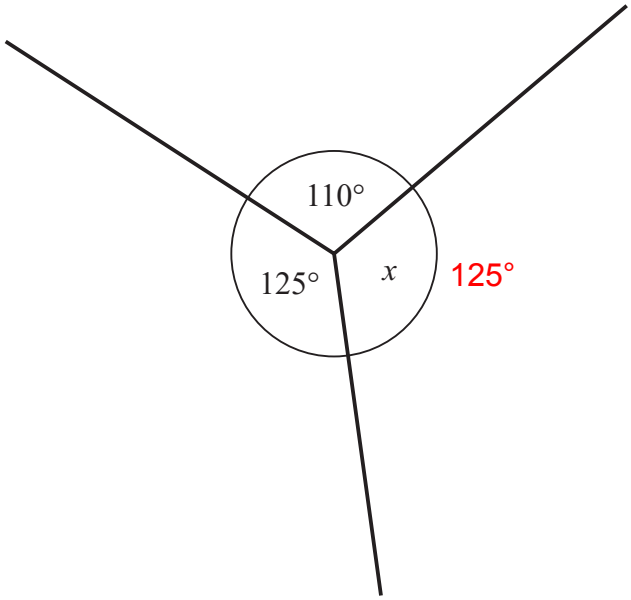
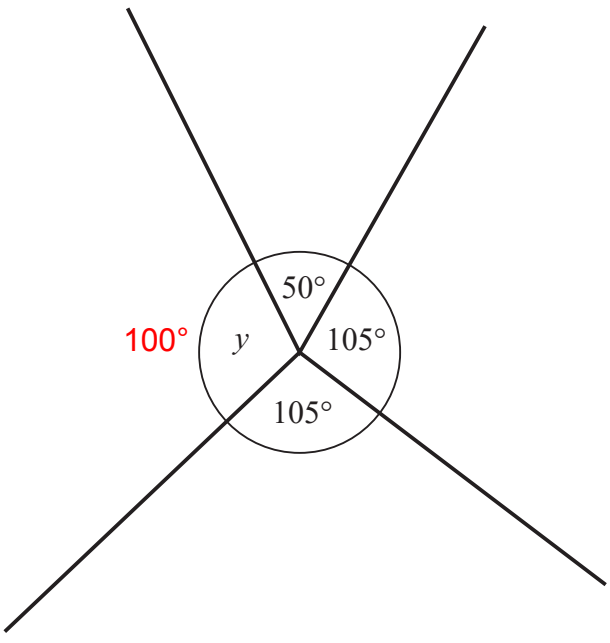
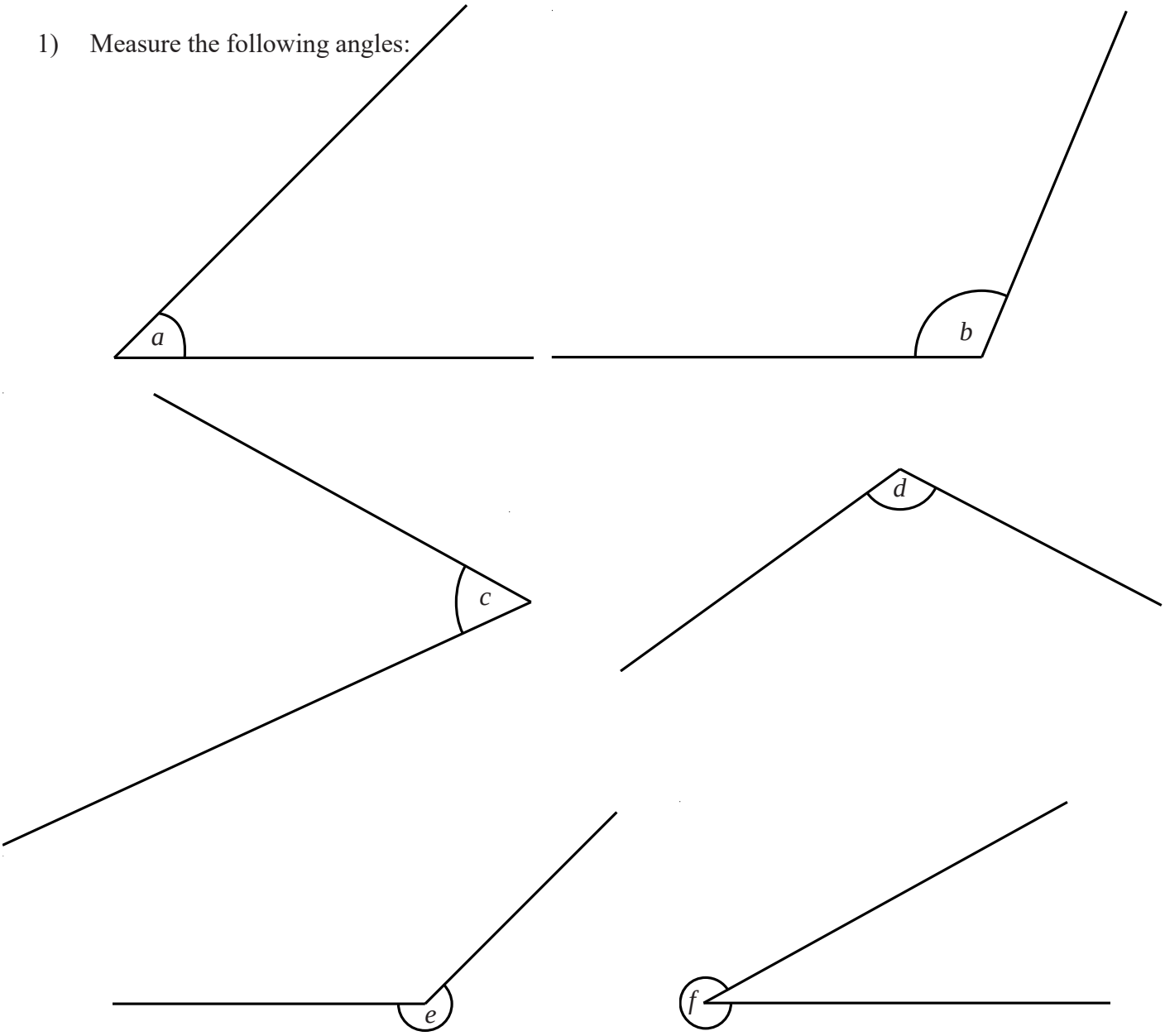




Measuring and Drawing Angles

1) Measure the following angles:

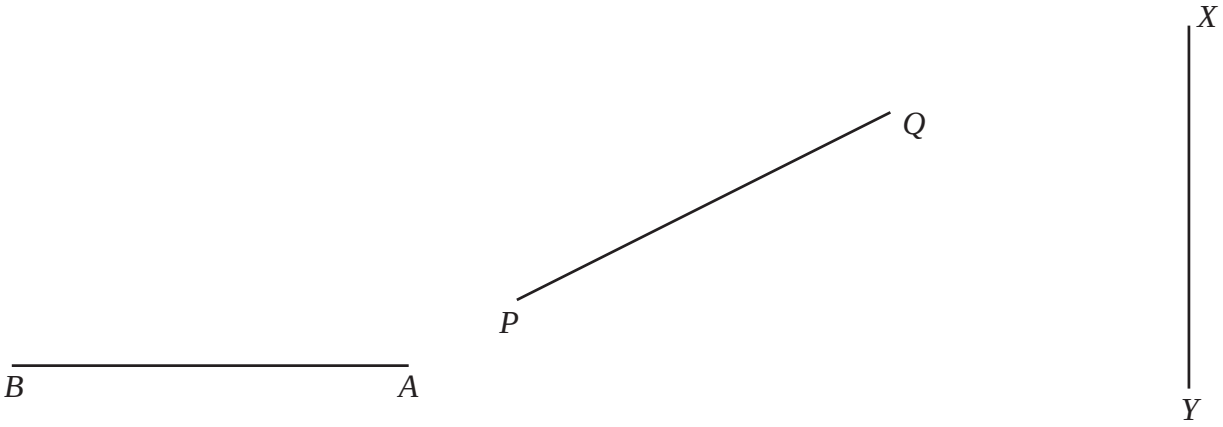


2) Draw the following angles:

a) Angle $ABC = 60°$

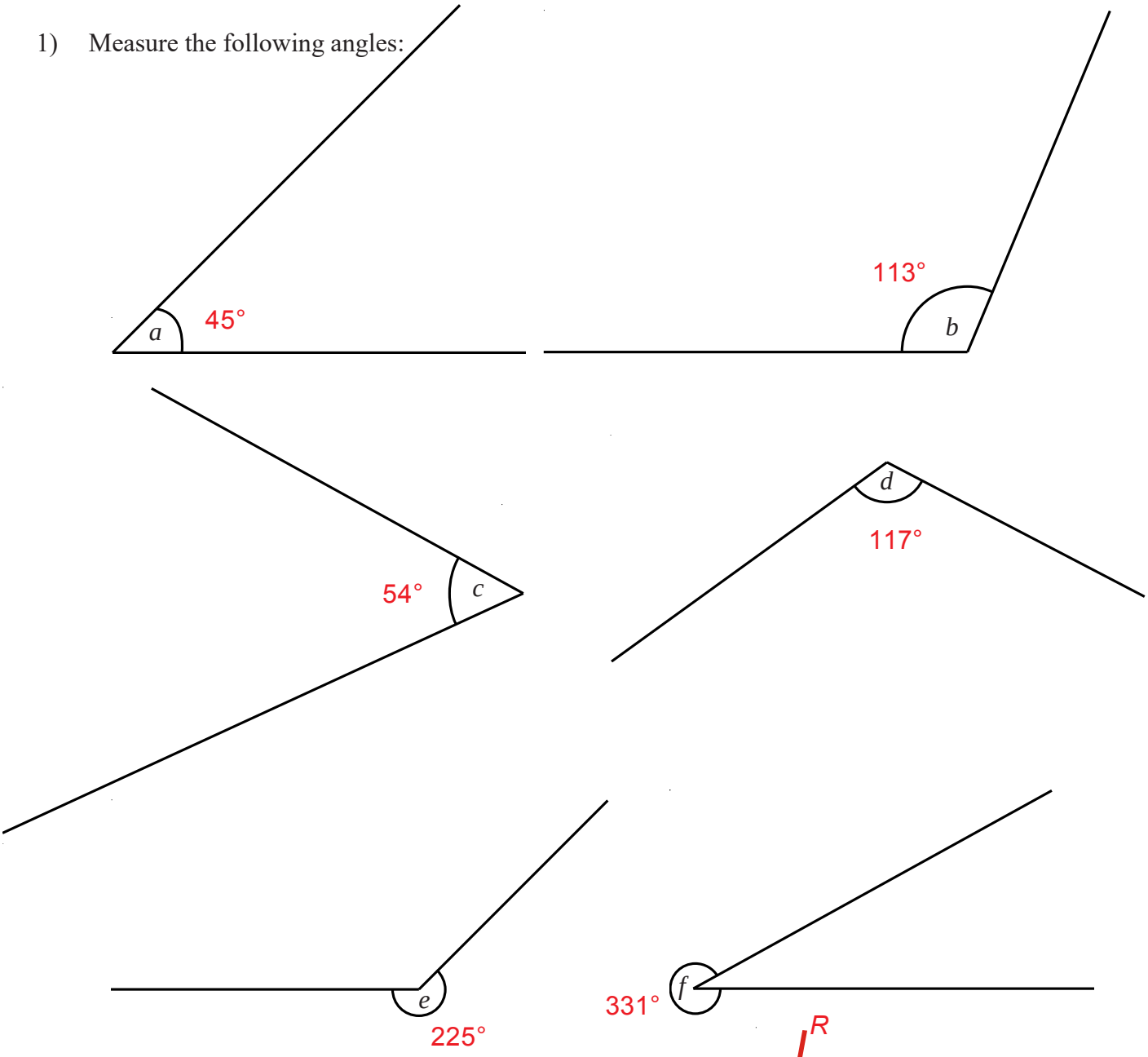
b) Angle $PQR = 127°$

c) Angle $XYZ = 275°$



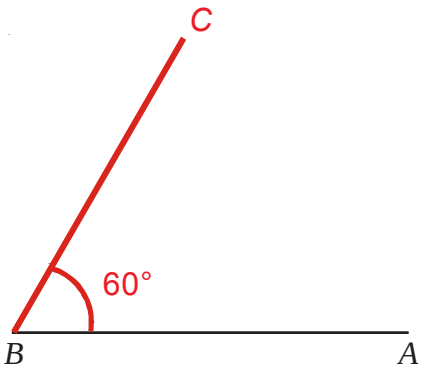
Measuring and Drawing Angles

1) Measure the following angles:

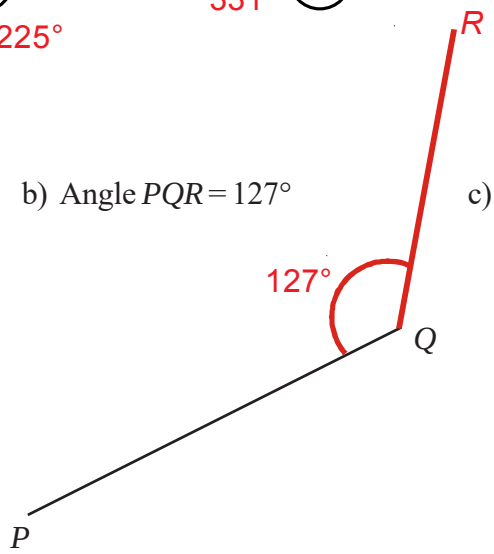


2) Draw the following angles:

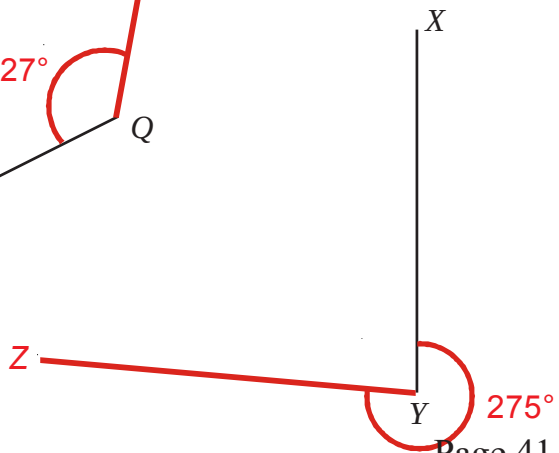
a) Angle $ABC = 60°$



b) Angle $PQR = 127°$



c) Angle $XYZ = 275°$



Drawing a Triangle Using a Protractor

1) The diagram shows a sketch of triangle *ABC*.

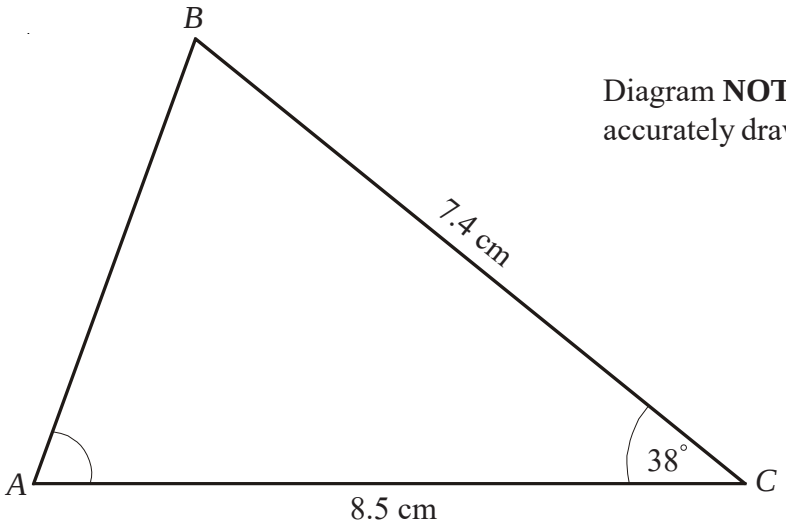


Diagram **NOT** accurately drawn

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) The diagram shows a sketch of triangle *PQR*.

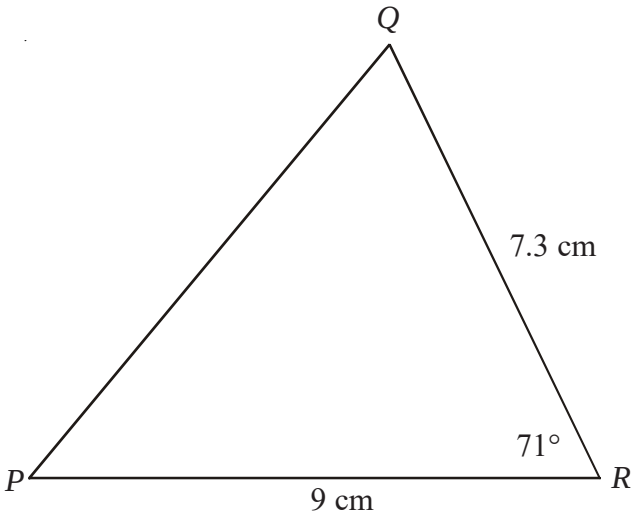
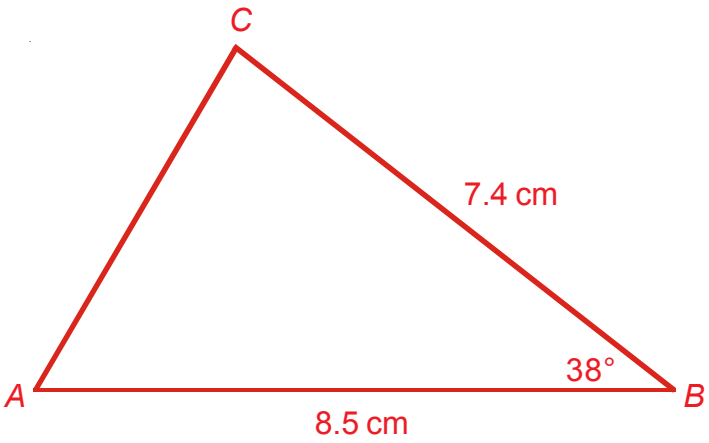


Diagram **NOT** accurately drawn

Make an accurate drawing of triangle *PQR*.

Drawing a Triangle Using a Protractor

1) The diagram shows a sketch of triangle *ABC*.

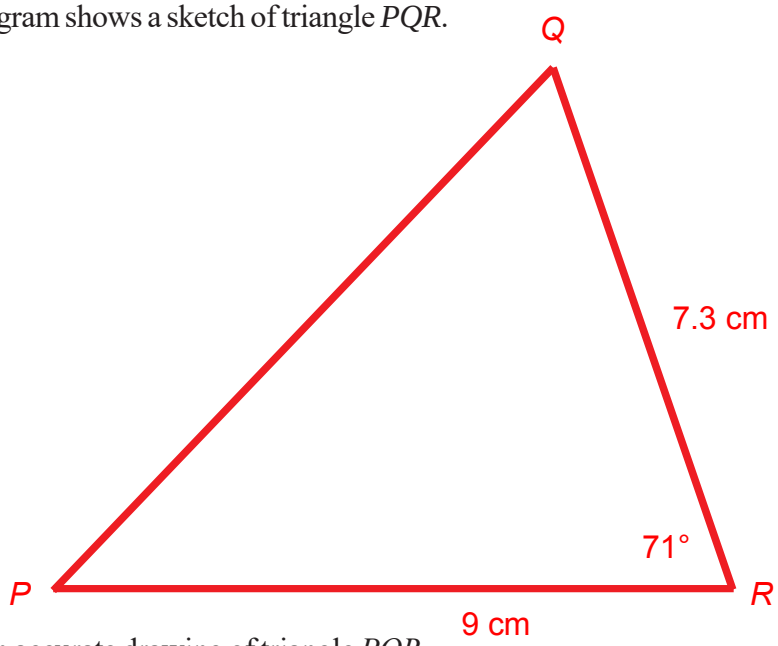


BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram. Angle *A* = 59°

2) The diagram shows a sketch of triangle *PQR*.

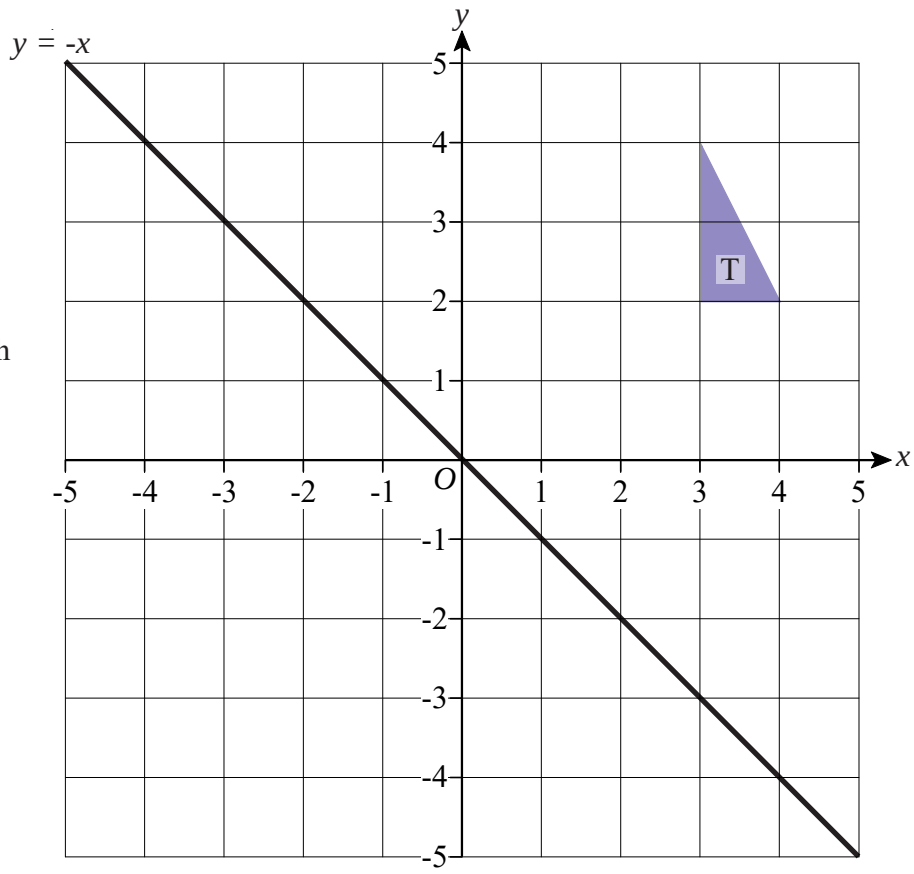


Make an accurate drawing of triangle *PQR*.

Reflections

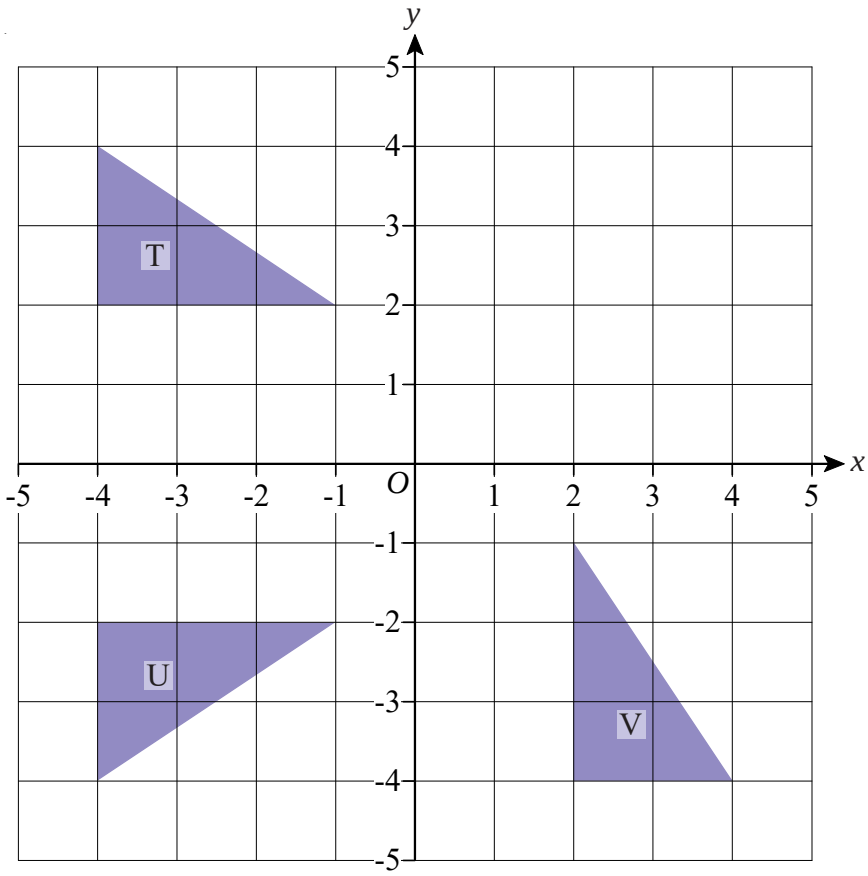
1) a) Reflect triangle T in the *x* axis.
Label your new triangle U.

b) Reflect triangle T in the line with equation $y = -x$.
Label your new triangle V.



2) a) Describe fully the single transformation which maps triangle T to triangle U.

b) Describe fully the single transformation which maps triangle T to triangle V.



Reflections

1) a) Reflect triangle T in the *x* axis.
Label your new triangle U.

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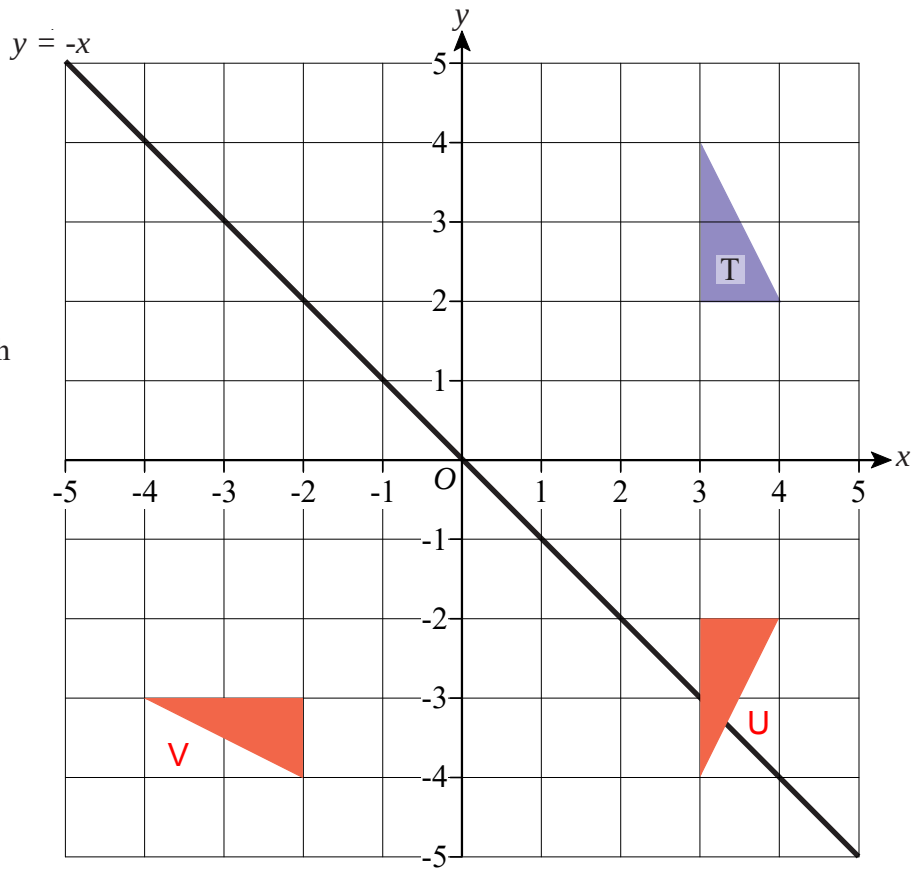
Label your new triangle V.

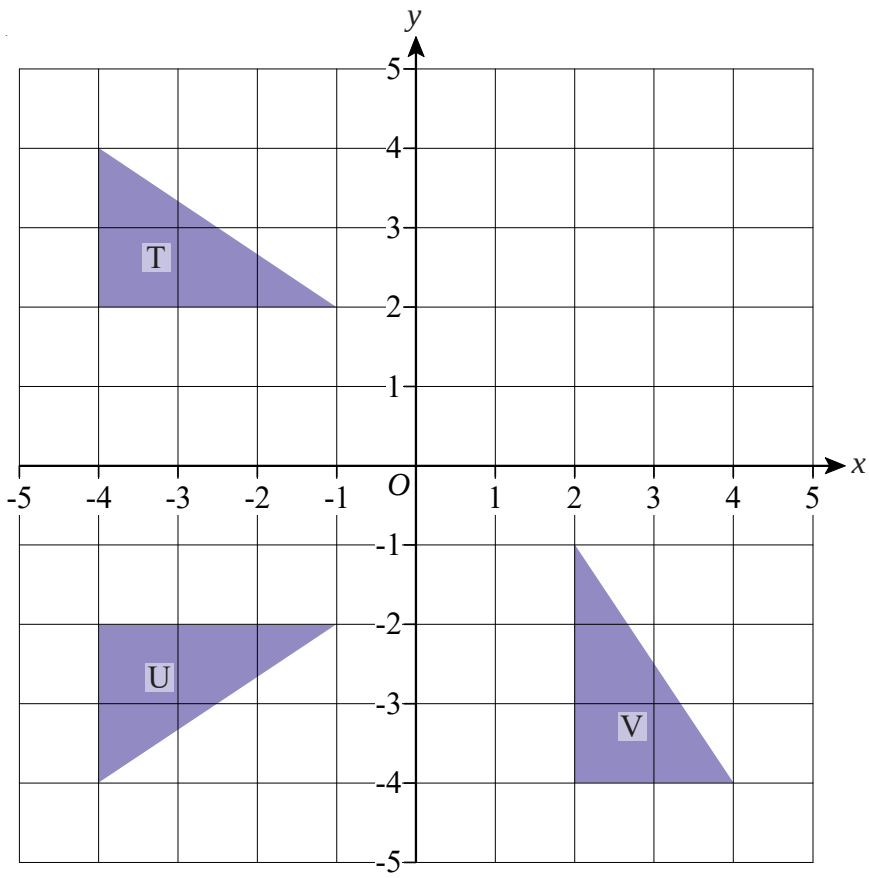


2) a) Describe fully the single transformation which maps triangle T to triangle U.

Reflection in the *x* axis.

b) Describe fully the single transformation which maps triangle T to triangle V.

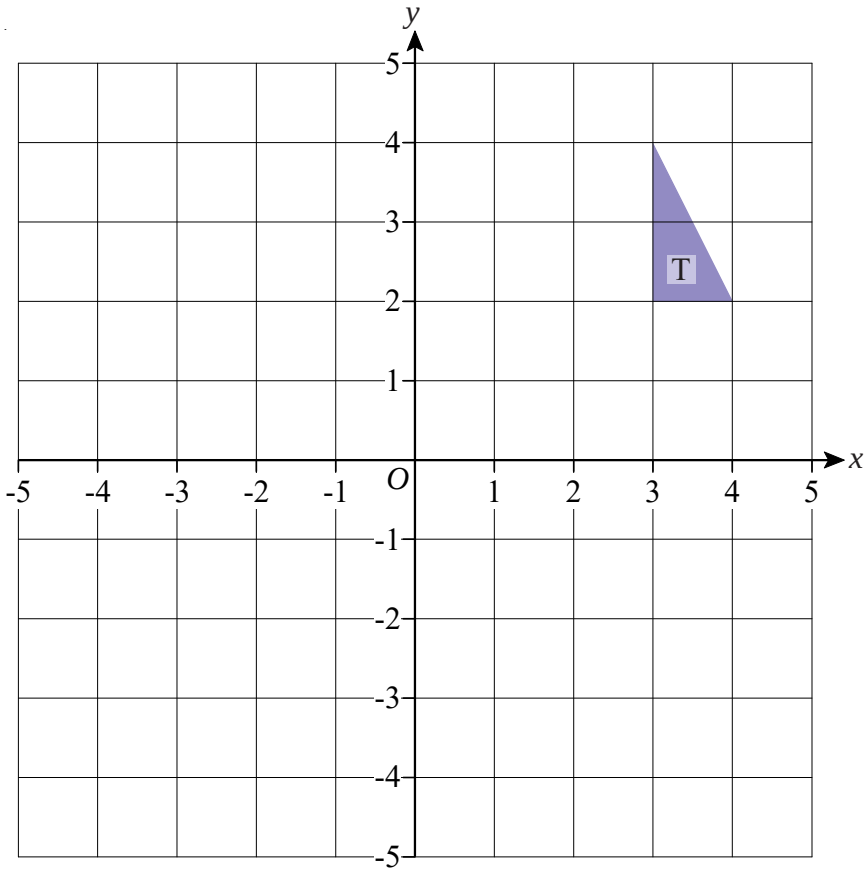
Reflection in the line $y = x$.



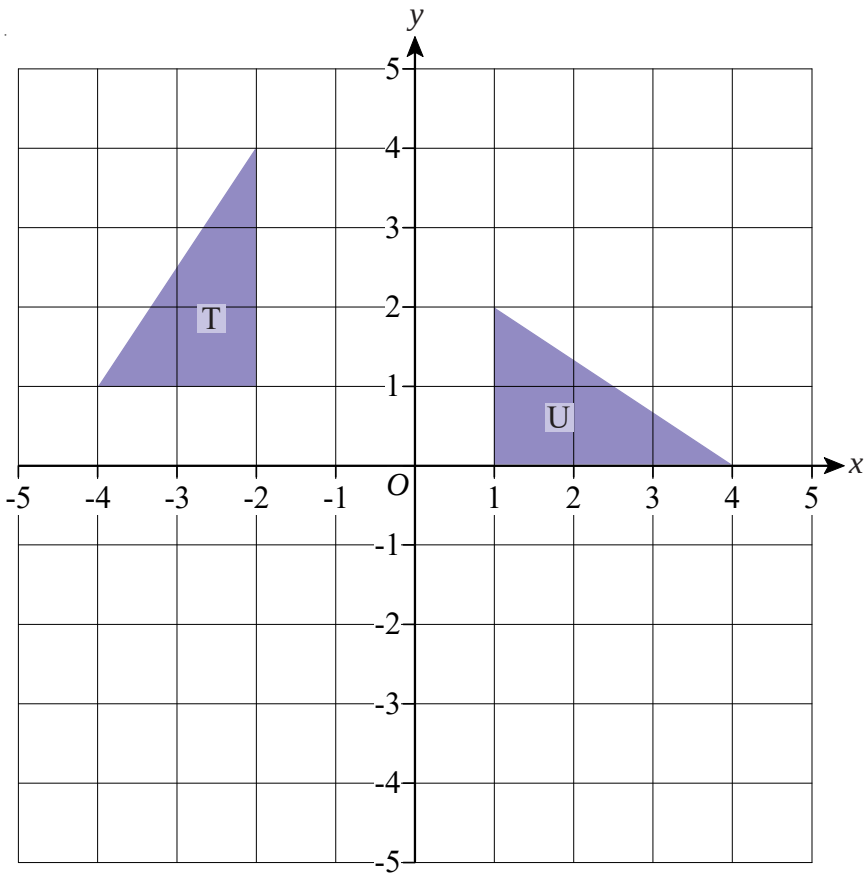
Rotations

1) a) Rotate triangle T 90° anti-clockwise about the point (0, 0).
Label your new triangle U.

b) Rotate triangle T 180° about the point (2, 0).
Label your new triangle V.



2) Describe fully the single transformation which maps triangle T to triangle U.



Rotations

1) a) Rotate triangle T 90° anti-clockwise about the point (0, 0).
Label your new triangle U.

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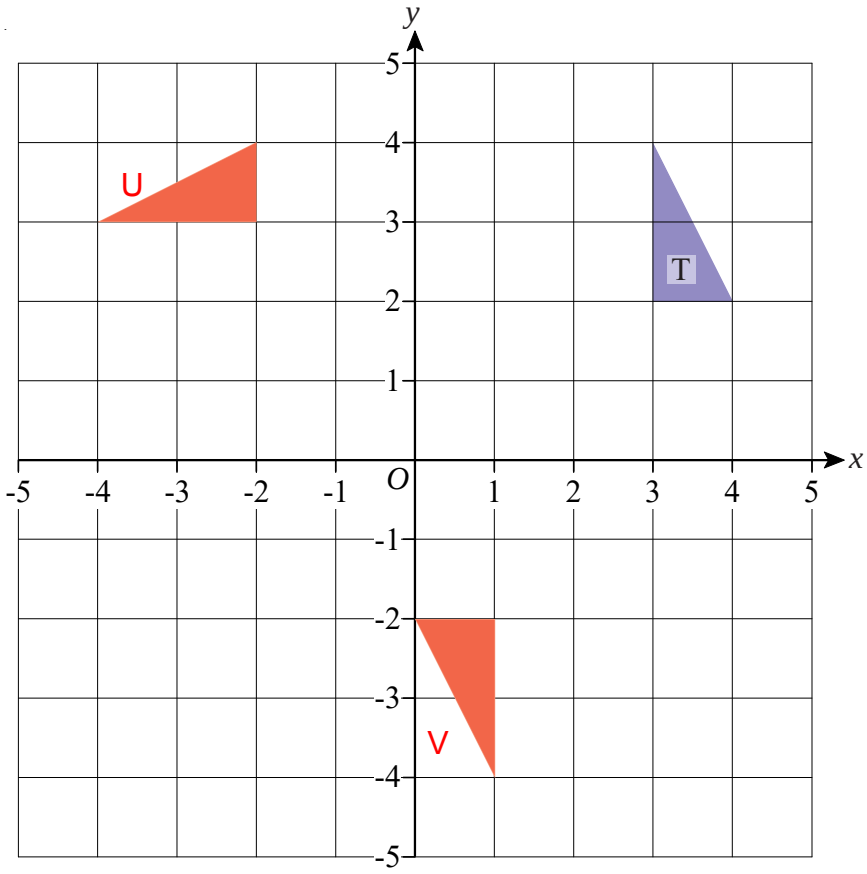
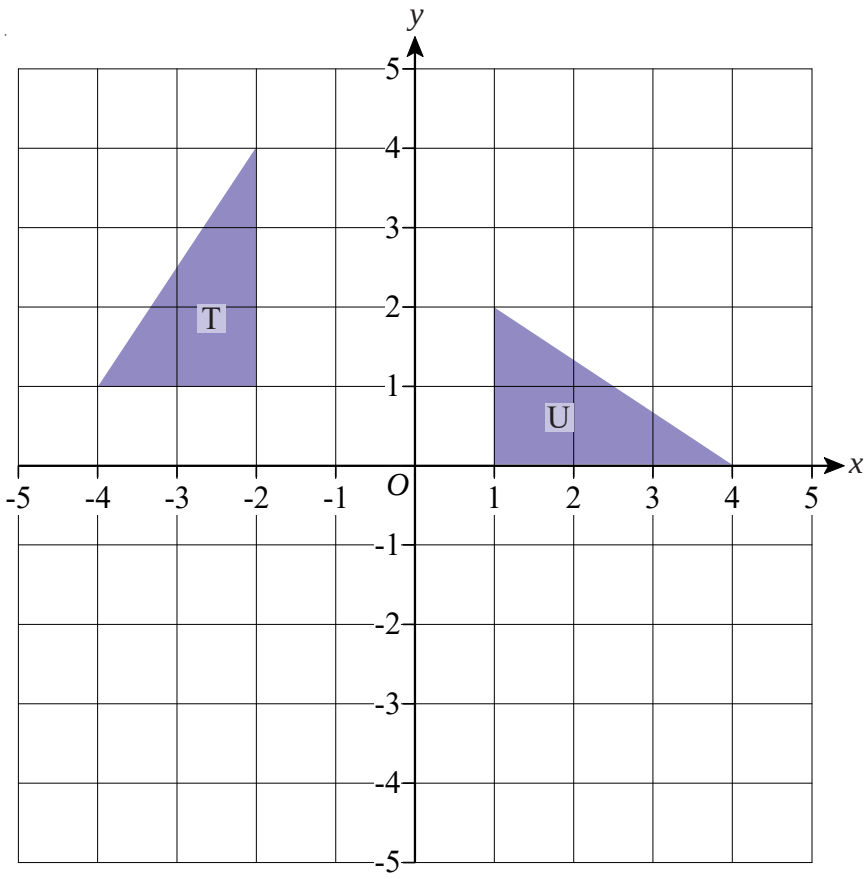
Label your new triangle V.



2) Describe fully the single transformation which maps triangle T to triangle U.

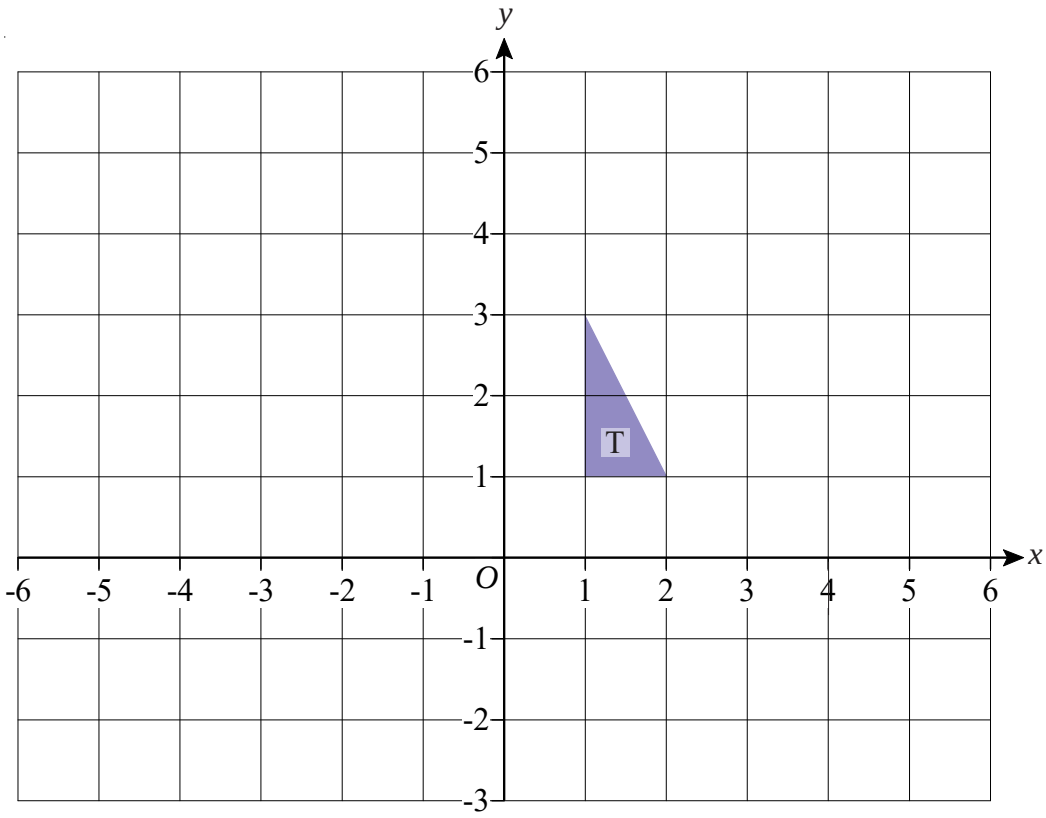
Rotation
90° clockwise
about the point (-1, -1)



Translations

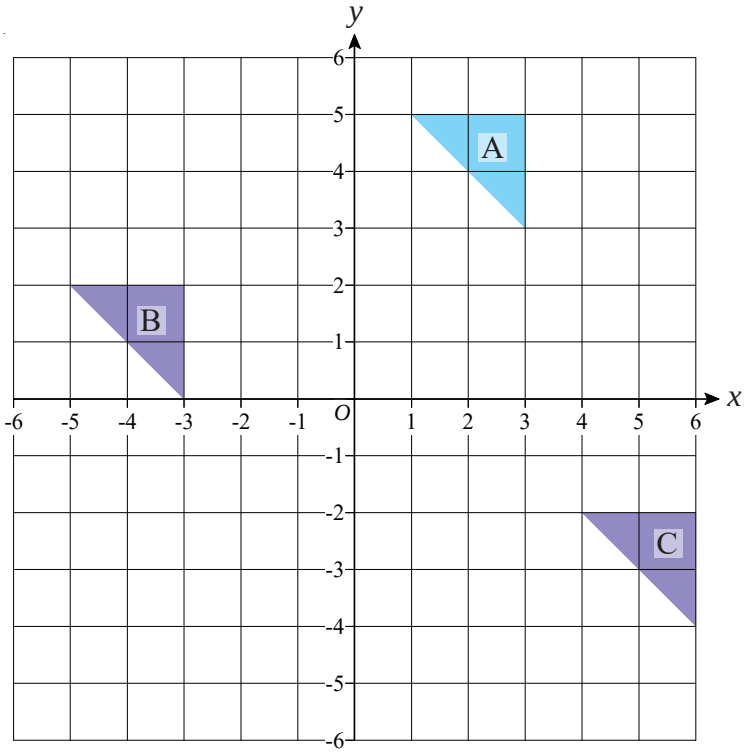
1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U.

b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V.



2) a) Describe fully the single transformation which maps triangle A to triangle B.

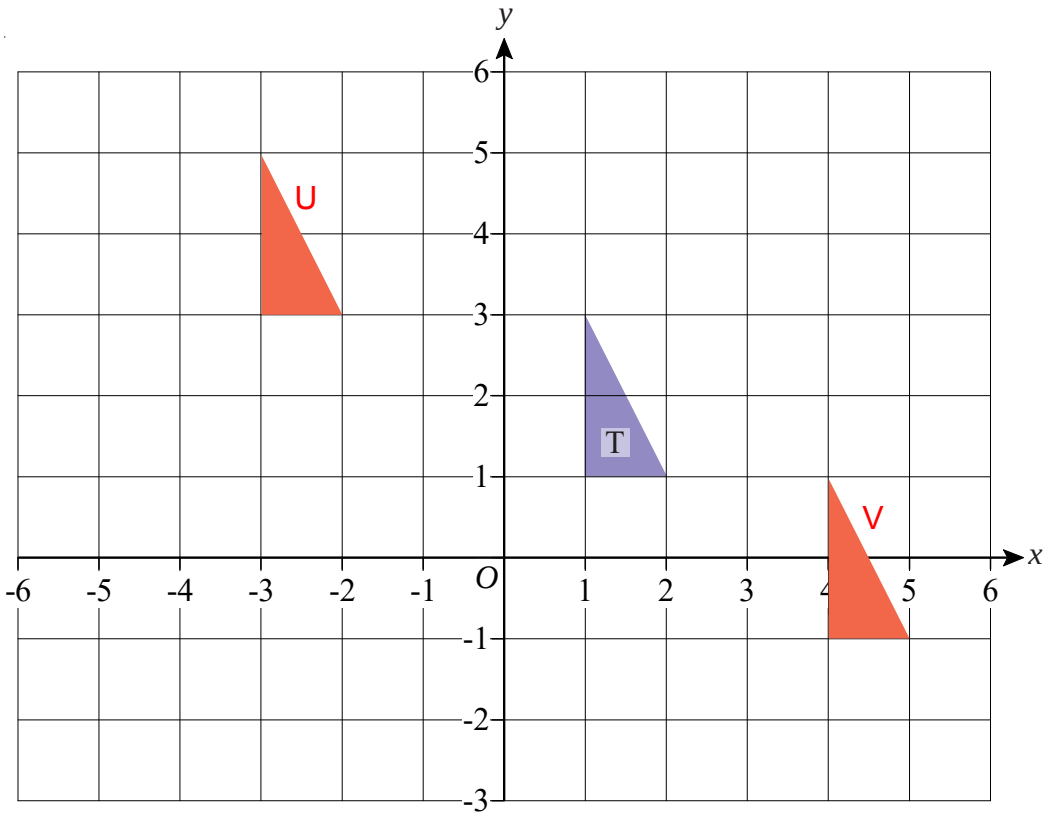
b) Describe fully the single transformation which maps triangle A to triangle C.



Translations

1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U.

b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V.

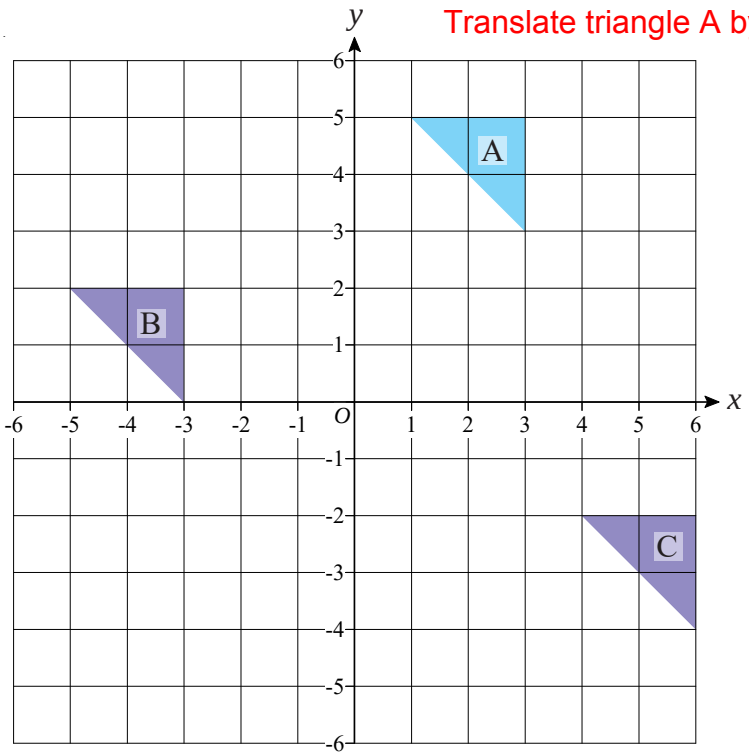


2) a) Describe fully the single transformation which maps triangle A to triangle B.

Translate triangle A by vector $\begin{bmatrix} -6 \\ -3 \end{bmatrix}$

b) Describe fully the single transformation which maps triangle A to triangle C.

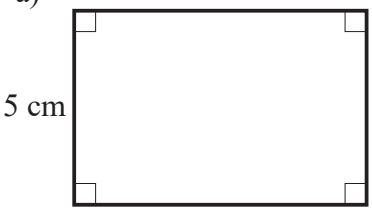
Translate triangle A by vector $\begin{bmatrix} 3 \\ -7 \end{bmatrix}$



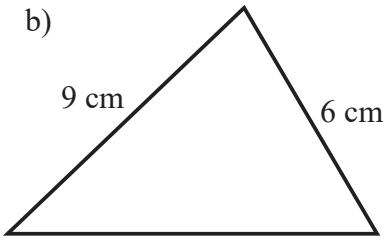
Perimeters

1) Find the perimeters of the following two shapes.

a)



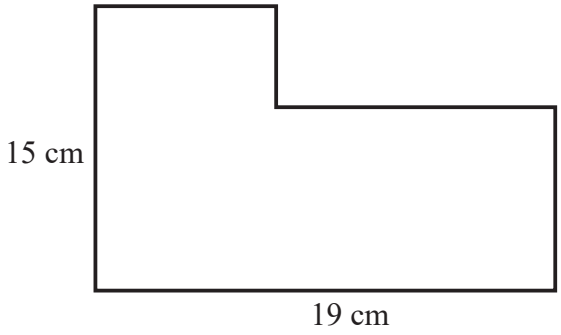
b)



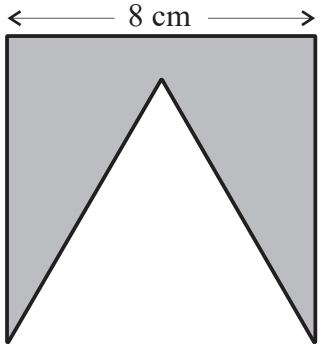
2) The length of a rectangle is 9 cm.
The total perimeter is 30 cm.

Calculate the length of the width of the rectangle.

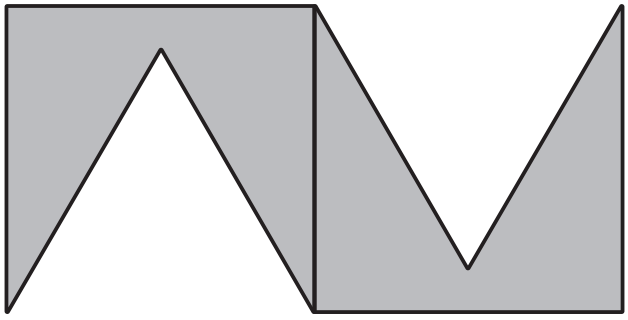
3) Work out the perimeter of this L shape.



4) This shape is made by cutting out an equilateral triangle from a square.



Two of these shapes are then put together to make this shape.

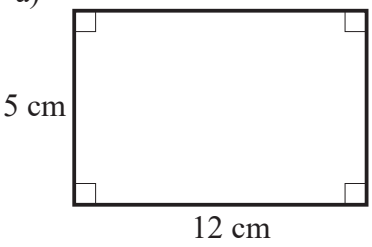


Work out the perimeter of this new shape.

Perimeters

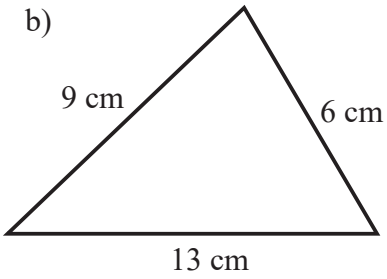
1) Find the perimeters of the following two shapes.

a)



34 cm

b)

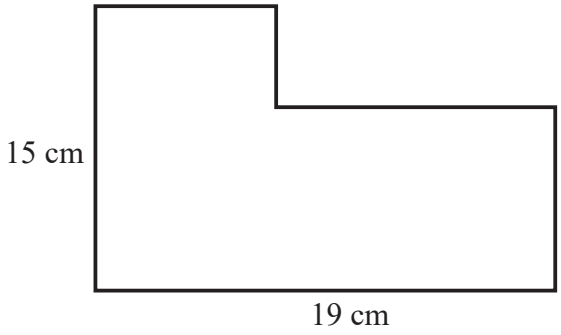


28 cm

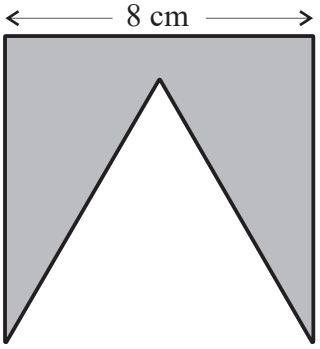
2) The length of a rectangle is 9 cm.
The total perimeter is 30 cm.

Calculate the length of the width of the rectangle. 6 cm

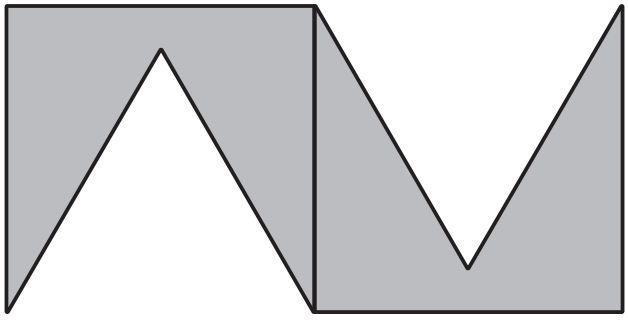
3) Work out the perimeter of this L shape. 68 cm



4) This shape is made by cutting out an equilateral triangle from a square.



Two of these shapes are then put together to make this shape.

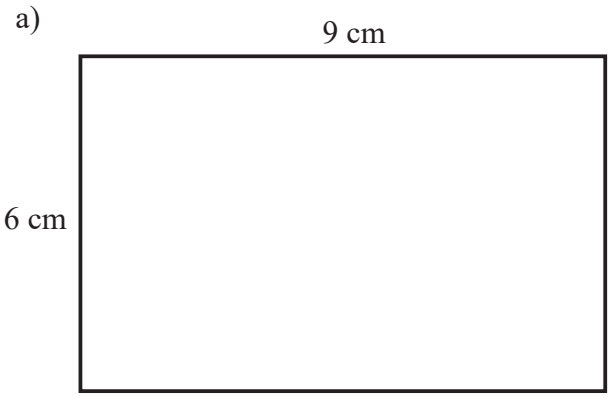


Work out the perimeter of this new shape. 64 cm

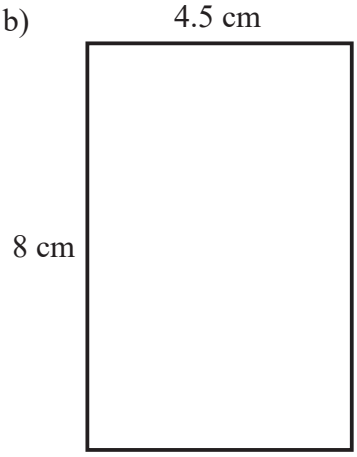
Area of a Rectangle

1) Find the areas of these two rectangles.

a)

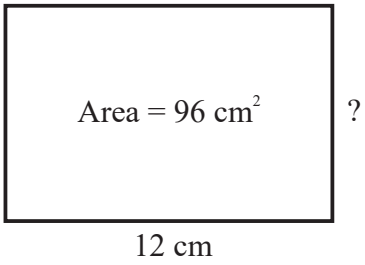


b)

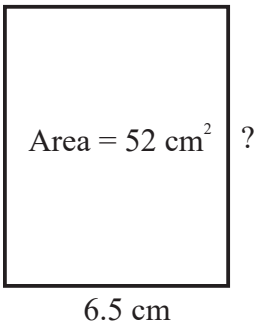


2) Find the size of the missing sides in these two rectangles.

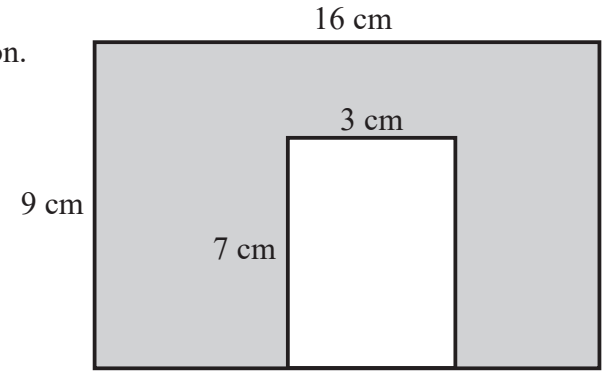
a)



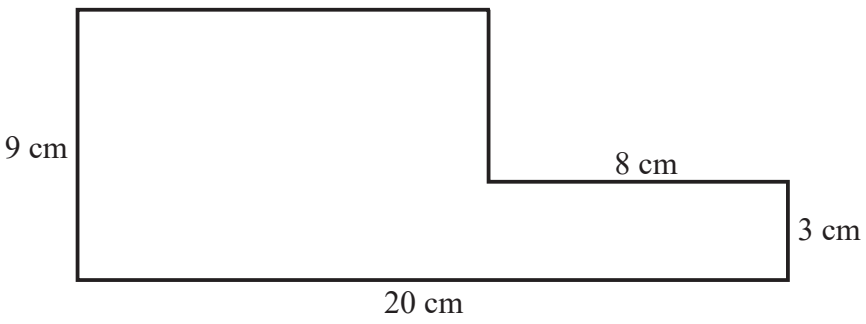
b)



3) Find the area of the shaded section.



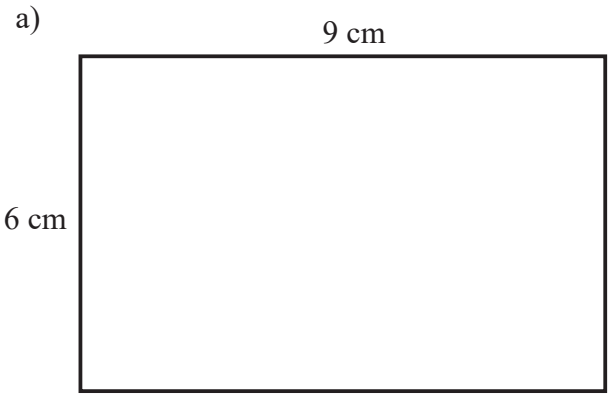
4) Find the area of the L shape.



Area of a Rectangle

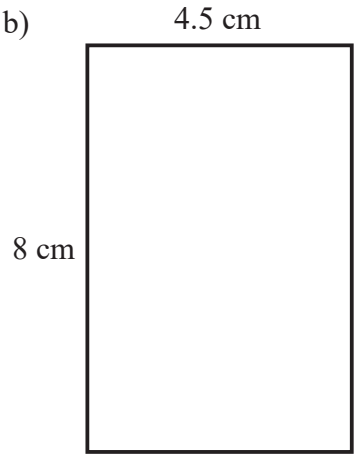
1) Find the areas of these two rectangles.

a)



54 cm²

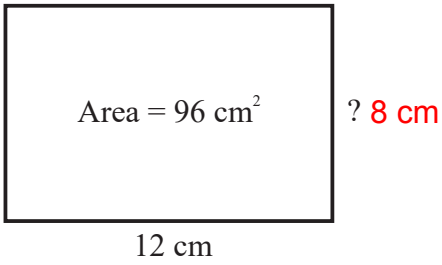
b)



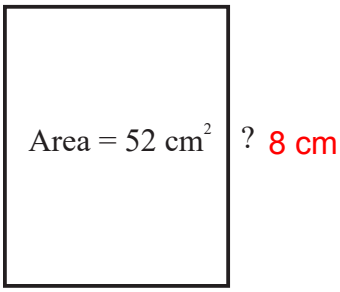
36 cm²

2) Find the size of the missing sides in these two rectangles.

a)

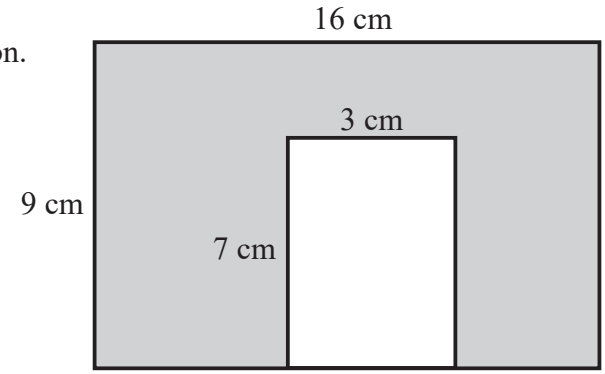


b)

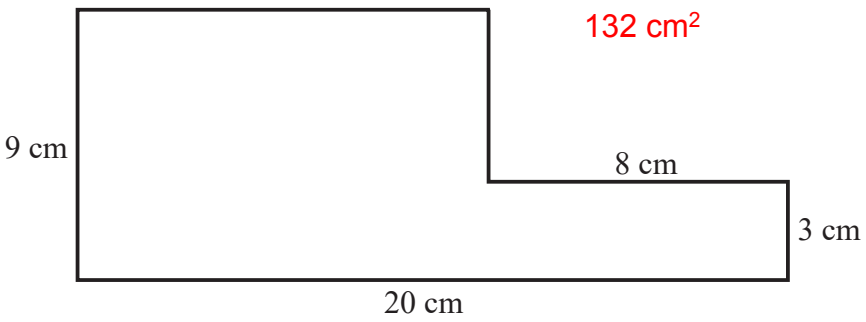


3) Find the area of the shaded section.

123 cm²



4) Find the area of the L shape.

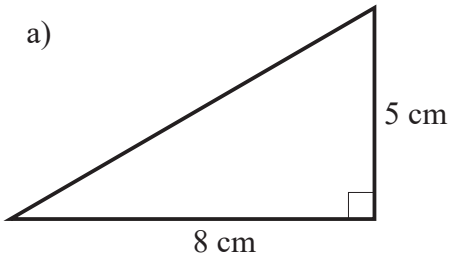


132 cm²

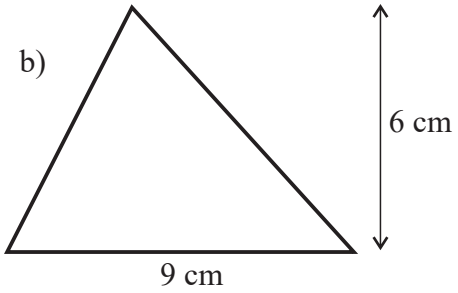
Area of a Triangle

1) Find the areas of the following two triangles.

a)

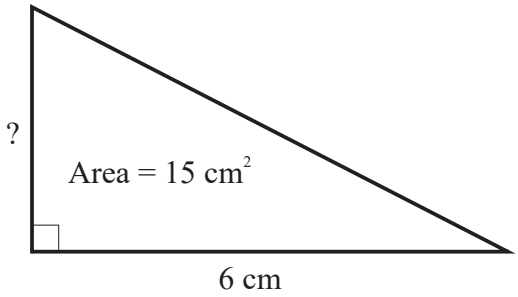


b)

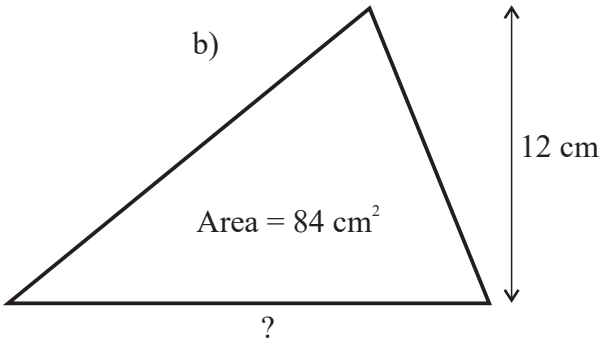


2) Find the missing lengths.

a)

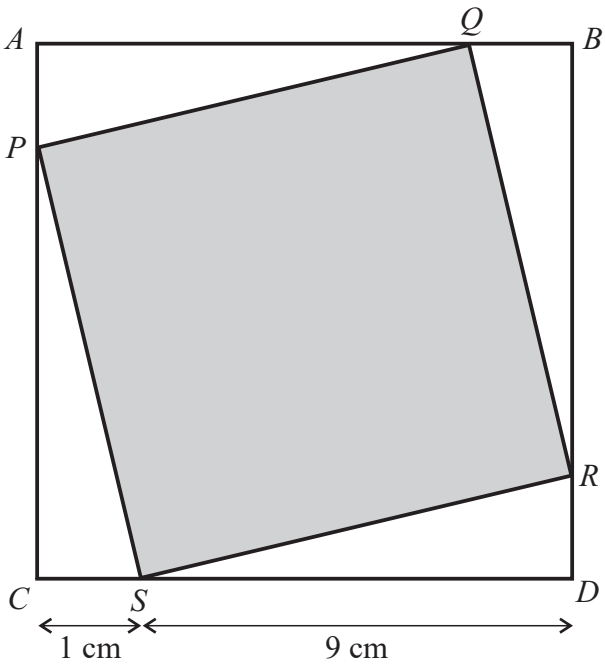


b)



3) *ABCD* is a square.

PQRS is a square.

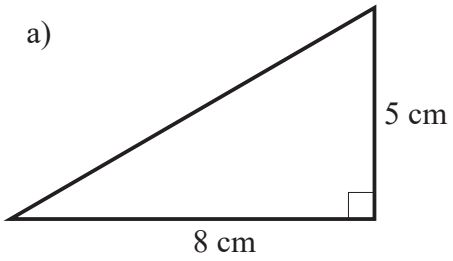


Find the area of the shaded square, *PQRS*.

Area of a Triangle

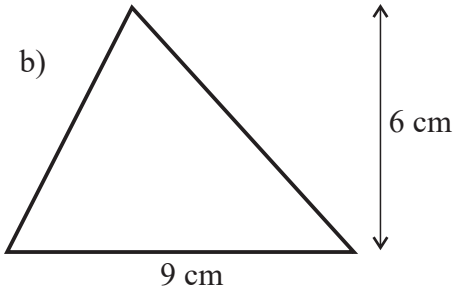
1) Find the areas of the following two triangles.

a)



20 cm²

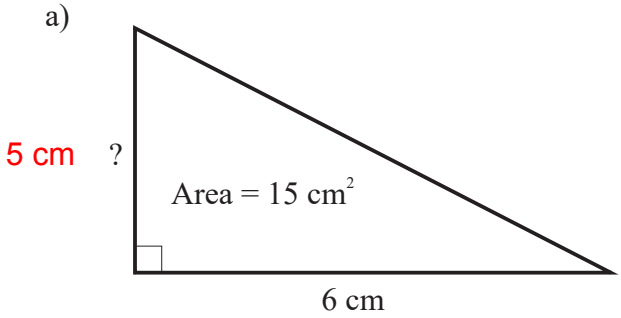
b)



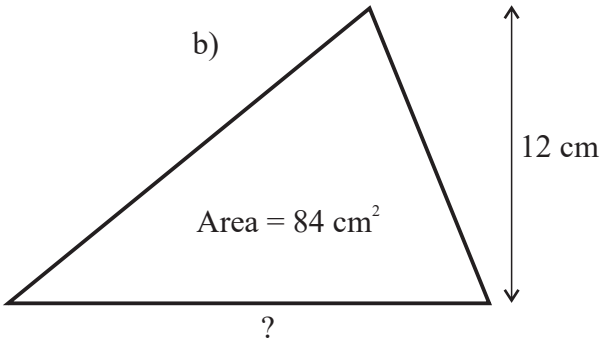
27 cm²

2) Find the missing lengths.

a)



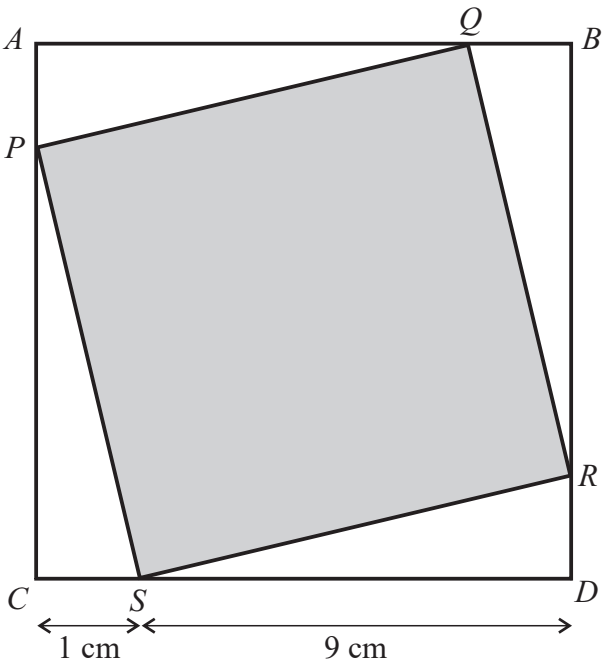
b)



14 cm

3) *ABCD* is a square.

PQRS is a square.

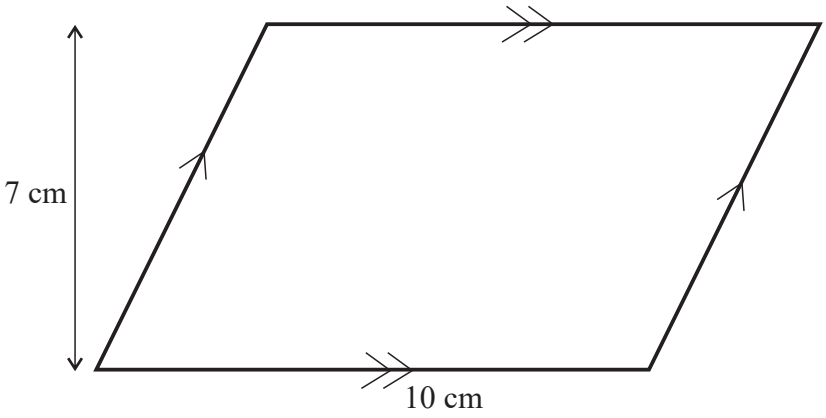


Find the area of the shaded square, *PQRS*. 82 cm²

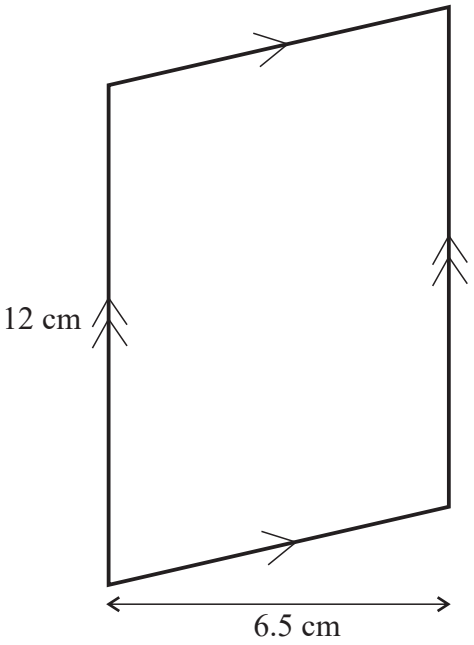
Area of a Parallelogram

1) Find the area of each of these parallelograms.

a)

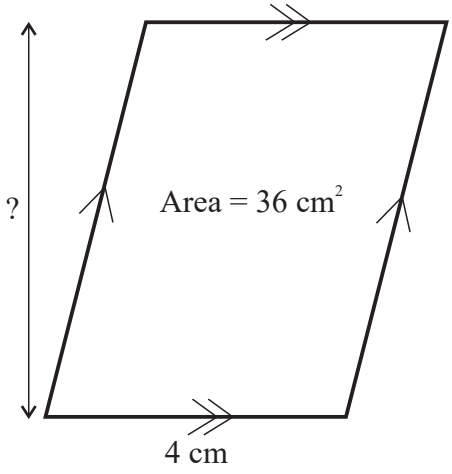


b)

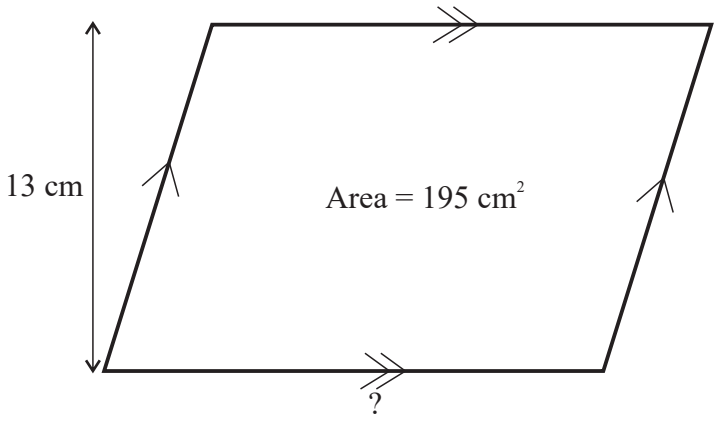


2) Find the missing lengths in these two parallelograms.

a)



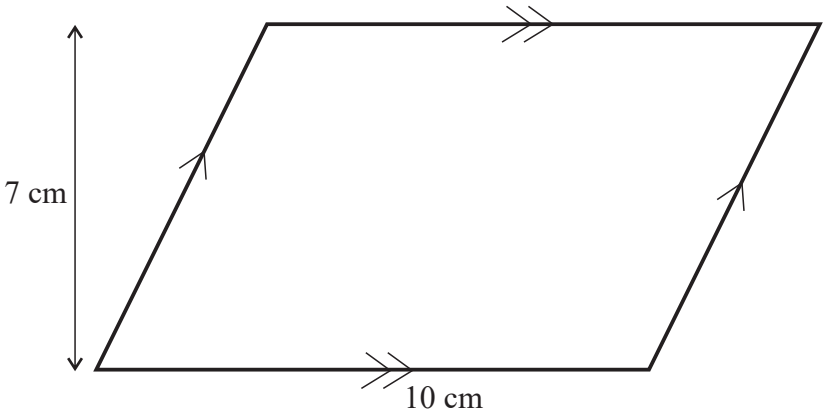
b)



Area of a Parallelogram

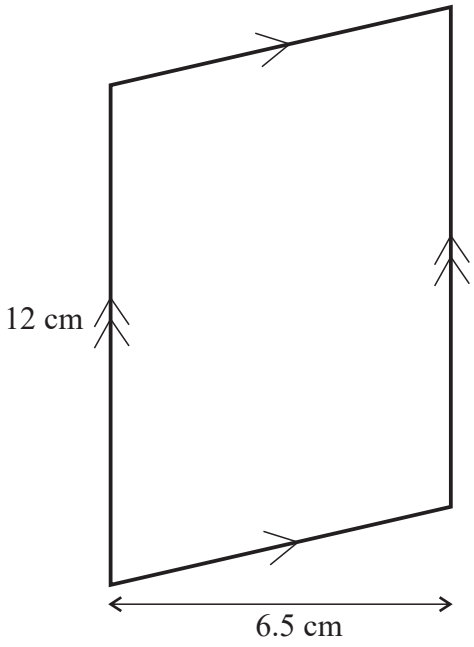
1) Find the area of each of these parallelograms.

a)



70 cm^2

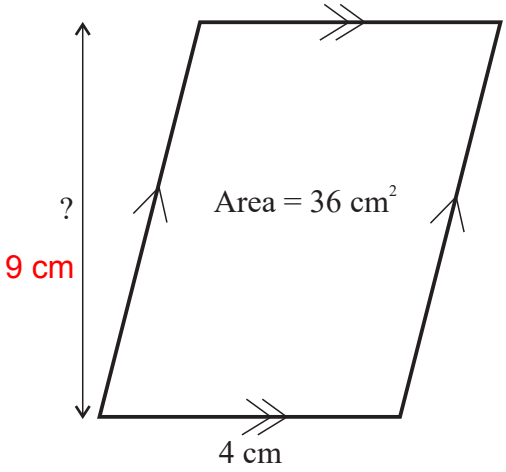
b)



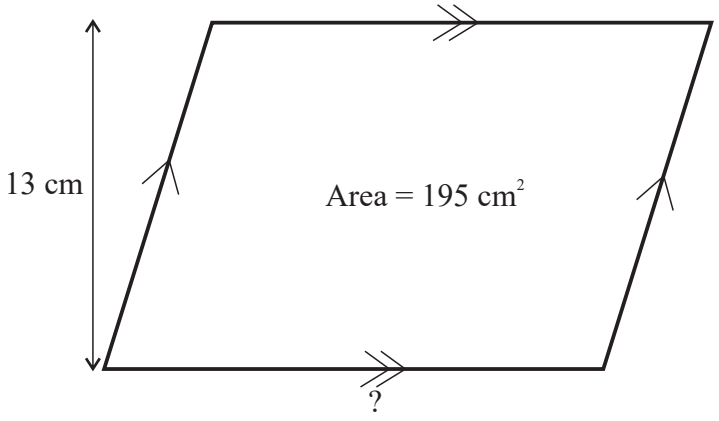
78 cm^2

2) Find the missing lengths in these two parallelograms.

a)



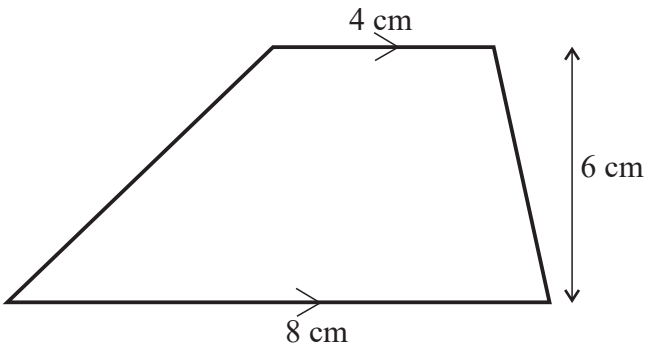
b)



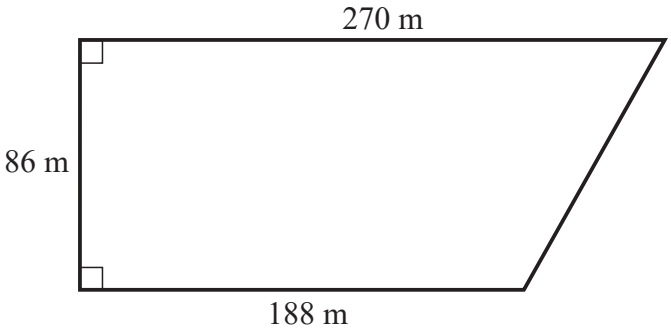
15 cm

Area of a Trapezium

1) Find the area of this trapezium.

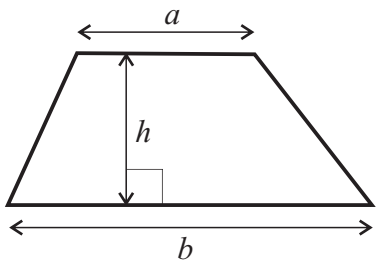


2) The diagram shows a field.



Work out the area of the field.

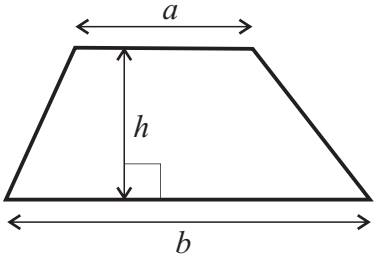
3) In the trapezium, $a = 6.6$ cm, $b = 8.4$ cm and $h = 3.6$ cm.



Work out the area of the trapezium.

4) In the trapezium below, the area is 45 cm^2.
$a = 5$ cm and $b = 10$ cm.

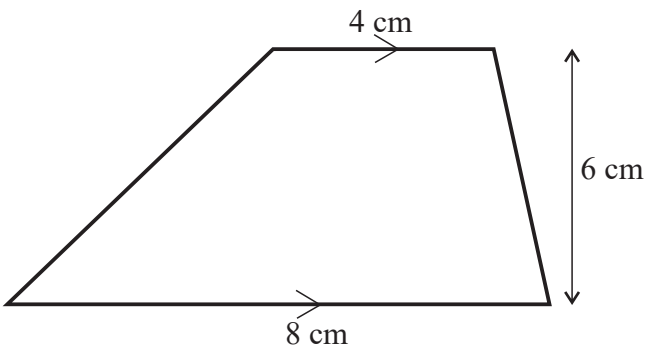
Calculate the height, h, of the trapezium.



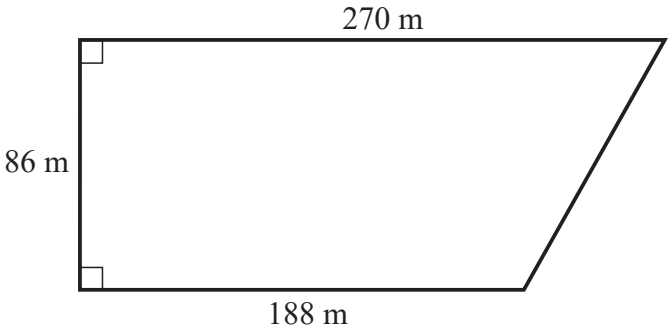
Area of a Trapezium

1) Find the area of this trapezium.

36 cm²

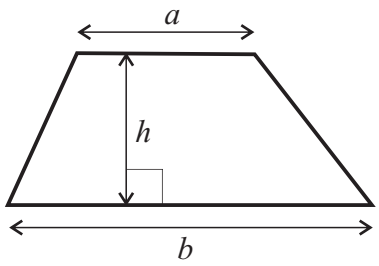


2) The diagram shows a field.



Work out the area of the field. 19694 m²

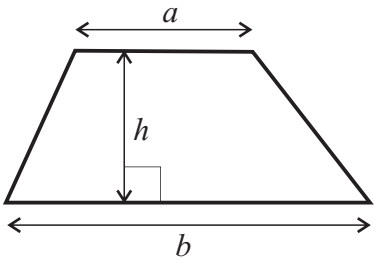
3) In the trapezium, $a = 6.6$ cm, $b = 8.4$ cm and $h = 3.6$ cm.



Work out the area of the trapezium. 27 cm²

4) In the trapezium below, the area is 45 cm².
$a = 5$ cm and $b = 10$ cm.

Calculate the height, h, of the trapezium. 6 cm



Listing Outcomes

1) List all the outcomes if two coins are flipped.

2) a) How many possible outcomes are there if three coins are flipped?

   b) List them all - the first one has been done for you: H H H

3) a) How many possible outcomes are there if two six-sided dice are rolled?

   b) List them all.

4) a) How many possible outcomes are there if a coin is flipped and a dice is rolled?

   b) List them all.

5) a) How many possible outcomes are there if two coins are flipped and a dice is rolled?

   b) List them all.

6) How many possible outcomes are there if 6 coins are flipped?

7) If Carly has each fingernail painted at a salon and can choose between red, blue and green for each nail, how many different combinations are there for her to choose from?

Listing Outcomes

1) List all the outcomes if two coins are flipped.

H H, H T, T H, T T

2) a) How many possible outcomes are there if three coins are flipped? 8

b) List them all - the first one has been done for you: H H H

H H T, H T H, T H H, T T H, T H T, H T T, T T T

3) a) How many possible outcomes are there if two six-sided dice are rolled? 36

b) List them all.

1 1, 1 2, 1 3, 1 4, 1 5, 1 6
2 1, 2 2, 2 3, 2 4, 2 5, 2 6
3 1, 3 2, 3 3, 3 4, 3 5, 3 6
4 1, 4 2, 4 3, 4 4, 4 5, 4 6
5 1, 5 2, 5 3, 5 4, 5 5, 5 6
6 1, 6 2, 6 3, 6 4, 6 5, 6 6

4) a) How many possible outcomes are there if a coin is flipped and a dice is rolled? 12

b) List them all.

H 1, H 2, H 3, H 4, H 5, H 6
T 1, T 2, T 3, T 4, T 5, T 6

5) a) How many possible outcomes are there if two coins are flipped and a dice is rolled? 24

b) List them all.

H H 1, H H 2, H H 3, H H 4, H H 5, H H 6
H T 1, H T 2, H T 3, H T 4, H T 5, H T 6
T H 1, T H 2, T H 3, T H 4, T H 5, T H 6
T T 1, T T 2, T T 3, T T 4, T T 5, T T 6

6) How many possible outcomes are there if 6 coins are flipped? 64

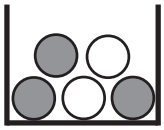
7) If Carly has each fingernail painted at a salon and can choose between red, blue and green for each nail, how many different combinations are there for her to choose from? 59049

Calculating Probabilities

1) A box contains 3 grey counters and 2 white counters.

A counter is taken from the box at random.

What is the probability of choosing a white counter?



2) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

A counter is taken from the bag at random.

a) What is the probability that a green counter will be chosen?

b) What is the probability that a blue or red counter will be chosen?

3) In a class there are 10 boys and 15 girls.

A teacher chooses a student at random from the class.

Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

Jenny says that Eric is wrong.

Decide who is correct - Eric or Jenny - giving reasons for your answer.

4) Spinner A has numbers 1 to 4 on it.

Spinner B has numbers 1 to 3 on it.

Both spinners are spun and the numbers on each are added together to give a score.

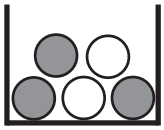
What is the probability that the score will be

a) 7?

b) 3 or 4?

Calculating Probabilities

1) A box contains 3 grey counters and 2 white counters.



A counter is taken from the box at random.

What is the probability of choosing a white counter?

$\frac{2}{5}$

2) There are 3 blue counters, 5 red counters and 7 green counters in a bag.

A counter is taken from the bag at random.

a) What is the probability that a green counter will be chosen? $\frac{7}{15}$

b) What is the probability that a blue or red counter will be chosen? $\frac{8}{15}$

3) In a class there are 10 boys and 15 girls.

A teacher chooses a student at random from the class.

Eric says that the probability a boy will be chosen is 0.5 because a student can be either a boy or a girl.

Jenny says that Eric is wrong.

Decide who is correct - Eric or Jenny - giving reasons for your answer.

Jenny is correct because there are more girls than boys, so the probability of choosing a girl will be greater than that of choosing a boy.

4) Spinner A has numbers 1 to 4 on it.

Spinner B has numbers 1 to 3 on it.

Both spinners are spun and the numbers on each are added together to give a score.

What is the probability that the score will be

a) 7? $\frac{1}{12}$

b) 3 or 4? $\frac{5}{12}$

Mutually Exclusive Events

1) If the probability of passing a driving test is 0.54,
what is the probability of failing it?

2) The probability that a football team will win their next game is $\frac{2}{11}$.
The probability they will lose is $\frac{3}{11}$.
What is the probability the game will be a draw?

3) On the school dinner menu there is only ever one of four options.
Some of the options are more likely to be on the menu than others.
The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41		0.09

a) Work out the probability of the dinner option being Fish.

b) Which option is most likely?

c) Work out the probability that it is a Curry or Sausages on any particular day.

d) Work out the probability that it is **not** Casserole.

4) Julie buys a book every week.
Her favourite types are Novel, Drama, Biography and Romance.
The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

a) Work out the probability that she will choose a Novel or a Drama.

b) Work out the probability that she will choose a Biography or a Romance.

The probability that she will choose a Biography is the same as the probability she will choose a Romance.

c) Work out the probability that she will choose a Biography.

Mutually Exclusive Events

1) If the probability of passing a driving test is 0.54,
what is the probability of failing it? 0.46

2) The probability that a football team will win their next game is $\frac{2}{11}$.
The probability they will lose is $\frac{3}{11}$.
What is the probability the game will be a draw? $\frac{6}{11}$

3) On the school dinner menu there is only ever one of four options.
Some of the options are more likely to be on the menu than others.
The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41	0.14	0.09

a) Work out the probability of the dinner option being Fish. 0.14

b) Which option is most likely? Sausages

c) Work out the probability that it is a Curry or Sausages on any particular day. 0.77

d) Work out the probability that it is **not** Casserole. 0.91

4) Julie buys a book every week.
Her favourite types are Novel, Drama, Biography and Romance.
The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

a) Work out the probability that she will choose a Novel or a Drama. 0.4

b) Work out the probability that she will choose a Biography or a Romance. 0.6

The probability that she will choose a Biography is the same as the probability she will choose a Romance.

c) Work out the probability that she will choose a Biography. 0.3

Data - Discrete and Continuous

1) Out of the following types of data, decide which is continuous and which is discrete:

The lengths of some roads.

The number of 'cats eyes' on a one mile stretch of road.

The time it takes twenty students to complete an English essay.

The number of pages in twenty students English essays.

The weights of sacks of potatoes.

The number of potatoes in some sacks of potatoes.

The depth of water as the tide comes in and goes out.

The number of crackers in some packets of biscuits.

The weight of the crackers in some packs of bicuits.

2) Write a short statement which explains what continuous data is.

3) Write a short statement which explains what discrete data is.

Data - Discrete and Continuous

1) Out of the following types of data, decide which is continuous and which is discrete:

The lengths of some roads. Continuous

The number of 'cats eyes' on a one mile stretch of road. Discrete

The time it takes twenty students to complete an English essay. Continuous

The number of pages in twenty students English essays. Discrete

The weights of sacks of potatoes. Continuous

The number of potatoes in some sacks of potatoes. Discrete

The depth of water as the tide comes in and goes out. Continuous

The number of crackers in some packets of biscuits. Discrete

The weight of the crackers in some packs of bicuits. Continuous

2) Write a short statement which explains what continuous data is.
Continuous data is data that is measured using a continuous scale.

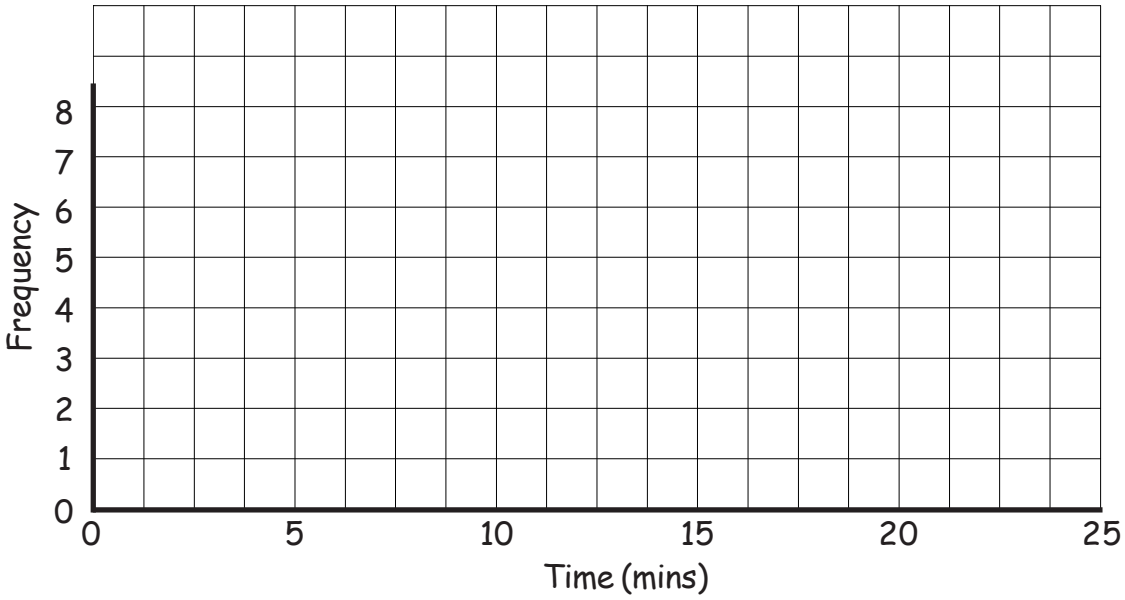
3) Write a short statement which explains what discrete data is.
Discrete data is data that is counted.

Frequency Tables and Diagrams

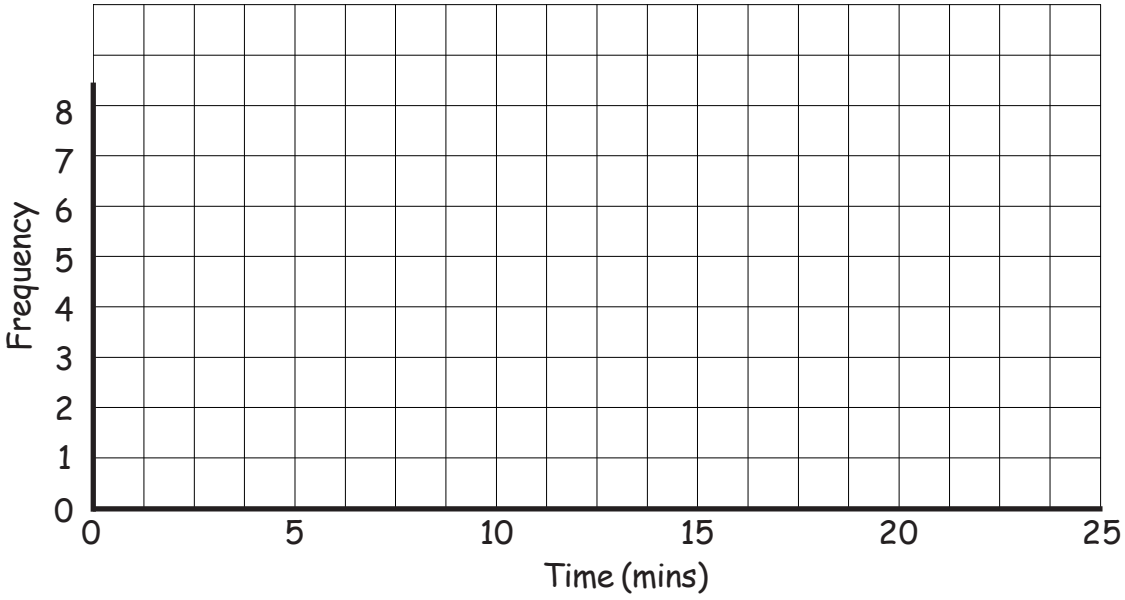
A class of pupils is asked to solve a puzzle.
The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.



b) Draw a frequency polygon to show this information.



Frequency Tables and Diagrams

A class of pupils is asked to solve a puzzle.
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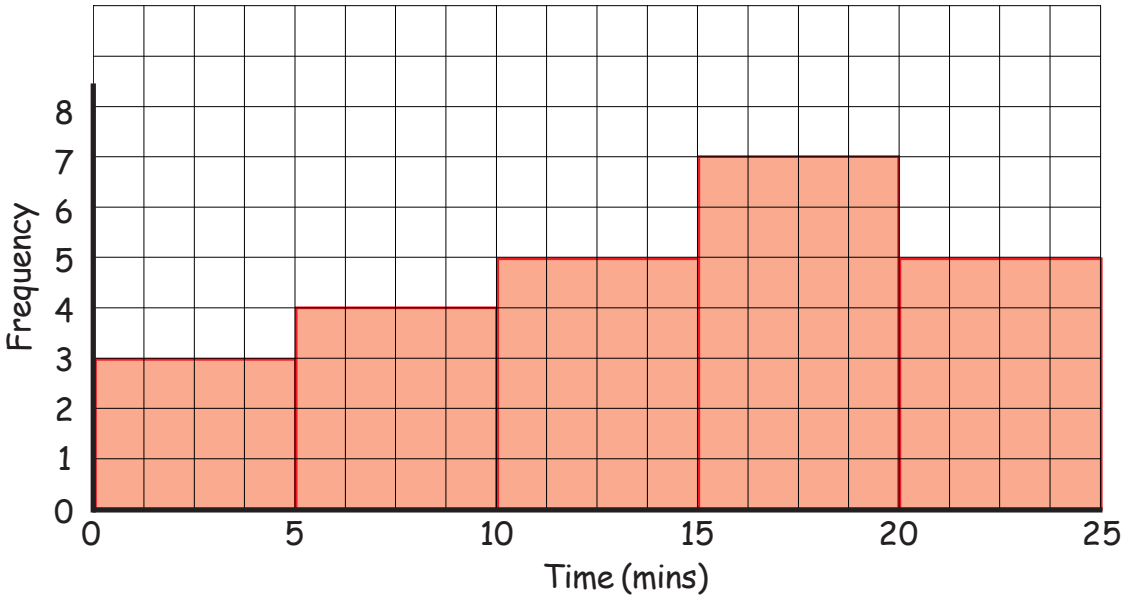
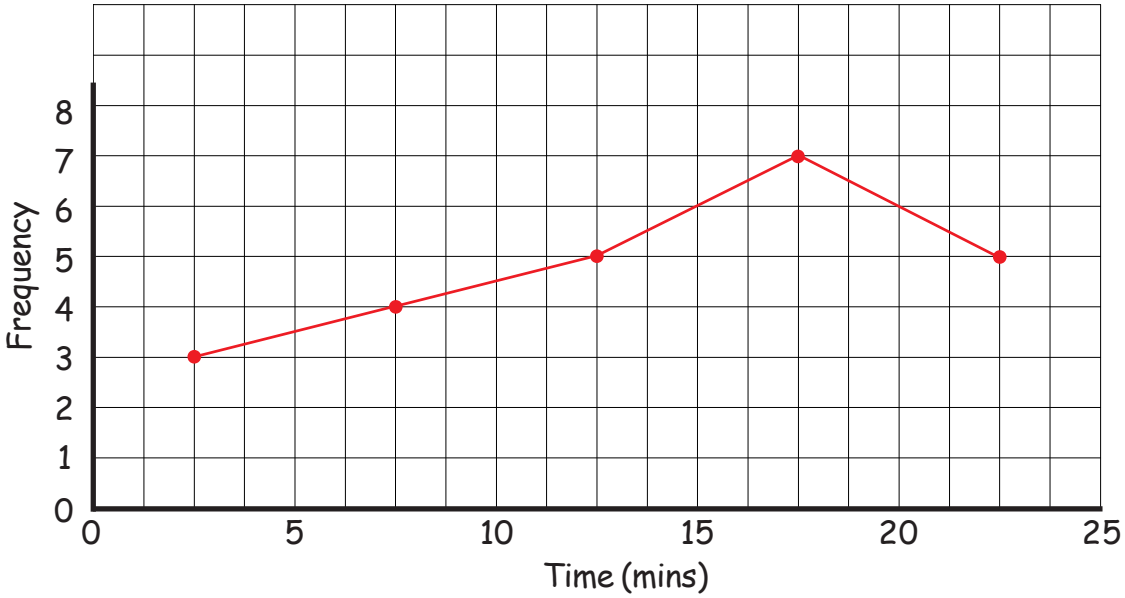
Time (t) in min	Frequency
$0 < t \leqslant 5$	3
$5 < t \leqslant 10$	4
$10 < t \leqslant 15$	5
$15 < t \leqslant 20$	7
$20 < t \leqslant 25$	5

a) Draw a frequency diagram to show this information.



b) Draw a frequency polygon to show this information.



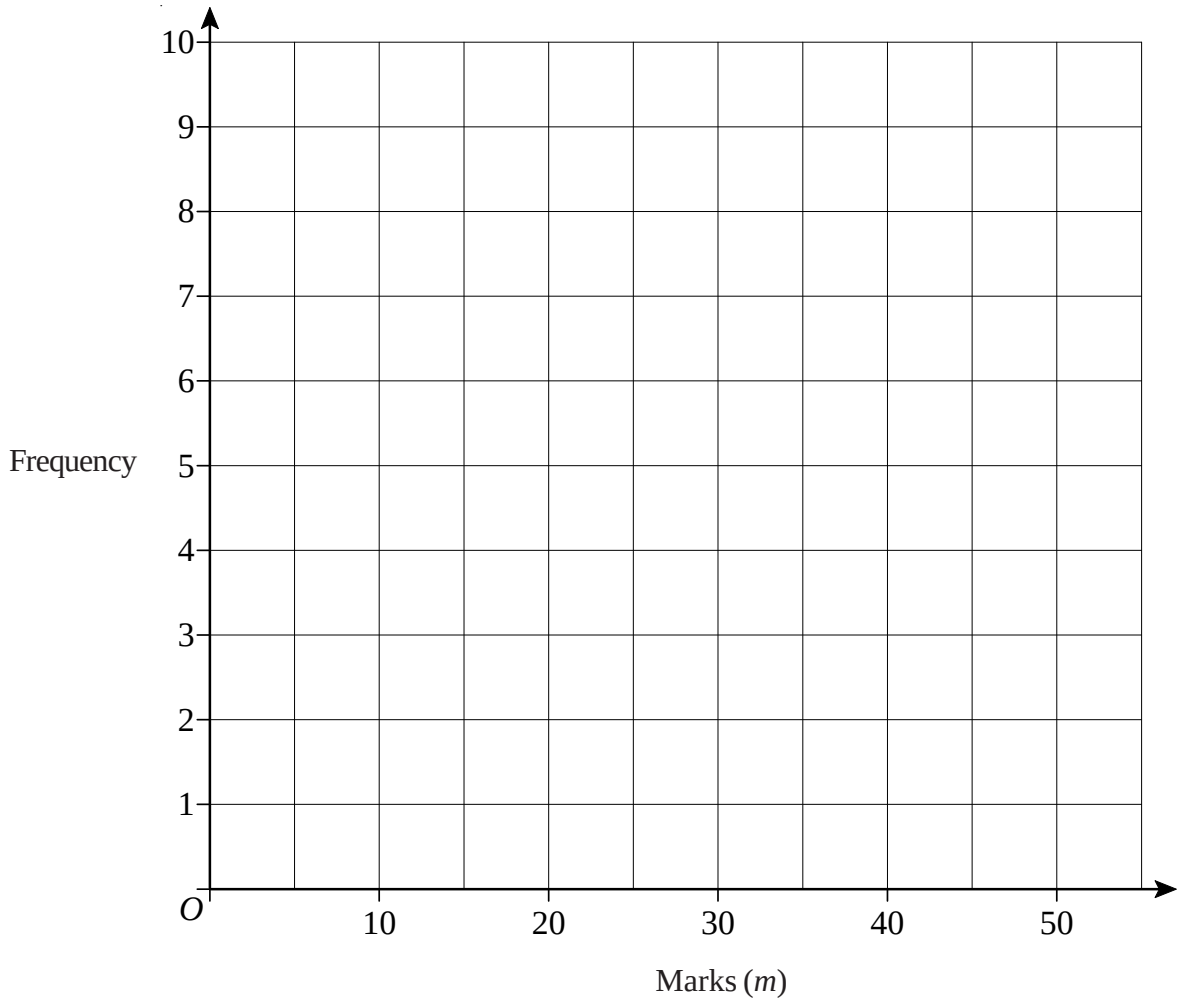
Frequency Tables and Diagrams

30 students took a test.

The table shows information about how many marks they gained in the test.

Marks (m)	Frequency
$0 < m \leqslant 10$	4
$10 < m \leqslant 20$	8
$20 < m \leqslant 30$	9
$30 < m \leqslant 40$	6
$40 < m \leqslant 50$	3

On the grid, draw a frequency polygon for this information.



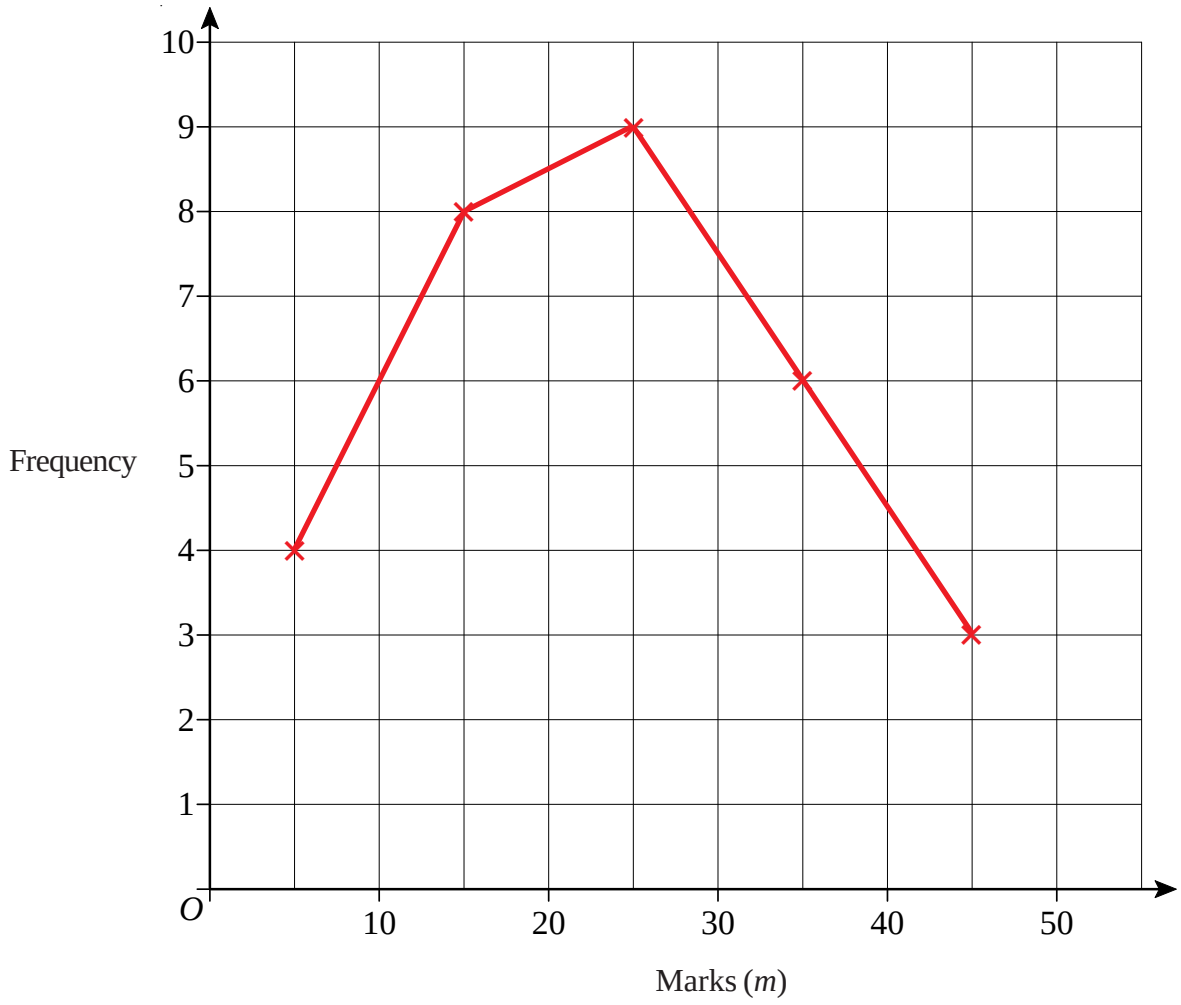
Frequency Tables and Diagrams

30 students took a test.

The table shows information about how many marks they gained in the test.

Marks (m)		Frequency
$0 < m \leqslant 10$	5	4
$10 < m \leqslant 20$	15	8
$20 < m \leqslant 30$	25	9
$30 < m \leqslant 40$	35	6
$40 < m \leqslant 50$	45	3

On the grid, draw a frequency polygon for this information.



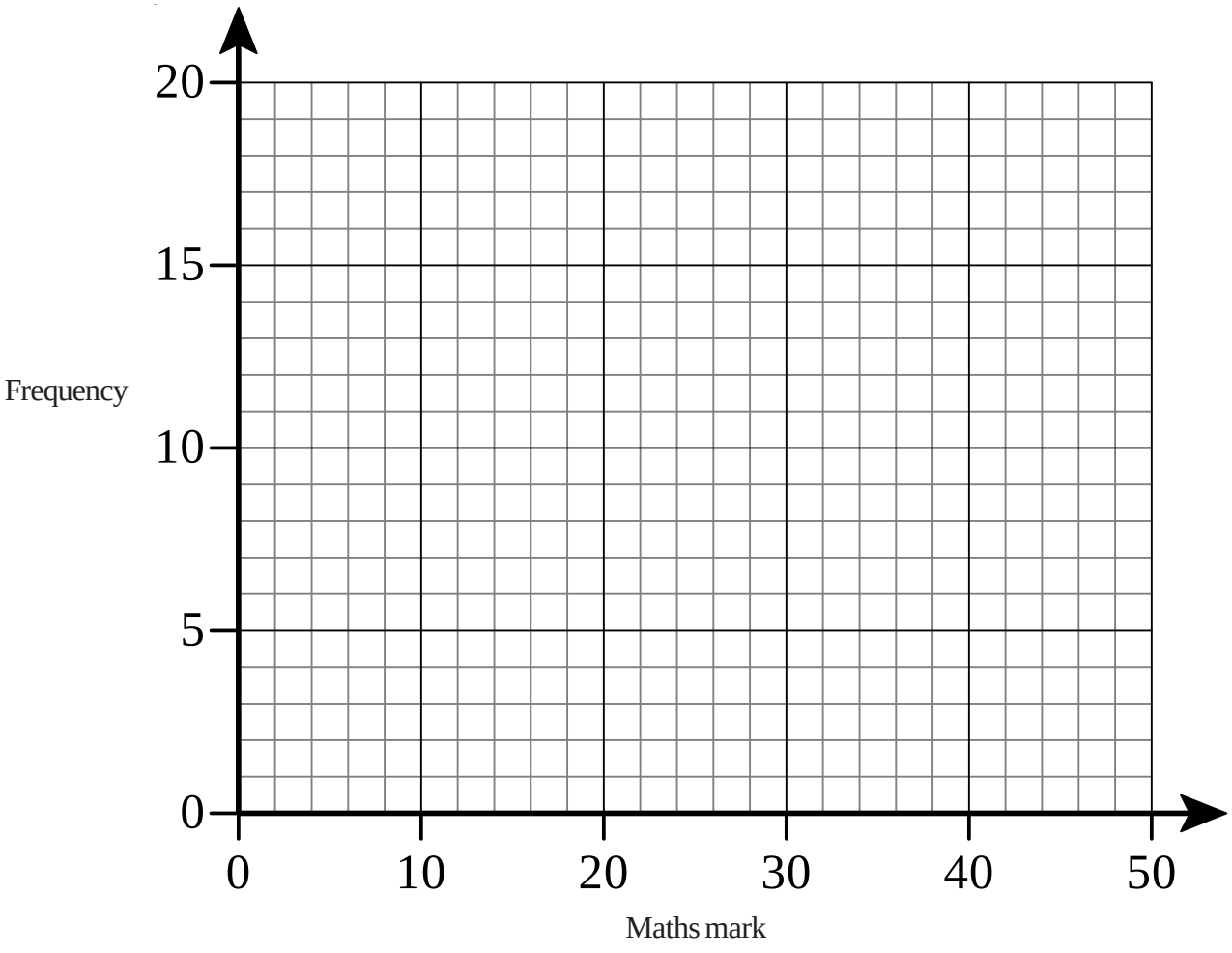
Frequency Tables and Diagrams

60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.



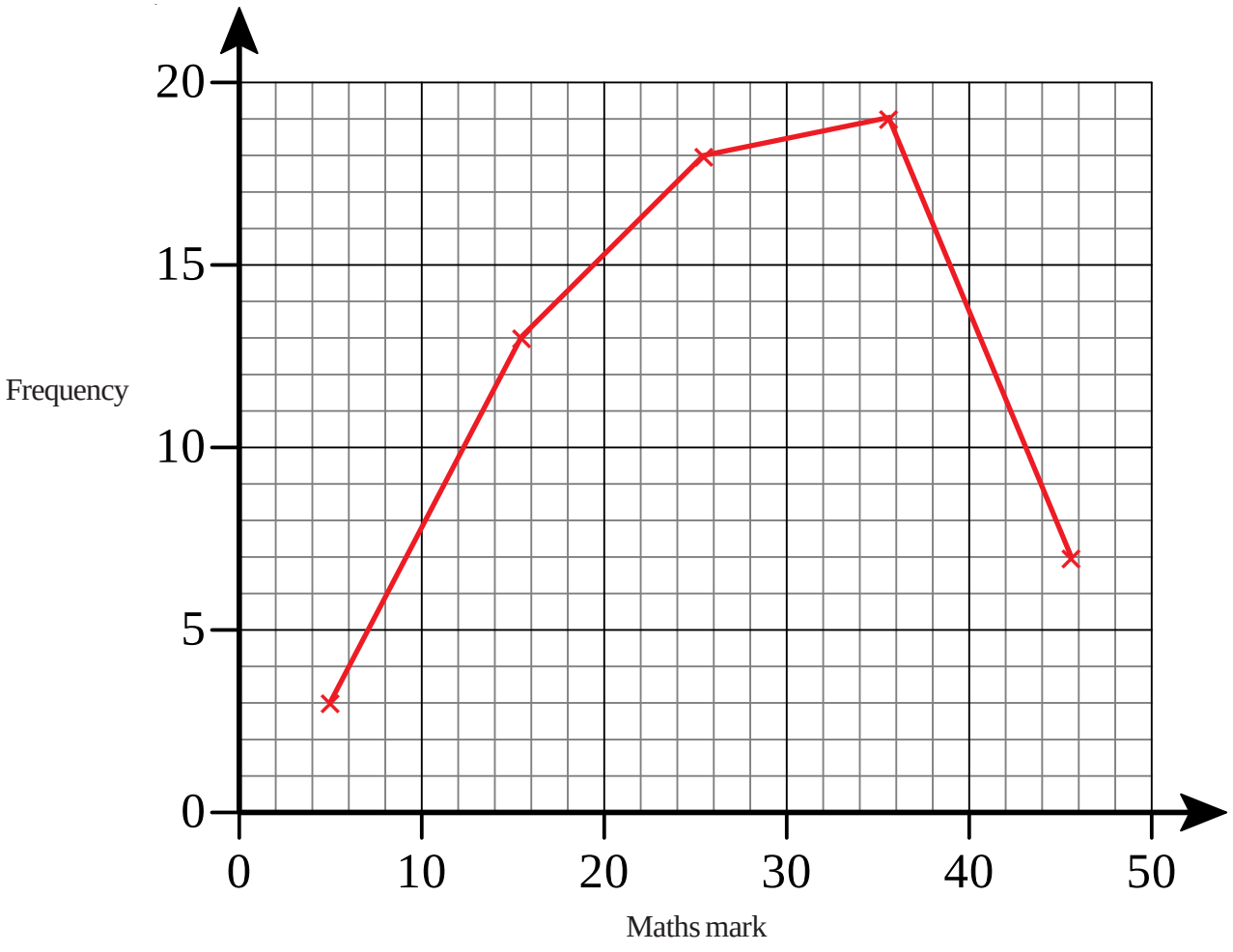
Frequency Tables and Diagrams

60 students take a Maths test.
The test is marked out of 50.

This table shows information about students' marks.

	5	15.5	25.5	35.5	45.5
Maths mark	0 - 10	11 - 20	21 - 30	31 - 40	41 - 50
Frequency	3	13	18	19	7

On the grid, draw a frequency polygon to show this information.



Multiplying Decimals

1) Work out

a) 6×0.2

b) 0.2×0.3

c) 0.4×7

d) 0.2×0.8

e) 0.03×0.9

f) 1.5×0.2

2) A box contains 7 books, each weighing 2.5 kg.

Work out the total weight of the box.

3) Jim takes 13 boxes out of his van.

The weight of each box is 25.5 kg.

Work out the total weight of the 13 boxes.

4) Tim has a job which pays £6.85 per hour.

If he works for 34 hours, one week, how much does he earn?

5) Sue has a part-time job and the hourly pay is £7.50 per hour.

How much does she earn if she works for 8.5 hours, one week?

6) Fencing costs £13.25 per metre.

How much does 12.5 m cost?

Multiplying Decimals

1) Work out

a) 6×0.2 1.2

b) 0.2×0.3 0.06

c) 0.4×7 2.8

d) 0.2×0.8 0.16

e) 0.03×0.9 0.027

f) 1.5×0.2 0.3

2) A box contains 7 books, each weighing 2.5 kg.

Work out the total weight of the box. 17.5 kg

3) Jim takes 13 boxes out of his van.

The weight of each box is 25.5 kg.

Work out the total weight of the 13 boxes. 331.5 kg

4) Tim has a job which pays £6.85 per hour.

If he works for 34 hours, one week, how much does he earn? £232.90

5) Sue has a part-time job and the hourly pay is £7.50 per hour.

How much does she earn if she works for 8.5 hours, one week? £63.75

6) Fencing costs £13.25 per metre.

How much does 12.5 m cost? £165.63

Dividing Decimals

1) Work out

a) $9 \div 0.3$

b) $6 \div 0.1$

c) $12 \div 0.4$

d) $25 \div 0.5$

e) $21 \div 0.3$

f) $15 \div 0.2$

2) Work out

a) $3.6 \div 0.4$

b) $0.8 \div 0.2$

c) $2.4 \div 0.4$

d) $0.56 \div 0.08$

e) $5.5 \div 0.05$

f) $8.1 \div 0.09$

3) John takes boxes out of his van.
The total weight of the boxes is 4.9 kg
The weight of each box is 0.7 kg
Work out the number of boxes in John's van.

4) Mr Rogers bought a bag of elastic bands for £6
Each elastic band costs 12p.
Work out the number of elastic bands in the bag.

Dividing Decimals

1) Work out

a) $9 \div 0.3$ 30

b) $6 \div 0.1$ 60

c) $12 \div 0.4$ 30

d) $25 \div 0.5$ 50

e) $21 \div 0.3$ 70

f) $15 \div 0.2$ 75

2) Work out

a) $3.6 \div 0.4$ 9

b) $0.8 \div 0.2$ 4

c) $2.4 \div 0.4$ 6

d) $0.56 \div 0.08$ 7

e) $5.5 \div 0.05$ 110

f) $8.1 \div 0.09$ 90

3) John takes boxes out of his van.
The total weight of the boxes is 4.9 kg
The weight of each box is 0.7 kg
Work out the number of boxes in John's van. 7

4) Mr Rogers bought a bag of elastic bands for £6
Each elastic band costs 12p.
Work out the number of elastic bands in the bag. 50

Four Rules of Negatives

1) Work out the following:

   a) 2 – 7

   b) 4 – 6

   c) 1 – 8

   d) 0 – 4

2) Work out the following:

   a) -3 + 2

   b) -7 + 5

   c) -3 + 8

   d) -9 + 11

3) Work out the following:

   a) -1 – 3

   b) -4 – 5

   c) -7 – 8

   d) -2 – 12

4) Work out the following:

   a) 6 – -3

   b) -3 – -5

   c) -9 – -2

   d) 1 – -13

5) Work out the following:

   a) -3 × 4

   b) 5 × -2

   c) -4 × -5

   d) -6 × -3

6) Work out the following:

   a) 12 ÷ -4

   b) -20 ÷ -2

   c) -15 ÷ 3

   d) -100 ÷ -5

Four Rules of Negatives

1) Work out the following:

a) 2 – 7 -5

b) 4 – 6 -2

c) 1 – 8 -7

d) 0 – 4 -4

2) Work out the following:

a) -3 + 2 1

b) -7 + 5 -2

c) -3 + 8 5

d) -9 + 11 2

3) Work out the following:

a) -1 – 3 -4

b) -4 – 5 -9

c) -7 – 8 -15

d) -2 – 12 -14

4) Work out the following:

a) 6 – -3 9

b) -3 – -5 2

c) -9 – -2 -7

d) 1 – -13 14

5) Work out the following:

a) -3 × 4 -12

b) 5 × -2 -10

c) -4 × -5 20

d) -6 × -3 18

6) Work out the following:

a) 12 ÷ -4 -3

b) -20 ÷ -2 10

c) -15 ÷ 3 -5

d) -100 ÷ -5 20

Comparing Fractions

1) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{3}$

b) $\frac{3}{5}$ $\frac{2}{3}$

c) $\frac{1}{2}$ $\frac{3}{8}$

2) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{8}$

b) $\frac{3}{5}$ $\frac{1}{2}$ $\frac{3}{4}$

c) $\frac{5}{6}$ $\frac{2}{3}$ $\frac{3}{4}$

3) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{2}{3}$ $\frac{7}{12}$ $\frac{3}{4}$ $\frac{5}{6}$

b) $\frac{5}{8}$ $\frac{2}{3}$ $\frac{3}{24}$ $\frac{7}{12}$

c) $\frac{6}{10}$ $\frac{4}{5}$ $\frac{5}{12}$ $\frac{8}{15}$

4) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines

$\frac{4}{10}$ on chocolates

$\frac{1}{4}$ on games

Order the items Ben bought by value, largest first.
Show all your working.

Comparing Fractions

1) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{2}$

b) $\frac{3}{5}$ $\frac{2}{3}$ $\frac{3}{5}$ $\frac{2}{3}$

c) $\frac{1}{2}$ $\frac{3}{8}$ $\frac{3}{8}$ $\frac{1}{2}$

2) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{1}{2}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$

b) $\frac{3}{5}$ $\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{2}$ $\frac{3}{5}$ $\frac{3}{4}$

c) $\frac{5}{6}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$

3) Put these fractions in order of size, smallest to largest.
Show your working for each question.

a) $\frac{2}{3}$ $\frac{7}{12}$ $\frac{3}{4}$ $\frac{5}{6}$ $\frac{7}{12}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$

b) $\frac{5}{8}$ $\frac{2}{3}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{5}{8}$ $\frac{2}{3}$

c) $\frac{6}{10}$ $\frac{4}{5}$ $\frac{5}{12}$ $\frac{8}{15}$ $\frac{5}{12}$ $\frac{8}{15}$ $\frac{6}{10}$ $\frac{4}{5}$

4) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines

$\frac{4}{10}$ on chocolates

$\frac{1}{4}$ on games

Order the items Ben bought by value, largest first. Chocolates, magazines, games
Show all your working.

Adding and Subtracting Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{7} + \frac{3}{7}$

b) $\frac{4}{9} + \frac{1}{9}$

2) Work out the following:

a) $\frac{1}{5} + \frac{3}{4}$

b) $\frac{3}{8} + \frac{1}{4}$

c) $\frac{2}{3} + \frac{3}{10}$

d) $\frac{1}{2} + \frac{2}{5}$

3) Work out the following:

a) $\frac{2}{3} + \frac{1}{2}$

b) $\frac{3}{5} + \frac{2}{3}$

c) $\frac{5}{8} + \frac{3}{4}$

d) $\frac{5}{7} + \frac{2}{5}$

4) Work out the following:

a) $2\frac{1}{2} + 1\frac{3}{4}$

b) $1\frac{2}{5} + \frac{2}{3}$

c) $2\frac{1}{6} + 1\frac{1}{2}$

d) $1\frac{3}{7} + \frac{2}{5}$

5) Work out the following:

a) $\frac{3}{4} - \frac{1}{2}$

b) $\frac{5}{7} - \frac{2}{3}$

c) $\frac{5}{8} - \frac{1}{3}$

d) $\frac{8}{9} - \frac{2}{3}$

6) Work out the following:

a) $2\frac{1}{2} - 1\frac{3}{4}$

b) $1\frac{2}{3} - \frac{3}{4}$

c) $3\frac{2}{5} - 1\frac{1}{2}$

d) $2\frac{3}{8} - \frac{3}{5}$

7) Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

He spent $\frac{1}{10}$ of his pocket money on magazines.

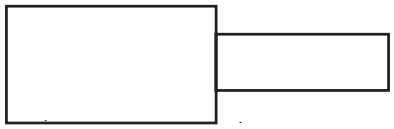
What fraction of his pocket money did he have left?

8) Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

a) What fraction of the bag of flour was used?
b) What fraction of the bag of flour is left?

9) Work out the total length of this shape.
Give your answer as a mixed number.



Adding and Subtracting Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{7} + \frac{3}{7}$ $\frac{4}{7}$

b) $\frac{4}{9} + \frac{1}{9}$ $\frac{5}{9}$

2) Work out the following:

a) $\frac{1}{5} + \frac{3}{4}$ $\frac{19}{20}$

b) $\frac{3}{8} + \frac{1}{4}$ $\frac{5}{8}$

c) $\frac{2}{3} + \frac{3}{10}$ $\frac{29}{30}$

d) $\frac{1}{2} + \frac{2}{5}$ $\frac{9}{10}$

3) Work out the following:

a) $\frac{2}{3} + \frac{1}{2}$ $1\frac{1}{6}$

b) $\frac{3}{5} + \frac{2}{3}$ $1\frac{4}{15}$

c) $\frac{5}{8} + \frac{3}{4}$ $1\frac{3}{8}$

d) $\frac{5}{7} + \frac{2}{5}$ $1\frac{4}{35}$

4) Work out the following:

a) $2\frac{1}{2} + 1\frac{3}{4}$ $4\frac{1}{4}$

b) $1\frac{2}{5} + \frac{2}{3}$ $2\frac{1}{15}$

c) $2\frac{1}{6} + 1\frac{1}{2}$ $3\frac{2}{3}$

d) $1\frac{3}{7} + \frac{2}{5}$ $1\frac{29}{35}$

5) Work out the following:

a) $\frac{3}{4} - \frac{1}{2}$ $\frac{1}{4}$

b) $\frac{5}{7} - \frac{2}{3}$ $\frac{1}{21}$

c) $\frac{5}{8} - \frac{1}{3}$ $\frac{7}{24}$

d) $\frac{8}{9} - \frac{2}{3}$ $\frac{2}{9}$

6) Work out the following:

a) $2\frac{1}{2} - 1\frac{3}{4}$ $\frac{3}{4}$

b) $1\frac{2}{3} - \frac{3}{4}$ $\frac{11}{12}$

c) $3\frac{2}{5} - 1\frac{1}{2}$ $1\frac{9}{10}$

d) $2\frac{3}{8} - \frac{3}{5}$ $1\frac{31}{40}$

7) Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

He spent $\frac{1}{10}$ of his pocket money on magazines.

What fraction of his pocket money did he have left? $\frac{3}{10}$

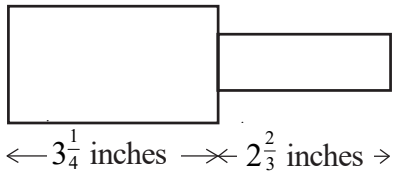
8) Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

a) What fraction of the bag of flour was used? $\frac{13}{20}$

b) What fraction of the bag of flour is left? $\frac{7}{20}$

9) Work out the total length of this shape.
Give your answer as a mixed number. $5\frac{11}{12}$



Finding a Fraction of an Amount

1) Work out these amounts.

a) $\frac{3}{4}$ of £20 b) $\frac{2}{3}$ of 60 kg c) $\frac{3}{8} \times 24$

d) $150 \times \frac{2}{3}$ e) $\frac{2}{9}$ of 180 cm f) $49 \times \frac{4}{7}$

g) $60 \times \frac{1}{4}$ h) $\frac{5}{8}$ of £48 i) $4000 \times \frac{7}{8}$

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them?

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday?

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price?

5) Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day?

6) Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left?

Finding a Fraction of an Amount

1) Work out these amounts.

a) $\frac{3}{4}$ of £20 £15

b) $\frac{2}{3}$ of 60 kg 40 kg

c) $\frac{3}{8} \times 24$ 9

d) $150 \times \frac{2}{3}$ 100

e) $\frac{2}{9}$ of 180 cm 40 cm

f) $49 \times \frac{4}{7}$ 28

g) $60 \times \frac{1}{4}$ 15

h) $\frac{5}{8}$ of £48 £30

i) $4000 \times \frac{7}{8}$ 3 500

2) There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them? 360 apples

3) Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday? 550 km

4) A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price? £21

5) Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day? 105 miles

6) Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left? £4

Multiplying Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{2} \times \frac{1}{2}$

b) $\frac{2}{3} \times \frac{1}{3}$

c) $\frac{3}{5} \times \frac{2}{7}$

d) $\frac{4}{7} \times \frac{5}{9}$

2) Work out the following:

a) $\frac{1}{2} \times \frac{2}{3}$

b) $\frac{3}{4} \times \frac{8}{11}$

c) $\frac{2}{9} \times \frac{3}{4}$

d) $\frac{4}{5} \times \frac{1}{12}$

3) Work out the following:

a) $1\frac{1}{2} \times \frac{1}{3}$

b) $\frac{2}{3} \times 2\frac{2}{5}$

c) $3\frac{1}{2} \times 1\frac{1}{2}$

d) $1\frac{2}{7} \times 3\frac{1}{3}$

Multiplying Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{1}{2} \times \frac{1}{2}$ $\frac{1}{4}$

b) $\frac{2}{3} \times \frac{1}{3}$ $\frac{2}{9}$

c) $\frac{3}{5} \times \frac{2}{7}$ $\frac{6}{35}$

d) $\frac{4}{7} \times \frac{5}{9}$ $\frac{20}{63}$

2) Work out the following:

a) $\frac{1}{2} \times \frac{2}{3}$ $\frac{1}{3}$

b) $\frac{3}{4} \times \frac{8}{11}$ $\frac{6}{11}$

c) $\frac{2}{9} \times \frac{3}{4}$ $\frac{1}{6}$

d) $\frac{4}{5} \times \frac{1}{12}$ $\frac{1}{15}$

3) Work out the following:

a) $1\frac{1}{2} \times \frac{1}{3}$ $\frac{1}{2}$

b) $\frac{2}{3} \times 2\frac{2}{5}$ $1\frac{3}{5}$

c) $3\frac{1}{2} \times 1\frac{1}{2}$ $5\frac{1}{4}$

d) $1\frac{2}{7} \times 3\frac{1}{3}$ $4\frac{2}{7}$

Dividing Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{2}{5} \div \frac{3}{4}$

b) $\frac{1}{7} \div \frac{3}{5}$

c) $\frac{4}{9} \div \frac{1}{2}$

d) $\frac{3}{10} \div \frac{5}{9}$

2) Work out the following:

a) $\frac{1}{2} \div \frac{1}{3}$

b) $\frac{3}{7} \div \frac{4}{7}$

c) $\frac{1}{9} \div \frac{2}{3}$

d) $\frac{2}{5} \div \frac{3}{10}$

3) Work out the following:

a) $1\frac{1}{3} \div \frac{1}{4}$

b) $\frac{3}{5} \div 2\frac{2}{3}$

c) $3\frac{2}{3} \div 1\frac{1}{5}$

d) $4\frac{1}{2} \div 1\frac{1}{2}$

Dividing Fractions

In all the questions on this page, please give your answers in their simplest form.

1) Work out the following:

a) $\frac{2}{5} \div \frac{3}{4}$ $\frac{8}{15}$

b) $\frac{1}{7} \div \frac{3}{5}$ $\frac{5}{21}$

c) $\frac{4}{9} \div \frac{1}{2}$ $\frac{8}{9}$

d) $\frac{3}{10} \div \frac{5}{9}$ $\frac{27}{50}$

2) Work out the following:

a) $\frac{1}{2} \div \frac{1}{3}$ $1\frac{1}{2}$

b) $\frac{3}{7} \div \frac{4}{7}$ $\frac{3}{4}$

c) $\frac{1}{9} \div \frac{2}{3}$ $\frac{1}{6}$

d) $\frac{2}{5} \div \frac{3}{10}$ $1\frac{1}{3}$

3) Work out the following:

a) $1\frac{1}{3} \div \frac{1}{4}$ $5\frac{1}{3}$

b) $\frac{3}{5} \div 2\frac{2}{3}$ $\frac{9}{40}$

c) $3\frac{2}{3} \div 1\frac{1}{5}$ $3\frac{1}{18}$

d) $4\frac{1}{2} \div 1\frac{1}{2}$ 3

BODMAS/BIDMAS

1) $6 \times 5 + 2$

2) $2 + 6 \times 5$

3) $35 - 4 \times 3$

4) $48 \div (14 - 2)$

5) $27 \div (3 + 6)$

6) $27 \div 3 + 6$

7) $(9 + 2) \times 2 + 5$

8) $4 \times (1 + 4) - 6$

9) $6 \times 4 - 3 \times 5$

10) $\dfrac{9+3}{4+2}$

11) $\dfrac{23+9}{7-3}$

12) $\dfrac{7-2^2}{4^2-15}$

13) $\dfrac{5^2+3}{2\times 7}$

14) $\dfrac{5\times 6-4}{13}$

15) $\dfrac{8\times 2-4}{3+1^2}$

16) $\dfrac{12-3\times 2}{14\div 7}$

17) $\dfrac{20-3^2}{10-(5+4)}$

18) $\dfrac{3+9\times 8}{1+6\times 4}$

BODMAS/BIDMAS

1) $6 \times 5 + 2$ 32

2) $2 + 6 \times 5$ 32

3) $35 - 4 \times 3$ 23

4) $48 \div (14 - 2)$ 4

5) $27 \div (3 + 6)$ 3

6) $27 \div 3 + 6$ 15

7) $(9 + 2) \times 2 + 5$ 27

8) $4 \times (1 + 4) - 6$ 14

9) $6 \times 4 - 3 \times 5$ 9

10) $\frac{9+3}{4+2}$ 2

11) $\frac{23+9}{7-3}$ 8

12) $\frac{7-2^2}{4^2-15}$ 3

13) $\frac{5^2+3}{2\times 7}$ 2

14) $\frac{5\times 6-4}{13}$ 2

15) $\frac{8\times 2-4}{3+1^2}$ 3

16) $\frac{12-3\times 2}{14\div 7}$ 3

17) $\frac{20-3^2}{10-(5+4)}$ 11

18) $\frac{3+9\times 8}{1+6\times 4}$ 3

Calculator Questions

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2}$$

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35}$$

Write down all the figures on your calculator display.

3) Work out $\dfrac{5.8 + 4.65}{3.1^2 + 1.62}$

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71}$$

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$$

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}}$$

Write down all the figures on your calculator display.

Calculator Questions

1) Use your calculator to work out

$$\frac{23.7 \times 14.2}{8.4 \times 3.2}$$

12.52008929

Write down all the figures on your calculator display.

2) Use your calculator to work out

$$\frac{\sqrt{21.4}}{5.7 - 2.35}$$

1.380899523

Write down all the figures on your calculator display.

3) Work out $\dfrac{5.8 + 4.65}{3.1^2 + 1.62}$

0.9305431879

Write down all the figures on your calculator display.

4) Use your calculator to work out the value of

$$\frac{9.2 \times 16.3}{9.4 - 5.71}$$

40.6395664

Write down all the digits from your calculator.
Give your answer as a decimal.

5) Use your calculator to work out

$$\frac{3}{2.1 + 3.45}$$

0.5405405405

Write down all the figures on your calculator display.
You must give your answer as a decimal.

6) Use your calculator to work out

$$\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$$

33.83823544

Write down all the figures on your calculator display.
You must give your answer as a decimal.

7) Use a calculator to work out

$$\sqrt{\frac{22.4 \times 13.9}{3.6}}$$

9.299940263

Write down all the figures on your calculator display.

Money Questions

1) Tony buys

4 kg of potatoes at £1.60 per kilogram

and

2 kg of onions at £1.80 per kilogram.

She pays with a £20 note.

How much change should she receive?

2)

Bags of sweets
£1.50 per bag
Buy 3, get 1 free

How many bags of sweets can you buy for £9?

3)

Cinema Prices

Adult	£2.99
Child	£2.30
Family ticket (2 adults and 2 children	£9.00

a) 1 adult and 7 children went to the cinema.

How much did they pay altogether?

b) 2 adults and 2 children went to the cinema and bought a family ticket.

How much did they save altogether?

Money Questions

1) Tony buys

4 kg of potatoes at £1.60 per kilogram

and

2 kg of onions at £1.80 per kilogram.

She pays with a £20 note.

How much change should she receive? £10

2)

Bags of sweets
£1.50 per bag
Buy 3, get 1 free

How many bags of sweets can you buy for £9? 8

3)

Cinema Prices

Adult	£2.99
Child	£2.30
Family ticket (2 adults and 2 children	£9.00

a) 1 adult and 7 children went to the cinema.

How much did they pay altogether? £19.09

b) 2 adults and 2 children went to the cinema and bought a family ticket.

How much did they save altogether? £1.58

Product of Primes

1) List the first seven prime numbers.

2) Express the following numbers as the product of their prime factors:

   a) 12

   b) 20

   c) 30

   d) 24

3) Express the following numbers as the product of their prime factors:

   a) 64

   b) 100

   c) 150

4) Express the following numbers as the product of their prime factors:

   a) 175

   b) 192

   c) 315

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.
   Find the value of m and the value of n.

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.
   Find the value of x and the value of y.

Product of Primes

1) List the first seven prime numbers. 2, 3, 5, 7, 11, 13, 17

2) Express the following numbers as the product of their prime factors:

a) 12 $2 \times 2 \times 3$

b) 20 $2 \times 2 \times 5$

c) 30 $2 \times 3 \times 5$

d) 24 $2 \times 2 \times 2 \times 3$

3) Express the following numbers as the product of their prime factors:

a) 64 $2 \times 2 \times 2 \times 2 \times 2 \times 2$

b) 100 $2 \times 2 \times 5 \times 5$

c) 150 $2 \times 3 \times 5 \times 5$

4) Express the following numbers as the product of their prime factors:

a) 175 $5 \times 5 \times 7$

b) 192 $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

c) 315 $3 \times 3 \times 5 \times 7$

5) The number 96 can be written as $2^m \times n$, where m and n are prime numbers.
Find the value of m and the value of n. $m = 5$ and $n = 3$

6) The number 75 can be written as $5^x \times y$, where x and y are prime numbers.
Find the value of x and the value of y. $x = 2$ and $y = 3$

Squares, Cubes and Roots

1) What is the value of 5^2?

2) What is the value of 8^2?

3) These are the first five square numbers: 1, 4, 9, 16, 25
   a) What is the sixth square number?
   b) What is the 10th square number?

4) Which square number lies between 60 and 70?

5) What is the value of 2^3?

6) What is the value of 4^3?

7) Work out $1^3 + 2^3 + 3^3$

8) Work out $\sqrt{25}$

9) Work out $\sqrt{49}$

10) Work out the value of $\sqrt{121} \times \sqrt{121}$

11) Match together cards with the same answer

9^2	$\sqrt{9}$	81	5^3
2^5	125	32	3

Squares, Cubes and Roots

1) What is the value of 5^2? 25

2) What is the value of 8^2? 64

3) These are the first five square numbers: 1, 4, 9, 16, 25
   a) What is the sixth square number? 36
   b) What is the 10th square number? 100

4) Which square number lies between 60 and 70? $8^2 = 64$

5) What is the value of 2^3? 8

6) What is the value of 4^3? 64

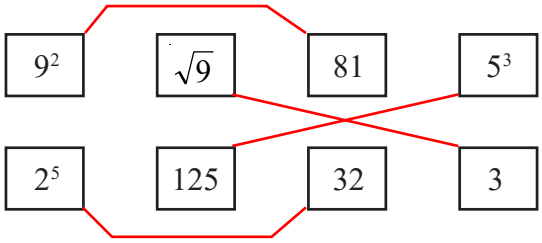
7) Work out $1^3 + 2^3 + 3^3$ 36

8) Work out $\sqrt{25}$ 5

9) Work out $\sqrt{49}$ 7

10) Work out the value of $\sqrt{121} \times \sqrt{121}$ 121

11) Match together cards with the same answer



Working with Indices

1) Evaluate the following:

a) 2^3

b) 3^2

c) 10^4

2) Evaluate the following:

a) 2^8

b) 6^4

c) 5^6

3) Find the value of

a) $2^4 + 3^2$

b) $5^2 - 2^3$

c) $1^2 + 2^2 + 3^2$

4) Find the value of

a) $5^4 + 6^3$

b) $3^4 \times 2^5$

c) $9^3 - 6^3$

5) Find the value of

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$

Working with Indices

1) Evaluate the following:

a) 2^3 8

b) 3^2 9

c) 10^4 10000

2) Evaluate the following:

a) 2^8 256

b) 6^4 1296

c) 5^6 15625

3) Find the value of

a) $2^4 + 3^2$ 25

b) $5^2 - 2^3$ 17

c) $1^2 + 2^2 + 3^2$ 14

4) Find the value of

a) $5^4 + 6^3$ 841

b) $3^4 \times 2^5$ 2592

c) $9^3 - 6^3$ 513

5) Find the value of

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$ 666

Decimals and Fractions

Write the following fractions as decimals

1) $\frac{3}{10}$

2) $\frac{7}{10}$

3) $\frac{9}{100}$

4) $\frac{1}{2}$

5) $\frac{3}{4}$

6) $\frac{2}{5}$

7) $\frac{7}{20}$

8) $\frac{1}{3}$

9) $\frac{1}{8}$

10) $\frac{5}{8}$

Decimals and Fractions

Write the following fractions as decimals

1) $\frac{3}{10}$ 0.3

2) $\frac{7}{10}$ 0.7

3) $\frac{9}{100}$ 0.09

4) $\frac{1}{2}$ 0.5

5) $\frac{3}{4}$ 0.75

6) $\frac{2}{5}$ 0.4

7) $\frac{7}{20}$ 0.35

8) $\frac{1}{3}$ 0.3

9) $\frac{1}{8}$ 0.125

10) $\frac{5}{8}$ 0.625

Fractions, Percentages, Decimals

1) Write the following fractions as decimals and percentages:

eg. $\frac{1}{10} \xrightarrow{1 \div 10} 0{\cdot}1 \xrightarrow{0.1 \times 100} 10\%$

a) $\frac{3}{10}$ =

b) $\frac{1}{5}$ =

c) $\frac{2}{5}$ =

d) $\frac{1}{4}$ =

e) $\frac{3}{4}$ =

f) $\frac{1}{2}$ =

g) $\frac{1}{3}$ =

2) Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\frac{6}{10}$		
	0.2	
	0.9	
		40%
		25%
$\frac{4}{5}$		
$\frac{12}{100}$		
	$0.\dot{3}$	
		70%

Fractions, Percentages, Decimals

1) Write the following fractions as decimals and percentages:

eg. $\frac{1}{10} \xrightarrow{1 \div 10} 0{\cdot}1 \xrightarrow{0.1 \times 100} 10\%$

a) $\frac{3}{10}$ = 0.3 = 30%

b) $\frac{1}{5}$ = 0.2 = 20%

c) $\frac{2}{5}$ = 0.4 = 40%

d) $\frac{1}{4}$ = 0.25 = 25%

e) $\frac{3}{4}$ = 0.75 = 75%

f) $\frac{1}{2}$ = 0.5 = 50%

g) $\frac{1}{3}$ = 0.3 = 33.3%

2) Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\frac{6}{10}$	0.6	60%
$\frac{1}{5}$	0.2	20%
$\frac{9}{10}$	0.9	90%
$\frac{2}{5}$	0.4	40%
$\frac{1}{4}$	0.25	25%
$\frac{4}{5}$	0.8	80%
$\frac{12}{100}$	0.12	12%
$\frac{1}{3}$	$0.\dot{3}$	33.3%
$\frac{7}{10}$	0.7	70%

Reciprocals

1) Write down the reciprocal of

a) 8

b) 3

c) 1

d) 12

2) Write down the reciprocal of

a) $\frac{1}{2}$

b) $\frac{1}{3}$

c) $\frac{4}{3}$

d) $\frac{5}{8}$

3) Write down the reciprocal of

a) 0.1

b) 0.5

c) 0.2

4) Why can't we have a reciprocal of 0?

Reciprocals

1) Write down the reciprocal of

a) 8 $\frac{1}{8}$

b) 3 $\frac{1}{3}$

c) 1 1

d) 12 $\frac{1}{12}$

2) Write down the reciprocal of

a) $\frac{1}{2}$ 2

b) $\frac{1}{3}$ 3

c) $\frac{4}{3}$ $\frac{3}{4}$

d) $\frac{5}{8}$ $\frac{8}{5}$

3) Write down the reciprocal of

a) 0.1 10

b) 0.5 2

c) 0.2 5

4) Why can't we have a reciprocal of 0? Because division by "0" does not exist.

Percentage of an Amount with a Calculator

1) Work out:

a) 21% of £340

b) 64% of £1080

c) 36% of £800

d) 98% of £13

2) Work out:

a) 17.5% of £58

b) 20% of £5.40

c) 61.7% of £2000

d) 17.5% of £68.40

3) A computer costs £406 plus VAT at 20%.
Work out the total cost of the computer.

4) A car is usually priced at £9800 but now has a discount of 8%.
What is the new price of the car?

5) 9500 people attend a festival and 22% of them are children.
How many children are at the festival?

6) 65% of a car, by weight, is steel and iron.
If a car weighs 1100 kg, what is the weight of steel and iron in the car?

7) Tony earns £17800 per year and receives a 3.8% pay rise.
How much does he now earn?

Percentage of an Amount with a Calculator

1) Work out:

a) 21% of £340 £71.40

b) 64% of £1080 £691.20

c) 36% of £800 £288

d) 98% of £13 £12.74

2) Work out:

a) 17.5% of £58 £10.15

b) 20% of £5.40 £1.08

c) 61.7% of £2000 £1234

d) 17.5% of £68.40 £11.97

3) A computer costs £406 plus VAT at 20%.
Work out the total cost of the computer. £487.20

4) A car is usually priced at £9800 but now has a discount of 8%.
What is the new price of the car? £9016

5) 9500 people attend a festival and 22% of them are children.
How many children are at the festival? 2090

6) 65% of a car, by weight, is steel and iron.
If a car weighs 1100 kg, what is the weight of steel and iron in the car? 715 kg

7) Tony earns £17800 per year and receives a 3.8% pay rise.
How much does he now earn? £18476.40

Percentage of an Amount without a Calculator

1) Work out:

   a) 10% of £170

   b) 10% of £6800

   c) 10% of £923

   d) 10% of £16

2) Work out:

   a) 20% of £60

   b) 30% of £90

   c) 15% of £800

   d) 15% of £68

3) Work out:

   a) 35% of £80

   b) 90% of £160

   c) 17.5% of £600

   d) 17.5% of £850

4) Work out:

   a) 15% of £4.60

   b) 40% of £2.80

   c) 17.5% of £3.20

   d) 97.5% of £24

5) The normal price of a jacket is £54.
   In a sale, the price is reduced by 30%
   What is the sale price?

6) A football costs £14 plus 20% VAT.
   How much is the football?

Percentage of an Amount without a Calculator

1) Work out:

a) 10% of £170 £17

b) 10% of £6800 £680

c) 10% of £923 £92.30

d) 10% of £16 £1.60

2) Work out:

a) 20% of £60 £12

b) 30% of £90 £27

c) 15% of £800 £120

d) 15% of £68 £10.20

3) Work out:

a) 35% of £80 £28

b) 90% of £160 £144

c) 17.5% of £600 £105

d) 17.5% of £850 £148.75

4) Work out:

a) 15% of £4.60 £0.69

b) 40% of £2.80 £1.12

c) 17.5% of £3.20 £0.56

d) 97.5% of £24 £23.40

5) The normal price of a jacket is £54.
In a sale, the price is reduced by 30%
What is the sale price? £37.80

6) A football costs £14 plus 20% VAT.
How much is the football? £16.80

Change to a Percentage with a Calculator

1) Write the following as percentages, giving all your answers to 1 decimal place.

a) 12 out of 34

b) 62 out of 85

c) 113 out of 153

d) 2150 out of 3452

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

What was her mark as a percentage?
Give your answer to 1 decimal place.

3) In a class of 32 students, 18 of them are boys.

What percentage of the class are boys?
Give your answer to 1 decimal place.

4) In a French class there are 13 girls and 6 boys.

What percentage of the class are girls?
Give your answer to 1 decimal place.

5) A new car usually costs £8500.

Henry gets a discount of £1000.

What is the discount as a percentage of the usual cost?
Give your answer to 1 decimal place.

6) Write out £148 as a percentage of £600.
Give your answer to 1 decimal place.

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

What percentage of the trees are oak trees?

8) In England in 2010 there were 68820 deaths caused by cancer.

Of these deaths, 37500 were caused by smoking.

What percentage of deaths due to cancer were caused by smoking?
Give your answer to 1 decimal place.

Change to a Percentage with a Calculator

1) Write the following as percentages, giving all your answers to 1 decimal place.

a) 12 out of 34 35.3%

b) 62 out of 85 72.9%

c) 113 out of 153 73.9%

d) 2150 out of 3452 62.3%

2) Sarah sat a Science test and got a score of 64 marks out of 112 possible marks.

What was her mark as a percentage?
Give your answer to 1 decimal place. 57.1%

3) In a class of 32 students, 18 of them are boys.

What percentage of the class are boys?
Give your answer to 1 decimal place. 56.3%

4) In a French class there are 13 girls and 6 boys.

What percentage of the class are girls?
Give your answer to 1 decimal place. 68.4%

5) A new car usually costs £8500.

Henry gets a discount of £1000.

What is the discount as a percentage of the usual cost?
Give your answer to 1 decimal place. 11.8%

6) Write out £148 as a percentage of £600.
Give your answer to 1 decimal place. 24.7%

7) In a wood there are 200 oak trees, 650 silver birch trees and 400 wild cherry trees.

What percentage of the trees are oak trees? 16%

8) In England in 2010 there were 68820 deaths caused by cancer.

Of these deaths, 37500 were caused by smoking.

What percentage of deaths due to cancer were caused by smoking?
Give your answer to 1 decimal place. 54.5%

Change to a Percentage without a Calculator

1) Write the following as percentages.

   a) 12 out of 50

   b) 15 out of 25

   c) 8 out of 10

   d) 11 out of 20

   e) 4 out of 5

   f) 32 out of 40

   g) 12 out of 80

   h) 640 out of 800

   i) 36 out of 60

2) Tim got 17 out of 20 in a French test.
   Write 17 out of 20 as a percentage.

3) Write £19 as a percentage of £25

4) Work out £14 as a percentage of £40

5) A baker burnt 12 loaves out of the 200 loaves he baked.
   What percentage of the 200 loaves did he burn?

6) What is £380 as a percentage of £400?

7) What is £22 as a percentage of £40?

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls?

Change to a Percentage without a Calculator

1) Write the following as percentages.

a) 12 out of 50 24%

b) 15 out of 25 60%

c) 8 out of 10 80%

d) 11 out of 20 55%

e) 4 out of 5 80%

f) 32 out of 40 80%

g) 12 out of 80 15%

h) 640 out of 800 80%

i) 36 out of 60 60%

2) Tim got 17 out of 20 in a French test.
Write 17 out of 20 as a percentage. 85%

3) Write £19 as a percentage of £25 76%

4) Work out £14 as a percentage of £40 35%

5) A baker burnt 12 loaves out of the 200 loaves he baked.
What percentage of the 200 loaves did he burn? 6%

6) What is £380 as a percentage of £400? 95%

7) What is £22 as a percentage of £40? 55%

8) If there are 9 girls and 11 boys in a class, what percentage of the class are girls? 45%

Percentages

1) Find the following to the nearest penny:
   a) 23% of £670
   b) 12% of £580
   c) 48% of £64
   d) 13% of £7.50
   e) 87% of £44
   f) 15.7% of £7000
   g) 23.8% of £980
   h) 34% of £16.34
   i) 48.6% of £971.26
   j) 78.24% of £12.82
   k) 42.15% of £7876.42
   l) 0.57% of £60000

2) Find the following:
   a) 10% of £700
   b) 10% of £400
   c) 10% of £350
   d) 10% of £530
   e) 10% of £68
   f) 10% of £46
   g) 10% of £6.50
   h) 10% of £12.20
   i) 20% of £600
   j) 30% of £900
   k) 60% of £800
   l) 20% of £650
   m) 40% of £320
   n) 15% of £300
   o) 15% of £360
   p) 65% of £12000
   q) 45% of £64
   r) 85% of £96
   s) 17.5% of £800
   t) 17.5% of £40
   u) 17.5% of £8.80

3) Change the following to percentages, giving all answers to 1 decimal place:
   a) 6 out of 28
   b) 18 out of 37
   c) 42 out of 83
   d) 24 out of 96
   e) 73 out of 403
   f) 234 out of 659
   g) 871 out of 903
   h) 4.7 out of 23
   i) 6.9 out of 79
   j) 14.8 out of 23.6
   k) 65.8 out of 203.7

4) Change the following to percentages:
   a) 46 out of 100
   b) 18 out of 50
   c) 7 out of 25
   d) 23 out of 25
   e) 9 out of 20
   f) 16 out of 20
   g) 7 out of 10
   h) 9.5 out of 10
   i) 10 out of 40
   j) 16 out of 40
   k) 30 out of 40
   l) 12 out of 40
   m) 28 out of 80
   n) 32 out of 80
   o) 60 out of 80
   p) 3 out of 5
   q) 4 out of 5
   r) 15 out of 75
   s) 24 out of 75
   t) 30 out of 75

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence.

6) A television costs £596 plus VAT at 17.5%.
   Work out the cost of the television including VAT.

7) Peter has 128 trees in his garden.
   16 of the trees are pear trees.
   What percentage of the trees in his garden are pear trees?

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.
   What were her percentages in both subjects to 1 decimal place?

9) In class 9A there are 7 girls and 18 boys.
   What percentage of the class are girls?

10) A shop decides to reduce all the prices by 15%.
    The original price of a pair of trainers was £70. How much are they after the reduction?

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.
    How much does it cost with the VAT?

Percentages

1) Find the following to the nearest penny:

a) 23% of £670 £154.10
b) 12% of £580 £69.60
c) 48% of £64 £30.72
d) 13% of £7.50 £0.98
e) 87% of £44 £38.28
f) 15.7% of £7000 £1099
g) 23.8% of £980 £233.24
h) 34% of £16.34 £5.56
i) 48.6% of £971.26 £472.03
j) 78.24% of £12.82 £10.03
k) 42.15% of £7876.42 £3319.91
l) 0.57% of £60000 £342

2) Find the following:

a) 10% of £700 £70
b) 10% of £400 £40
c) 10% of £350 £35
d) 10% of £530 £53
e) 10% of £68 £6.80
f) 10% of £46 £4.60
g) 10% of £6.50 £0.65
h) 10% of £12.20 £1.22
i) 20% of £600 £120
j) 30% of £900 £270
k) 60% of £800 £480
l) 20% of £650 £130
m) 40% of £320 £128
n) 15% of £300 £45
o) 15% of £360 £54
p) 65% of £12000 £7800
q) 45% of £64 £28.80
r) 85% of £96 £81.60
s) 17.5% of £800 £140
t) 17.5% of £40 £7
u) 17.5% of £8.80 £1.54

3) Change the following to percentages, giving all answers to 1 decimal place:

a) 6 out of 28 21.4%
b) 18 out of 37 48.6%
c) 42 out of 83 50.6%
d) 24 out of 96 25%
e) 73 out of 403 18.1%
f) 234 out of 659 35.5%
g) 871 out of 903 96.5%
h) 4.7 out of 23 20.4%
i) 6.9 out of 79 8.7%
j) 14.8 out of 23.6 62.7%
k) 65.8 out of 203.7 32.3%

4) Change the following to percentages:

a) 46 out of 100 46%
b) 18 out of 50 36%
c) 7 out of 25 28%
d) 23 out of 25 92%
e) 9 out of 20 45%
f) 16 out of 20 80%
g) 7 out of 10 70%
h) 9.5 out of 10 95%
i) 10 out of 40 25%
j) 16 out of 40 40%
k) 30 out of 40 75%
l) 12 out of 40 30%
m) 28 out of 80 35%
n) 32 out of 80 40%
o) 60 out of 80 75%
p) 3 out of 5 60%
q) 4 out of 5 80%
r) 15 out of 75 20%
s) 24 out of 75 32%
t) 30 out of 75 40%

5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence. 56p

6) A television costs £596 plus VAT at 17.5%.
Work out the cost of the television including VAT. £700.30

7) Peter has 128 trees in his garden.
16 of the trees are pear trees.
What percentage of the trees in his garden are pear trees? 12.5%

8) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test.
What were her percentages in both subjects to 1 decimal place? Maths: 64.3% Science: 63.9%

9) In class 9A there are 7 girls and 18 boys.
What percentage of the class are girls? 28%

10) A shop decides to reduce all the prices by 15%.
The original price of a pair of trainers was £70. How much are they after the reduction? £59.50

11) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000.
How much does it cost with the VAT? £21150

Rounding to Significant Figures

1) Round the following numbers to 1 significant figure:

a) 428

b) 783

c) 5608

d) 3 521

e) 21 999

f) 793 041

2) Round the following numbers to 2 significant figures:

a) 846

b) 2 647

c) 3 552

d) 46 817

e) 89 711

f) 195 084

3) Round the following numbers to 3 significant figures:

a) 91 249

b) 64 182

c) 223 058

d) 389 512

e) 7 761 223

f) 4 997 124

4) Work out the following and give your answer to 3 significant figures:

a) 216 × 348

b) 7721 × 609

c) 8714 × 2198

5) Round the following numbers to 1 significant figure:

a) 0.00618

b) 0.00482

c) 0.00006492

d) 0.004981

6) Round the following numbers to 2 significant figures:

a) 0.035812

b) 0.00082477

c) 0.0038611

d) 0.000037211

7) Round the following numbers to 3 significant figures:

a) 0.00143229

b) 0.000721981

c) 0.0000044251

d) 0.000668821

8) Round the following numbers to 3 significant figures:

a) 47.84122

b) 9.778112

c) 12.35913

9) Work out the following and give your answer to 3 significant figures:

a) 15 ÷ 0.38

b) 0.31 ÷ 0.16

c) 208 × 366

Rounding to Significant Figures

1) Round the following numbers to 1 significant figure:

a) 428 400

b) 783 800

c) 5608 6000

d) 3 521 4000

e) 21 999 20000

f) 793 041 800000

2) Round the following numbers to 2 significant figures:

a) 846 850

b) 2 647 2600

c) 3 552 3600

d) 46 817 47000

e) 89 711 90000

f) 195 084 200000

3) Round the following numbers to 3 significant figures:

a) 91 249 91200

b) 64 182 64200

c) 223 058 223000

d) 389 512 390000

e) 7 761 223 7760000

f) 4 997 124 5000000

4) Work out the following and give your answer to 3 significant figures:

a) 216 × 348 75200

b) 7721 × 609 4700000

c) 8714 × 2198 19200000

5) Round the following numbers to 1 significant figure:

a) 0.00618 0.006

b) 0.00482 0.005

c) 0.00006492 0.00006

d) 0.004981 0.005

6) Round the following numbers to 2 significant figures:

a) 0.035812 0.036

b) 0.00082477 0.00082

c) 0.0038611 0.0039

d) 0.000037211 0.000037

7) Round the following numbers to 3 significant figures:

a) 0.00143229 0.00143

b) 0.000721981 0.000722

c) 0.0000044251 0.00000443

d) 0.000668821 0.000669

8) Round the following numbers to 3 significant figures:

a) 47.84122 47.8

b) 9.778112 9.78

c) 12.35913 12.4

9) Work out the following and give your answer to 3 significant figures:

a) 15 ÷ 0.38 39.5

b) 0.31 ÷ 0.16 1.94

c) 208 × 366 76100

Estimating Answers

1) Work out an estimate for $\dfrac{304 \times 9.96}{0.51}$

2) Work out an estimate for $\dfrac{6.7 \times 192}{0.051}$

3) Work out an estimate for $\dfrac{32 \times 4.92}{0.21}$

4) Work out an estimate for $\dfrac{3880}{236 \times 4.85}$

5) Work out an estimate for $\dfrac{7.18 \times 19.7}{0.47}$

Estimating Answers

1) Work out an estimate for $\frac{304 \times 9.96}{0.51}$ 6000

2) Work out an estimate for $\frac{6.7 \times 192}{0.051}$ 28000

3) Work out an estimate for $\frac{32 \times 4.92}{0.21}$ 750

4) Work out an estimate for $\frac{3880}{236 \times 4.85}$ 4

5) Work out an estimate for $\frac{7.18 \times 19.7}{0.47}$ 280

Exchanging Money

1) Lance goes on holiday to France.
The exchange rate is £1 = 1.15 Euros.

He changes £350 into Euros.

a) How many Euros should he get?

In France, Lance buys a digital camera for 115 Euros.

b) Work out the cost of the camera in pounds.

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?
Show all your working.

3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£).

4) The exchange rate in London is £1 = €1.14
The exchange rate in Paris is €1 = £0.86

Tony wants to change some pounds into euros.

In which of these cities would Tony get the most euros?
All working must be shown.

Exchanging Money

1) Lance goes on holiday to France.
The exchange rate is £1 = 1.15 Euros.

He changes £350 into Euros.

a) How many Euros should he get? €402.50

In France, Lance buys a digital camera for 115 Euros.

b) Work out the cost of the camera in pounds. £100

2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?
Show all your working. Spain, by £4.99

77 ÷ 1.40 = 55 59.99 - 55.00 = 4.99

3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£). Euros, saving £0.95

4) The exchange rate in London is £1 = €1.14
The exchange rate in Paris is €1 = £0.86

Tony wants to change some pounds into euros.

In which of these cities would Tony get the most euros?
All working must be shown. Paris

eg Suppose Tony changes £100.
In London he would get 100 × 1.14 = €114
In Paris he would get 100 ÷ 0.86 = €116.28

Expanding Brackets

1) Expand these brackets

a) $2(x + 3)$

b) $3(2x + 4)$

c) $5(3p – 2q)$

d) $4(x^2 + 2y^2)$

e) $6(r – r^2)$

2) Expand these brackets

a) $x(x – 2)$

b) $x(3x + 5)$

c) $p(3p – 7q)$

d) $y(y + 6y^2)$

e) $x(r + r^2)$

3) Expand these brackets

a) $2x(x – 5)$

b) $4x(2x + 3)$

c) $5p(4p – 2q)$

d) $2y(3y + 4x^2)$

e) $x(x + r^2)$

4) Expand these brackets

a) $x(x^2 – 2)$

b) $3x(2x^3 + 1)$

c) $5p^2(4p – 2)$

d) $2y^2(3y^3 + 4y)$

e) $2xy(x + y^2)$

Expanding Brackets

1) Expand these brackets

a) $2(x + 3)$ $2x + 6$

b) $3(2x + 4)$ $6x + 12$

c) $5(3p – 2q)$ $15p – 10q$

d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

e) $6(r – r^2)$ $6r – 6r^2$

2) Expand these brackets

a) $x(x – 2)$ $x^2 – 2x$

b) $x(3x + 5)$ $3x^2 + 5x$

c) $p(3p – 7q)$ $3p^2 – 7pq$

d) $y(y + 6y^2)$ $y^2 + 6y^3$

e) $x(r + r^2)$ $xr + xr^2$

3) Expand these brackets

a) $2x(x – 5)$ $2x^2 – 10x$

b) $4x(2x + 3)$ $8x^2 + 12x$

c) $5p(4p – 2q)$ $20p^2 – 10pq$

d) $2y(3y + 4x^2)$ $6y^2 + 8x^2y$

e) $x(x + r^2)$ $x^2 + r^2x$

4) Expand these brackets

a) $x(x^2 – 2)$ $x^3 – 2x$

b) $3x(2x^3 + 1)$ $6x^4 + 3x$

c) $5p^2(4p – 2)$ $20p^3 – 10p^2$

d) $2y^2(3y^3 + 4y)$ $6y^5 + 8y^3$

e) $2xy(x + y^2)$ $2x^2y + 2xy^3$

Simple Factorisation

1) Factorise

a) $2x + 4$

b) $2y + 10$

c) $3x + 12$

d) $3x - 6$

e) $5x - 15$

2) Factorise

a) $p^2 + 7p$

b) $x^2 + 4x$

c) $y^2 - 2y$

d) $p^2 - 5p$

e) $x^2 + x$

3) Factorise

a) $2x^2 + 6x$

b) $2y^2 - 8y$

c) $5p^2 + 10p$

d) $7c^2 - 21c$

e) $6x^2 + 9x$

4) Factorise

a) $2x^2 - 4xy$

b) $2t^2 + 10tu$

c) $6x^2 - 8xy$

d) $3x^2y^2 + 9xy$

Simple Factorisation

1) Factorise

a) $2x + 4$ $2(x + 2)$

b) $2y + 10$ $2(y + 5)$

c) $3x + 12$ $3(x + 4)$

d) $3x - 6$ $3(x - 2)$

e) $5x - 15$ $5(x - 3)$

2) Factorise

a) $p^2 + 7p$ $p(p + 7)$

b) $x^2 + 4x$ $x(x + 4)$

c) $y^2 - 2y$ $y(y - 2)$

d) $p^2 - 5p$ $p(p - 5)$

e) $x^2 + x$ $x(x + 1)$

3) Factorise

a) $2x^2 + 6x$ $2x(x + 3)$

b) $2y^2 - 8y$ $2y(y - 4)$

c) $5p^2 + 10p$ $5p(p + 2)$

d) $7c^2 - 21c$ $7c(c - 3)$

e) $6x^2 + 9x$ $3x(2x + 3)$

4) Factorise

a) $2x^2 - 4xy$ $2x(x - 2y)$

b) $2t^2 + 10tu$ $2t(t + 5u)$

c) $6x^2 - 8xy$ $2x(3x - 4y)$

d) $3x^2y^2 + 9xy$ $3xy(xy + 3)$

Substitution

1) $y = 5x$

a) Work out the value of y when $x = 3$

b) Work out the value of y when $x = -2$

2) $y = 2x + 7$

a) Work out the value of y when $x = 4$

b) Work out the value of y when $x = -3$

3) $y = 2x + 4t$

$x = 6$

$t = 1$

Work out the value of y.

4) $y = 2a - 3b$

$a = 4$

$b = -2$

Work out the value of y.

5) $v = 3a + 5b$

$a = 6$

$b = -3$

Work out the value of v.

6) $y = x^2$

a) Work out the value of y when $x = 6$

b) Work out the value of y when $x = -4$

7) $y = 2x^2$

a) Work out the value of y when $x = 5$

b) Work out the value of y when $x = -3$

8) $y = 3x^2 + 2x$

a) Work out the value of y when $x = 2$

b) Work out the value of y when $x = -4$

9) $v = u^2 + 5as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v.

10) $y = p - 2qx^2$

$p = -10$

$q = 2$

$x = -5$

Work out the value of y.

11) $v^2 = u^2 + 2as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v.

12) $v^2 = u^2 + 2as$

$u = 3$
$a = 9.8$
$s = 12$

Work out the value of v.
Give your answer correct to 1 decimal place

13) $s = ut + 0.5at^2$

$a = 9.8$
$t = 5$
$u = 7$

Work out the value of s.

Substitution

1) $y = 5x$

a) Work out the value of y when $x = 3$ 15

b) Work out the value of y when $x = -2$ -10

2) $y = 2x + 7$

a) Work out the value of y when $x = 4$ 15

b) Work out the value of y when $x = -3$ 1

3) $y = 2x + 4t$

$x = 6$

$t = 1$

Work out the value of y. 16

4) $y = 2a - 3b$

$a = 4$

$b = -2$

Work out the value of y. 14

5) $v = 3a + 5b$

$a = 6$

$b = -3$

Work out the value of v. 3

6) $y = x^2$

a) Work out the value of y when $x = 6$ 36

b) Work out the value of y when $x = -4$ 16

7) $y = 2x^2$

a) Work out the value of y when $x = 5$ 50

b) Work out the value of y when $x = -3$ 18

8) $y = 3x^2 + 2x$

a) Work out the value of y when $x = 2$ 16

b) Work out the value of y when $x = -4$ 40

9) $v = u^2 + 5as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v. 148.5

10) $y = p - 2qx^2$

$p = -10$

$q = 2$

$x = -5$

Work out the value of y. -110

11) $v^2 = u^2 + 2as$

$u = 6$
$a = 2.5$
$s = 9$

Work out the value of v. 9

12) $v^2 = u^2 + 2as$

$u = 3$
$a = 9.8$
$s = 12$

Work out the value of v. 15.6
Give your answer correct to 1 decimal place

13) $s = ut + 0.5at^2$

$a = 9.8$
$t = 5$
$u = 7$

Work out the value of s. 157.5

Straight Line Graphs

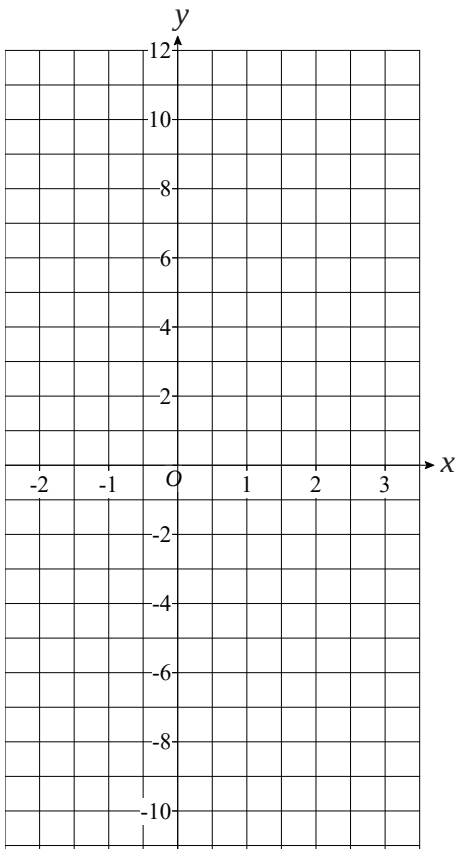
1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1	2	3
y	-10		-2			10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.

c) Use the graph to find the value of y when $x = 2.5$

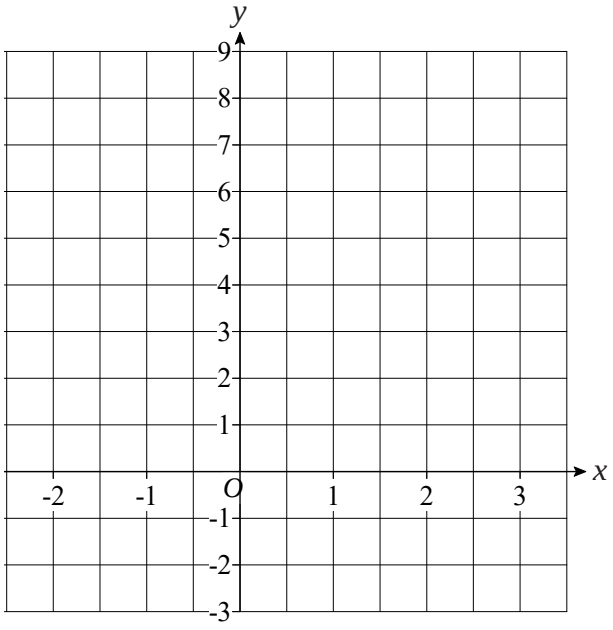
d) Use the graph to find the value of x when $y = -8$



2) a) Complete the table of values for $y = 2x + 2$

x	-2	-1	0	1	2	3
y		0	2			

b) On the grid, draw the graph of $y = 2x + 2$.

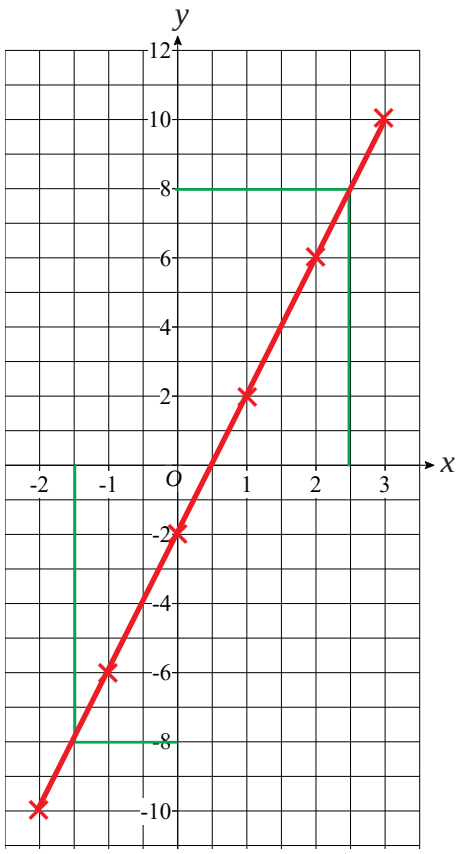


Straight Line Graphs

1) a) Complete the table of values for $y = 4x - 2$

x	-2	-1	0	1	2	3
y	-10	-6	-2	2	6	10

b) On the grid, draw the graph of $y = 4x - 2$, for values of x from -2 to 3.



c) Use the graph to find the value of y when $x = 2.5$

$y = 8$

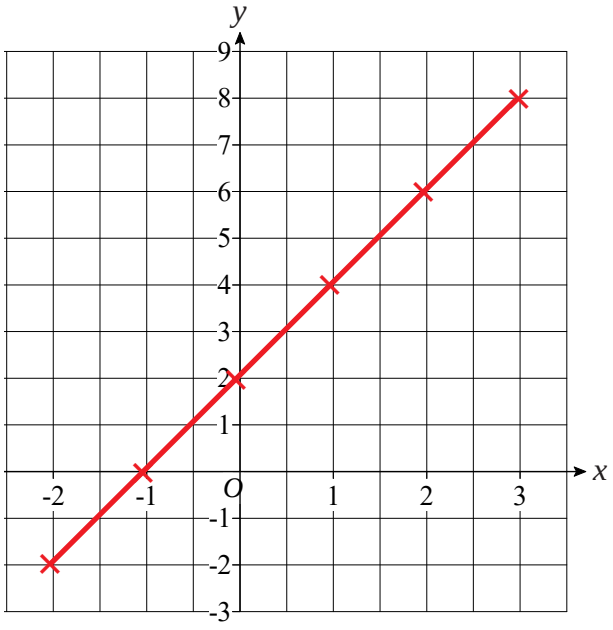
d) Use the graph to find the value of x when $y = -8$

$x = -1.5$

2) a) Complete the table of values for $y = 2x + 2$

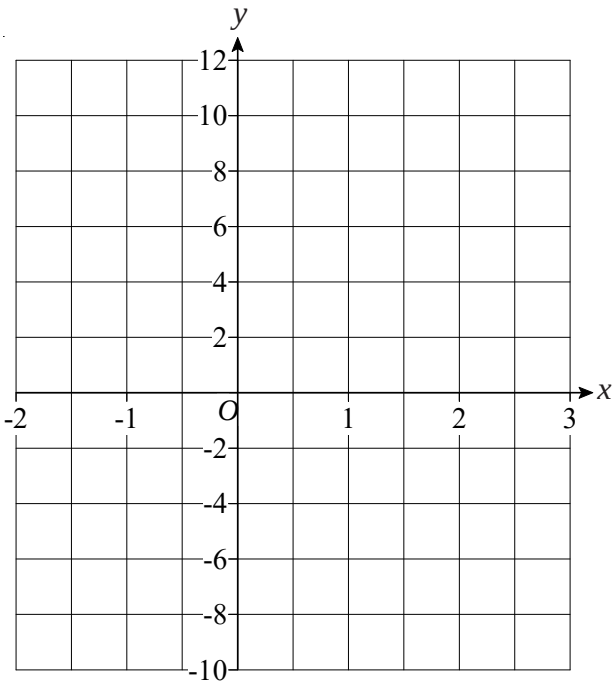
x	-2	-1	0	1	2	3
y	-2	0	2	4	6	8

b) On the grid, draw the graph of $y = 2x + 2$.



Straight Line Graphs

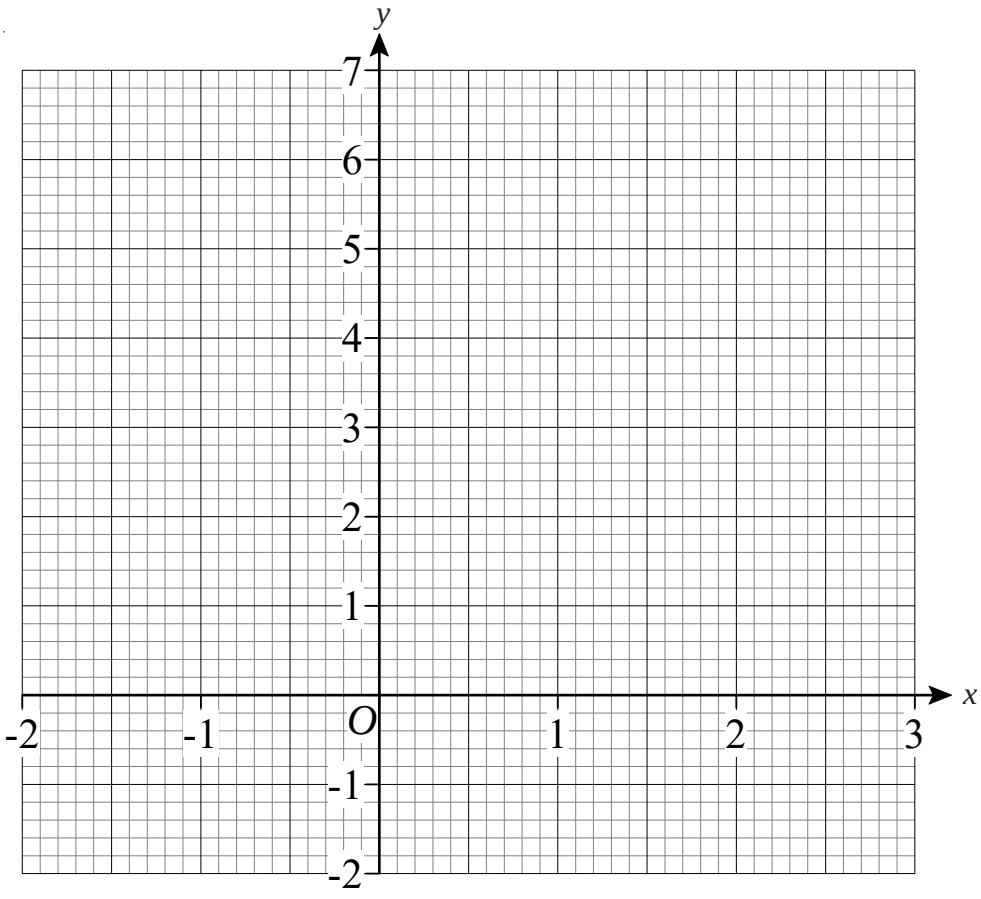
1) On the grid, draw the graph of $y = 2x - 4$



2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y		4.5	3			-1.5

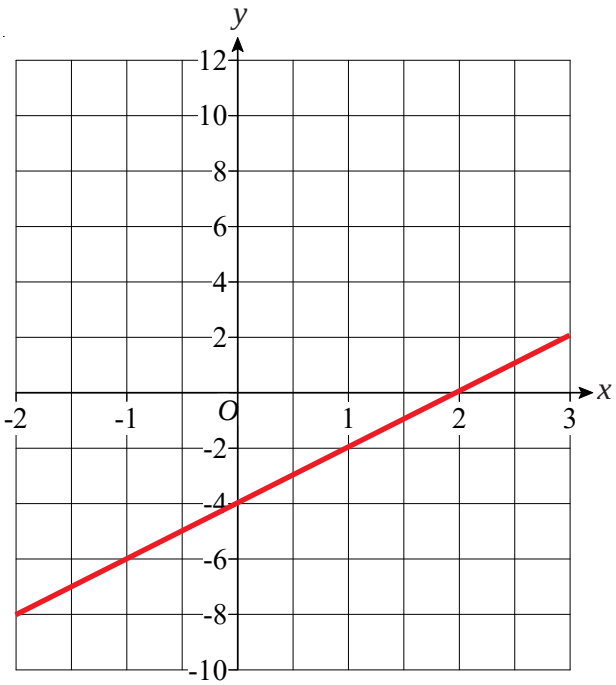
b) On the grid, draw the graph of $3x + 2y = 6$



c) Find the gradient of the graph of $3x + 2y = 6$.

Straight Line Graphs

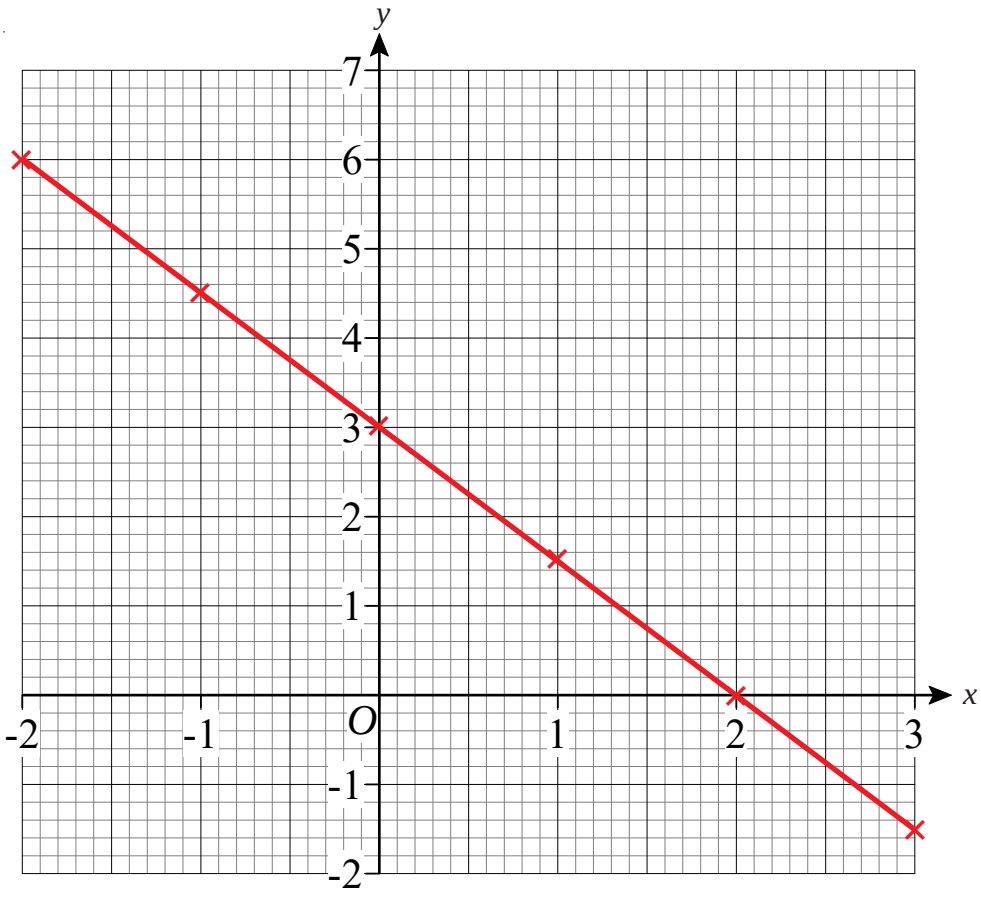
1) On the grid, draw the graph of $y = 2x - 4$



2) a) Complete the table of values for $3x + 2y = 6$

x	-2	-1	0	1	2	3
y	6	4.5	3	1.5	0	-1.5

b) On the grid, draw the graph of $3x + 2y = 6$



c) Find the gradient of the graph of $3x + 2y = 6$. Gradient is -1.5

Straight Line Graphs

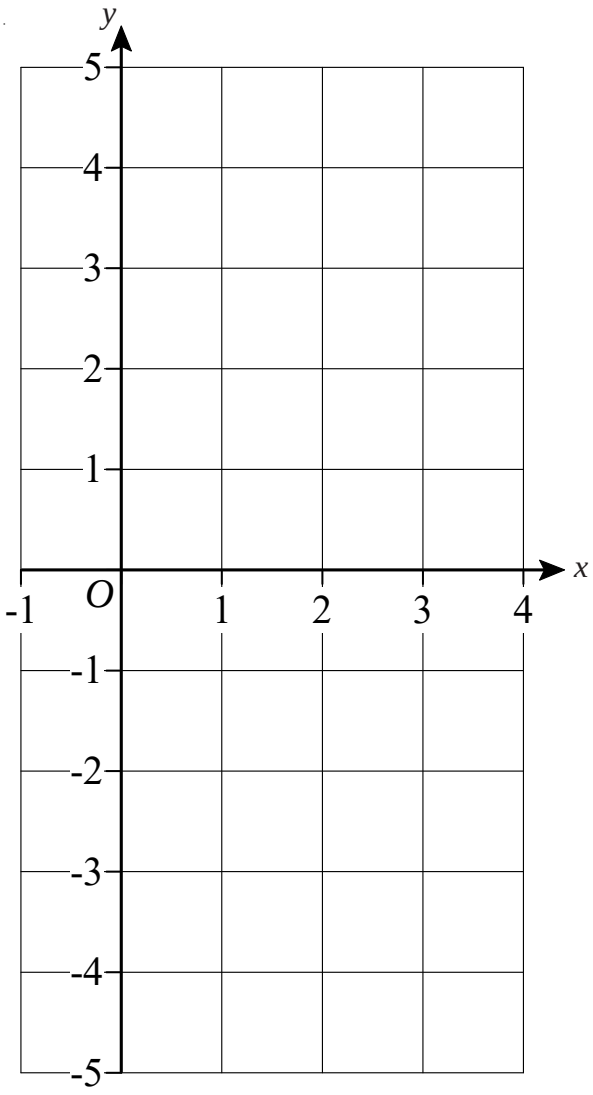
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y				1		

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$

d) Use your graph to work out the value of x when $y = 4.5$



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2) a) Complete the table of values for $y = 2 - x$

x	-1	0	1	2	3	4
y					-1	

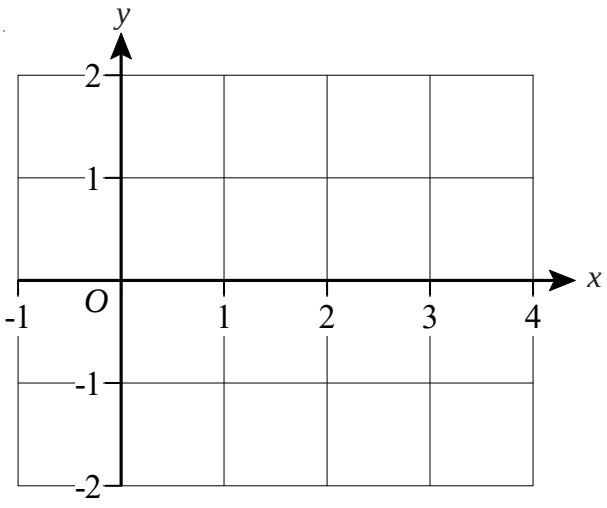
b) Using the axes on the right, again, draw the graph of $y = 2 - x$

---

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y				0		

b) Draw the graph of $y = \frac{1}{2}x - 1$



c) Use your graph to find the value of y when $x = 3.5$

Straight Line Graphs

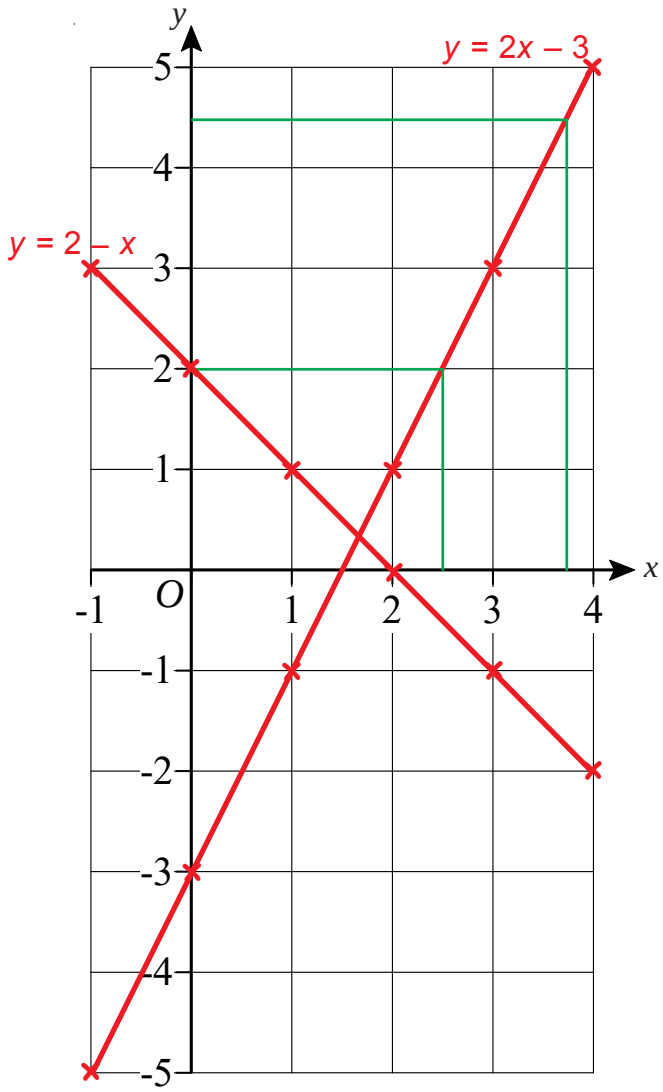
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y	-5	-3	-1	1	3	5

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$ $y = 2$

d) Use your graph to work out the value of x when $y = 4.5$ $x = 3.75$



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2) a) Complete the table of values for $y = 2 - x$

x	-1	0	1	2	3	4
y	3	2	1	0	-1	-2

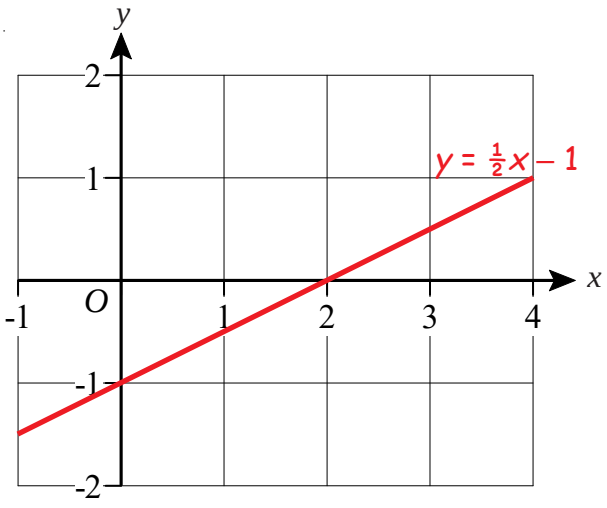
b) Using the axes on the right, again, draw the graph of $y = 2 - x$

---

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

b) Draw the graph of $y = \frac{1}{2}x - 1$

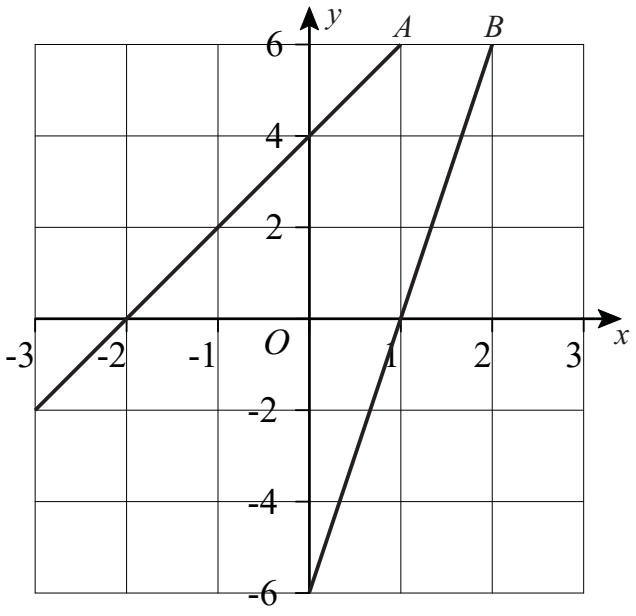
x	-1	0	1	2	3	4
y	$-1\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1

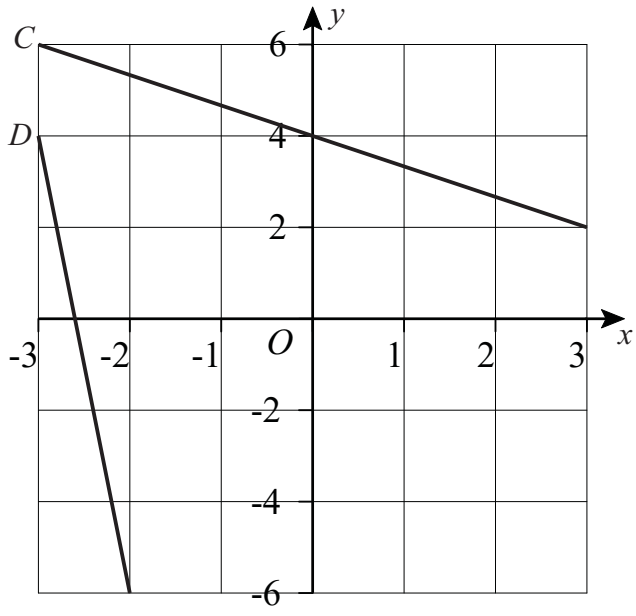


c) Use your graph to find the value of y when $x = 3.5$ $x = 0.75$

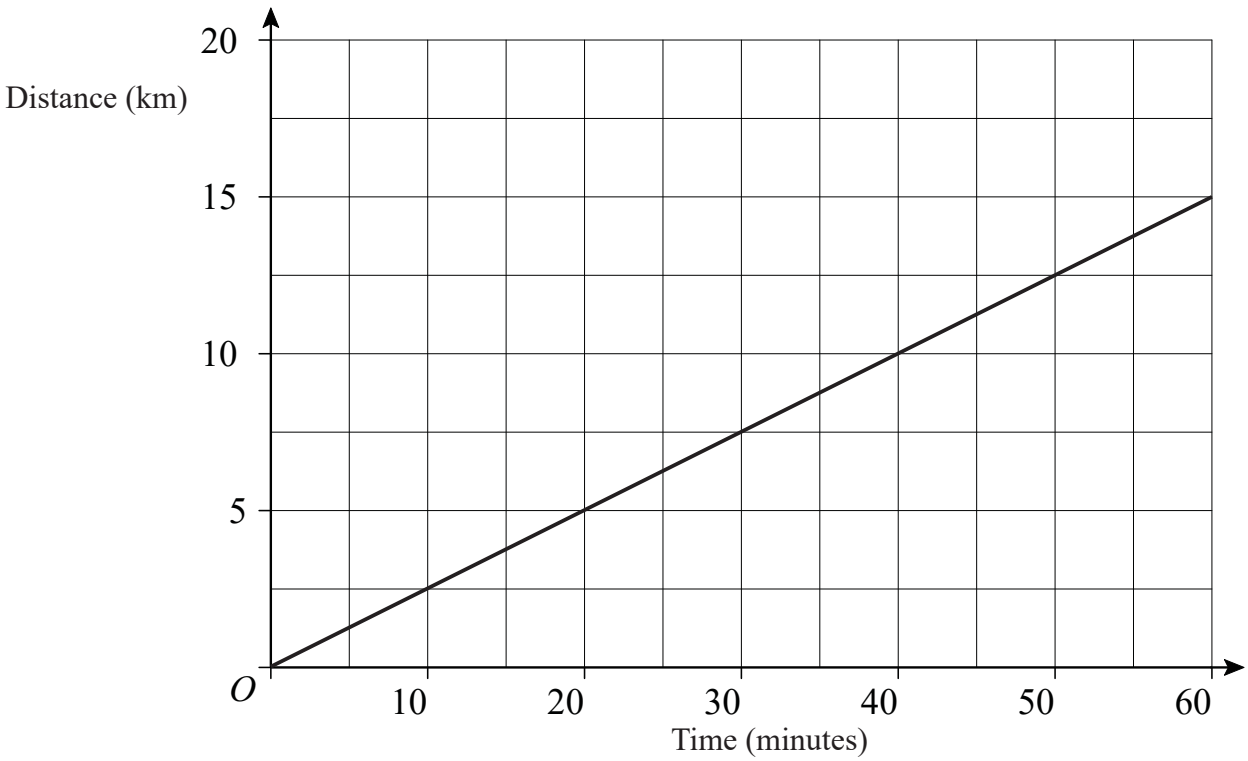
The Gradient of a Line

1) Find the gradient of lines A, B, C and D.





2) The graph shows how Meg cycles at a constant speed for 60 minutes.

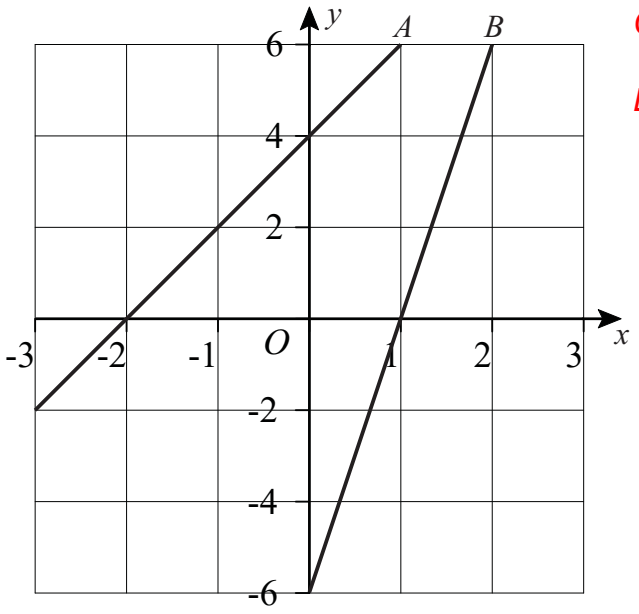


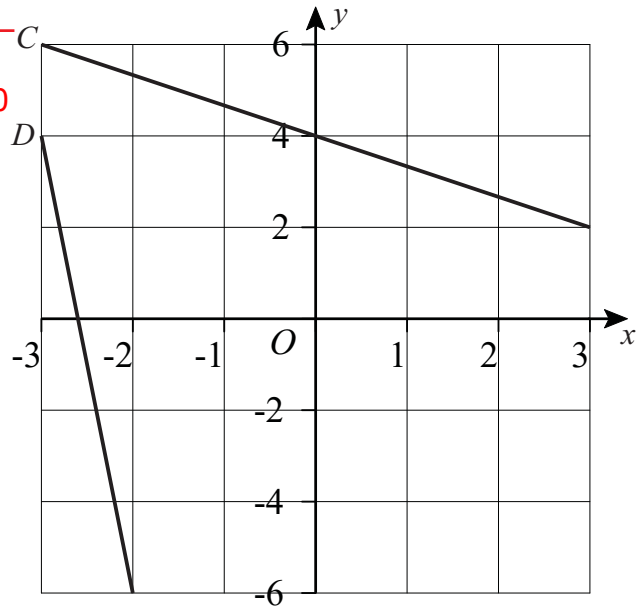
a) Find the gradient of the line.

b) What does the gradient show?

The Gradient of a Line

1) Find the gradient of lines A, B, C and D.





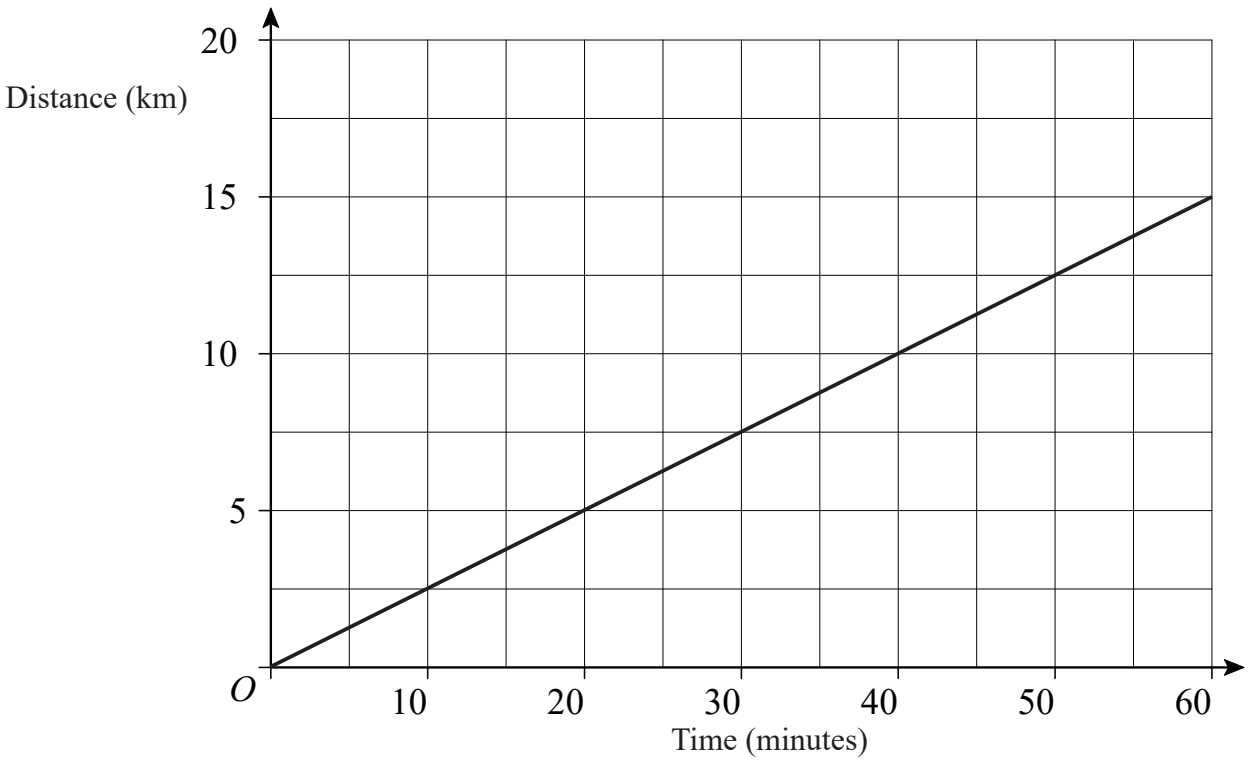
A: 2

B: 6

C: $-\frac{2}{3}$

D: -10

2) The graph shows how Meg cycles at a constant speed for 60 minutes.



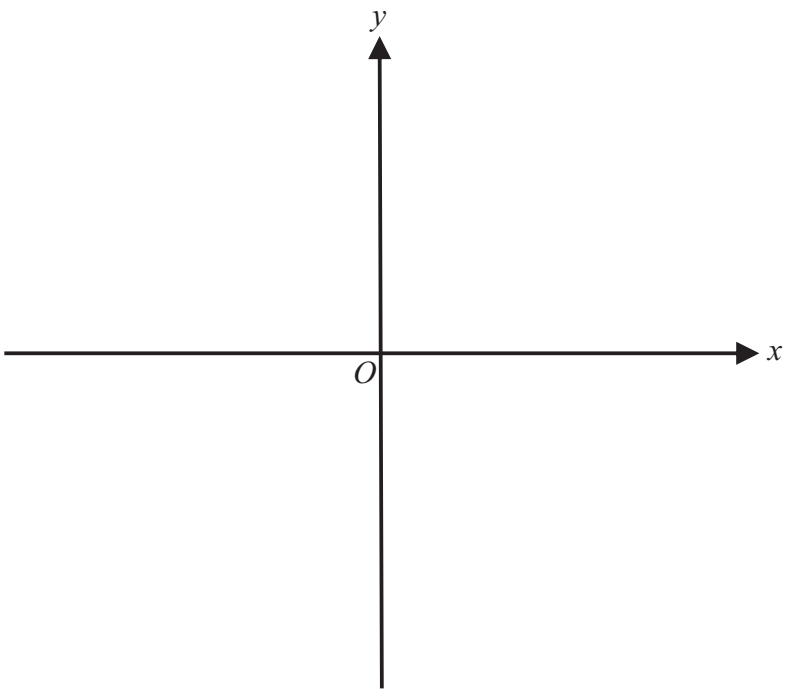
a) Find the gradient of the line. 0.25

b) What does the gradient show? Meg is cycling at 0.25 km per minute.

Sketching Functions

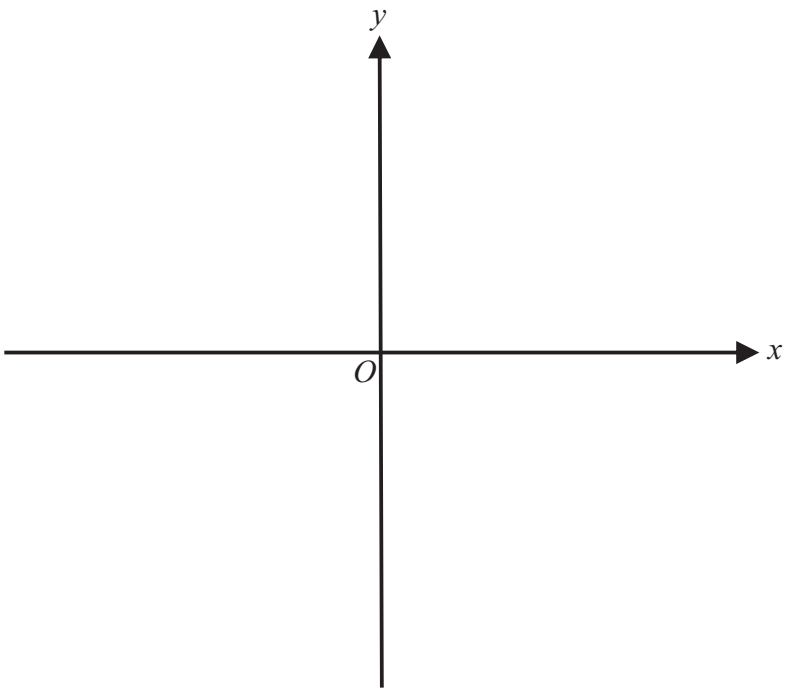
1) a) Sketch the graph of $y = 3x - 4$ on the axes, showing clearly where it crosses the y-axis.

b) Sketch the graph of $y = -2x + 3$ on the axes, showing clearly where it crosses the y-axis.



2) a) Sketch the graph of $y = x^2 + 2$ on the axes, showing clearly where it crosses the y-axis.

b) Sketch the graph of $y = -x^2 - 1$ on the axes, showing clearly where it crosses the y-axis.



Sketching Functions

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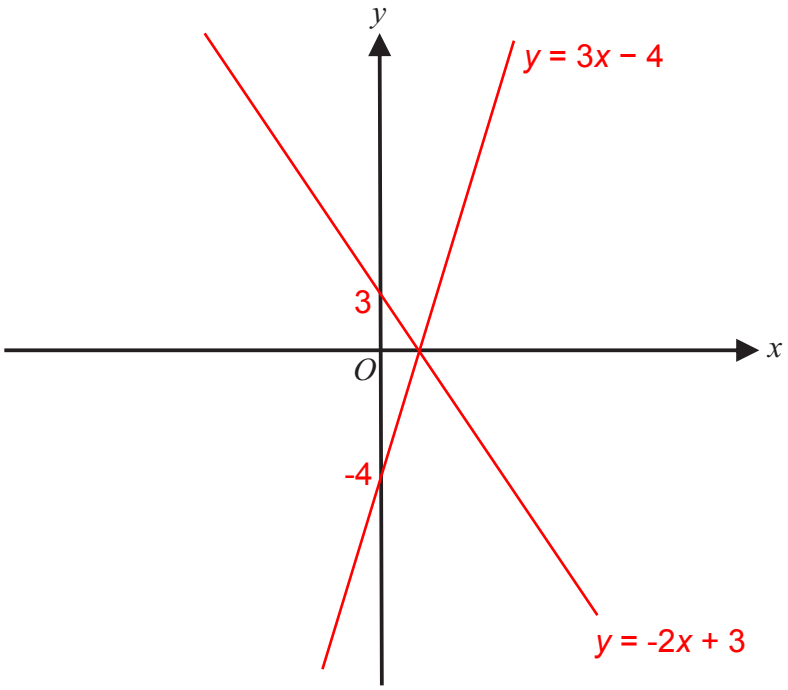
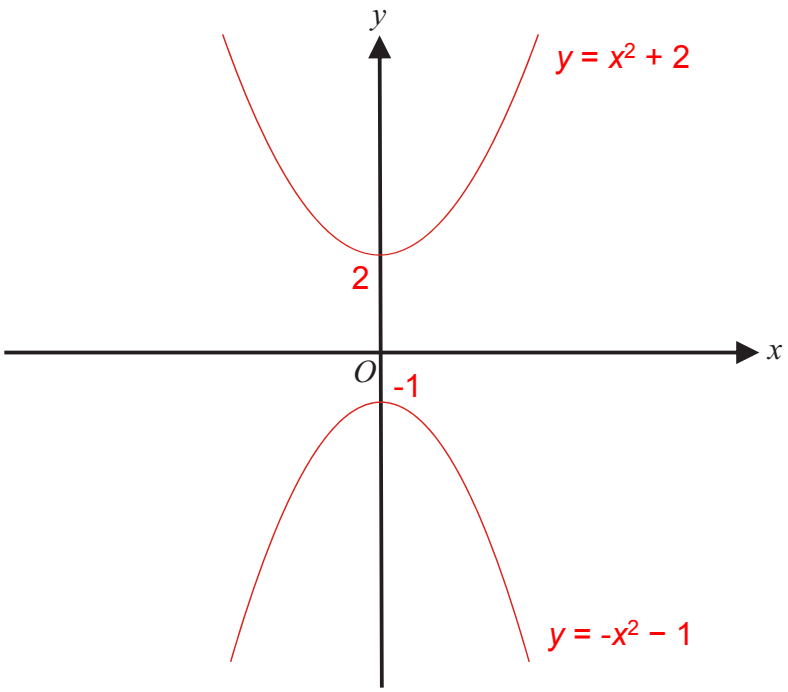


2) a) Sketch the graph of $y = x^2 + 2$ on the axes, showing clearly where it crosses the y-axis.

b) Sketch the graph of $y = -x^2 - 1$ on the axes, showing clearly where it crosses the y-axis.



Solving Equations - Introduction

1) Solve

a) $x + 3 = 8$

b) $x + 1 = 13$

c) $x - 4 = 10$

d) $x - 8 = 9$

e) $x + 7 = 21$

f) $x - 6 = 33$

g) $16 = x + 2$

h) $11 = x - 7$

i) $14 = 3 + x$

j) $5 = x - 12$

2) Solve

a) $x + 2 = 9$

b) $x + 1 = 16$

c) $x - 3 = 14$

d) $x - 8 = 7$

e) $x + 5 = 29$

f) $x - 8 = 35$

g) $21 = x + 3$

h) $18 = x - 6$

i) $15 = 7 + x$

j) $9 = x - 13$

3) Solve

a) $2x = 8$

b) $5x = 30$

c) $40 = 4x$

d) $24 = 8x$

e) $\frac{x}{4} = 7$

f) $\frac{x}{2} = 9$

g) $3 = \frac{x}{5}$

h) $6 = \frac{x}{6}$

i) $2x = 68$

j) $\frac{x}{8} = 7$

4) Solve

a) $2x = 6$

b) $6x = 30$

c) $50 = 2x$

d) $24 = 6x$

e) $\frac{x}{4} = 8$

f) $\frac{x}{2} = 10$

g) $7 = \frac{x}{5}$

h) $9 = \frac{x}{6}$

i) $2x = 82$

j) $\frac{x}{8} = 11$

5) Solve

a) $y + 12 = 20$

b) $\frac{d}{3} = 9$

c) $m - 10 = 13$

d) $7k = 35$

e) $11 + c = 24$

f) $60 = 10p$

g) $8 = r - 19$

h) $7 = \frac{c}{11}$

i) $72 = 9q$

j) $37 = 26 + x$

6) Solve

a) $y + 14 = 26$

b) $\frac{d}{3} = 12$

c) $m - 10 = 17$

d) $9k = 63$

e) $15 + c = 29$

f) $40 = 10p$

g) $9 = r - 17$

h) $6 = \frac{c}{11}$

i) $54 = 6q$

j) $34 = 27 + x$

Solving Equations - Introduction

1) Solve

a) $x + 3 = 8$ $x = 5$

b) $x + 1 = 13$ $x = 12$

c) $x - 4 = 10$ $x = 14$

d) $x - 8 = 9$ $x = 17$

e) $x + 7 = 21$ $x = 14$

f) $x - 6 = 33$ $x = 39$

g) $16 = x + 2$ $x = 14$

h) $11 = x - 7$ $x = 18$

i) $14 = 3 + x$ $x = 11$

j) $5 = x - 12$ $x = 17$

2) Solve

a) $x + 2 = 9$ $x = 7$

b) $x + 1 = 16$ $x = 15$

c) $x - 3 = 14$ $x = 17$

d) $x - 8 = 7$ $x = 15$

e) $x + 5 = 29$ $x = 24$

f) $x - 8 = 35$ $x = 43$

g) $21 = x + 3$ $x = 18$

h) $18 = x - 6$ $x = 24$

i) $15 = 7 + x$ $x = 8$

j) $9 = x - 13$ $x = 22$

3) Solve

a) $2x = 8$ $x = 4$

b) $5x = 30$ $x = 6$

c) $40 = 4x$ $x = 10$

d) $24 = 8x$ $x = 3$

e) $\frac{x}{4} = 7$ $x = 28$

f) $\frac{x}{2} = 9$ $x = 18$

g) $3 = \frac{x}{5}$ $x = 15$

h) $6 = \frac{x}{6}$ $x = 36$

i) $2x = 68$ $x = 34$

j) $\frac{x}{8} = 7$ $x = 56$

4) Solve

a) $2x = 6$ $x = 3$

b) $6x = 30$ $x = 5$

c) $50 = 2x$ $x = 25$

d) $24 = 6x$ $x = 4$

e) $\frac{x}{4} = 8$ $x = 32$

f) $\frac{x}{2} = 10$ $x = 20$

g) $7 = \frac{x}{5}$ $x = 35$

h) $9 = \frac{x}{6}$ $x = 54$

i) $2x = 82$ $x = 41$

j) $\frac{x}{8} = 11$ $x = 88$

5) Solve

a) $y + 12 = 20$ $y = 8$

b) $\frac{d}{3} = 9$ $d = 27$

c) $m - 10 = 13$ $m = 23$

d) $7k = 35$ $k = 5$

e) $11 + c = 24$ $c = 13$

f) $60 = 10p$ $p = 6$

g) $8 = r - 19$ $r = 27$

h) $7 = \frac{c}{11}$ $c = 77$

i) $72 = 9q$ $q = 8$

j) $37 = 26 + x$ $x = 11$

6) Solve

a) $y + 14 = 26$ $y = 12$

b) $\frac{d}{3} = 12$ $d = 36$

c) $m - 10 = 17$ $m = 27$

d) $9k = 63$ $k = 7$

e) $15 + c = 29$ $c = 14$

f) $40 = 10p$ $p = 4$

g) $9 = r - 17$ $r = 26$

h) $6 = \frac{c}{11}$ $c = 66$

i) $54 = 6q$ $q = 9$

j) $34 = 27 + x$ $x = 7$

Solving Equations Using Flowcharts

1) Solve the following equations.

a) $2x - 7 = 11$

b) $5x + 3 = 43$

2) Solve the following equations.

a) $\frac{x}{5} + 1 = 7$

b) $\frac{x}{2} - 6 = 2.5$

3) Solve the following equations.

a) $2(4x - 1) = 46$

b) $6(2x + 7) = 48$

4) Solve the following equations.

a) $3(\frac{x}{7} + 2) = 6$

b) $2(\frac{5x}{3} - 1) = 8$

Solving Equations Using Flowcharts

1) Solve the following equations.

a) $2x - 7 = 11$

$x = 9$

b) $5x + 3 = 43$

$x = 8$

2) Solve the following equations.

a) $\frac{x}{5} + 1 = 7$

$x = 30$

b) $\frac{x}{2} - 6 = 2.5$

$x = 17$

3) Solve the following equations.

a) $2(4x - 1) = 46$

$x = 6$

b) $6(2x + 7) = 48$

$x = 0.5$

4) Solve the following equations.

a) $3(\frac{x}{7} + 2) = 6$

$x = 0$

b) $2(\frac{5x}{3} - 1) = 8$

$x = 3$

Subject of a Formula

1) Make the variable shown in brackets the subject of the formula in each case.

a) $x = y + 7$ (y)

b) $y = x - 2$ (x)

c) $p = q + 12$ (q)

d) $q = p - 25$ (p)

e) $u = 8 + v$ (v)

f) $v = u - 1$ (u)

g) $a + 4 = b$ (a)

h) $b - 6 = a$ (b)

i) $9 + c = d$ (c)

j) $d + 10 = c$ (d)

3) Make the variable shown in brackets the subject of the formula in each case.

a) $5y = x$ (y)

b) $p = 3q$ (q)

c) $11u = v$ (u)

d) $a = 15b$ (b)

e) $\frac{x}{2} = y$ (x)

f) $\frac{p}{10} = q$ (p)

g) $u = \frac{v}{6}$ (v)

h) $b = \frac{a}{7}$ (a)

i) $c = 4d$ (d)

j) $\frac{c}{8} = d$ (c)

5) Make the variable shown in brackets the subject of the formula in each case.

a) $p - 7 = q$ (p)

b) $\frac{v}{9} = u$ (v)

c) $y = 3 + x$ (x)

d) $c = d - 14$ (d)

e) $m = 2n$ (n)

f) $a + 1 = b$ (a)

g) $6q = r$ (q)

h) $x = \frac{y}{3}$ (y)

i) $8 + c = d$ (c)

j) $\frac{b}{10} = a$ (b)

Subject of a Formula

1) Make the variable shown in brackets the subject of the formula in each case.

a) $x = y + 7$ (y) $y = x - 7$ or $y = -7 + x$

b) $y = x - 2$ (x) $x = y + 2$ or $x = 2 + y$

c) $p = q + 12$ (q) $q = p - 12$ or $q = -12 + p$

d) $q = p - 25$ (p) $p = q + 25$ or $p = 25 + q$

e) $u = 8 + v$ (v) $v = u - 8$ or $v = -8 + u$

f) $v = u - 1$ (u) $u = v + 1$ or $u = 1 + v$

g) $a + 4 = b$ (a) $a = b - 4$ or $a = -4 + b$

h) $b - 6 = a$ (b) $b = a + 6$ or $b = 6 + a$

i) $9 + c = d$ (c) $c = d - 9$ or $c = -9 + d$

j) $d + 10 = c$ (d) $d = c - 10$ or $d = -10 + c$

3) Make the variable shown in brackets the subject of the formula in each case.

a) $5y = x$ (y) $y = x \div 5$ or $y = \frac{x}{5}$

b) $p = 3q$ (q) $q = p \div 3$ or $q = \frac{p}{3}$

c) $11u = v$ (u) $u = v \div 11$ or $u = \frac{v}{11}$

d) $a = 15b$ (b) $b = a \div 15$ or $b = \frac{a}{15}$

e) $\frac{x}{2} = y$ (x) $x = 2y$

f) $\frac{p}{10} = q$ (p) $p = 10q$

g) $u = \frac{v}{6}$ (v) $v = 6u$

h) $b = \frac{a}{7}$ (a) $a = 7b$

i) $c = 4d$ (d) $d = c \div 4$ or $d = \frac{c}{4}$

j) $\frac{c}{8} = d$ (c) $c = 8d$

5) Make the variable shown in brackets the subject of the formula in each case.

a) $p - 7 = q$ (p) $p = q + 7$ or $p = 7 + q$

b) $\frac{v}{9} = u$ (v) $v = 9u$

c) $y = 3 + x$ (x) $x = y - 3$ or $x = -3 + y$

d) $c = d - 14$ (d) $d = c + 14$ or $d = 14 + c$

e) $m = 2n$ (n) $n = m \div 2$ or $n = \frac{m}{2}$

f) $a + 1 = b$ (a) $a = b - 1$ or $a = -1 + b$

g) $6q = r$ (q) $q = r \div 6$ or $q = \frac{r}{6}$

h) $x = \frac{y}{3}$ (y) $y = 3x$

i) $8 + c = d$ (c) $c = d - 8$ or $c = -8 + d$

j) $\frac{b}{10} = a$ (b) $b = 10a$

Subject of a Formula Using Flowcharts

1) Make x the subject of the formula $w = 5x + 2$

2) Make x the subject of the formula $y = 2x - 6$

3) Make x the subject of the formula $2w = 3y + \frac{x}{5}$

4) Make t the subject of the formula $a = 2(b + 3t) + 1$

5) Make x the subject of the formula $y = 5 + \sqrt{x}$

6) Make t the subject of the formula $w = x^2 + t$

7) Make n the subject of the formula $m = 3n^2 - p$

8) Make q the subject of the formula $2(5q^2 + 1) = c$

Subject of a Formula Using Flowcharts

1) Make x the subject of the formula $w = 5x + 2$

$x = \dfrac{w - 2}{5}$

2) Make x the subject of the formula $y = 2x - 6$

$x = \dfrac{y + 6}{2}$

3) Make x the subject of the formula $2w = 3y + \dfrac{x}{5}$

$x = 5(2w - 3y)$

4) Make t the subject of the formula $a = 2(b + 3t) + 1$

$t = \dfrac{\dfrac{a - 1}{2} + b}{3}$

5) Make x the subject of the formula $y = 5 + \sqrt{x}$

$x = (y - 5)^2$

6) Make t the subject of the formula $w = x^2 + t$

$t = w - x^2$

7) Make n the subject of the formula $m = 3n^2 - p$

$n = \sqrt{\dfrac{m + p}{3}}$

8) Make q the subject of the formula $2(5q^2 + 1) = c$

$q = \sqrt{\dfrac{\dfrac{c}{2} - 1}{5}}$

Generate a Sequence from the *n*th Term

1) The *n*th term of a number sequence is $2n + 5$

Write down the first three terms of the sequence.

2) The *n*th term of a number sequence is $3n - 1$

Write down the first four terms of the sequence.

3) The *n*th term of a number sequence is $3n + 2$

Write down the first four terms of the sequence.

4) The *n*th term of a number sequence is $5n - 7$

Write down the first four terms of the sequence.

5) The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence.

6) The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence.

7) The *n*th term of a number sequence is $11 - n^2$

a) Find the third term of this sequence.

b) Find the fifth term of this sequence.

8) The *n*th term of a number sequence is $n^2 + n$

a) Find the third term of this sequence.

b) Find the fifth term of this sequence.

Generate a Sequence from the *n*th Term

1) The *n*th term of a number sequence is $2n + 5$

Write down the first three terms of the sequence.

7, 9, 11

2) The *n*th term of a number sequence is $3n - 1$

Write down the first four terms of the sequence.

2, 5, 8, 11

3) The *n*th term of a number sequence is $3n + 2$

Write down the first four terms of the sequence.

5, 8, 11, 14

4) The *n*th term of a number sequence is $5n - 7$

Write down the first four terms of the sequence.

-2, 3, 8, 13

5) The *n*th term of a number sequence is n^2

Write down the first three terms of the sequence.

1, 4, 9

6) The *n*th term of a number sequence is $n^2 + 3$

Write down the first three terms of the sequence.

4, 7, 12

7) The *n*th term of a number sequence is $11 - n^2$

a) Find the third term of this sequence. 2

b) Find the fifth term of this sequence. -14

8) The *n*th term of a number sequence is $n^2 + n$

a) Find the third term of this sequence. 12

b) Find the fifth term of this sequence. 30

Metric Conversions

1) Change 9 m^2 into cm^2

2) How many square metres are there in 5 square kilometres?

3) Change 4 cm^2 into mm^2

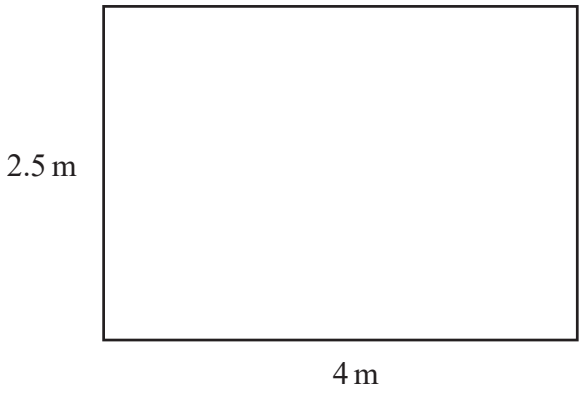
4) Convert 6.5 m^2 into mm^2

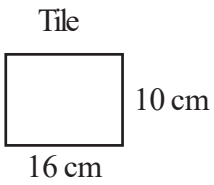
5) Change 2 m^3 into cm^3

6) How many cubic millimetres are there in 3 cubic centimetres?

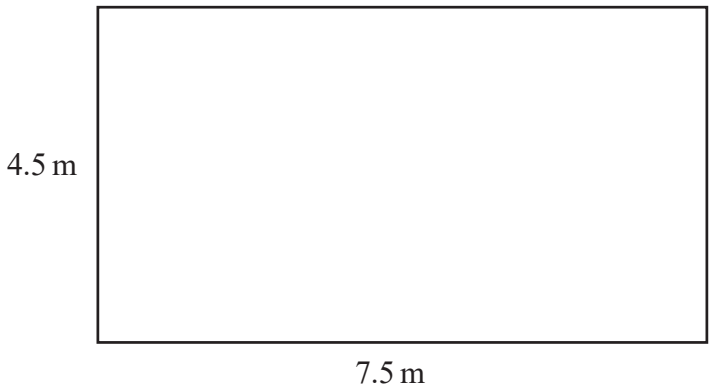
7) Change 7 m^3 into mm^3

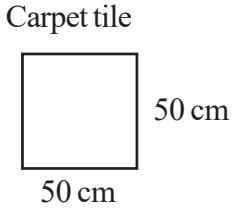
8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall?





9) A carpet-fitter is laying carpet tiles on a rectangular floor which measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor?





Metric Conversions

1) Change 9 m^2 into cm^2 90000 cm^2

2) How many square metres are there in 5 square kilometres? 5000000 m^2

3) Change 4 cm^2 into mm^2 400 mm^2

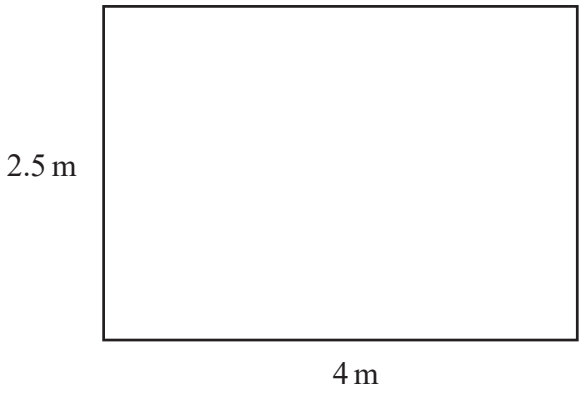
4) Convert 6.5 m^2 into mm^2 6500000 mm^2

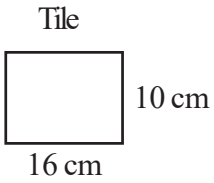
5) Change 2 m^3 into cm^3 2000000cm^3

6) How many cubic millimetres are there in 3 cubic centimetres? 3000 mm^3

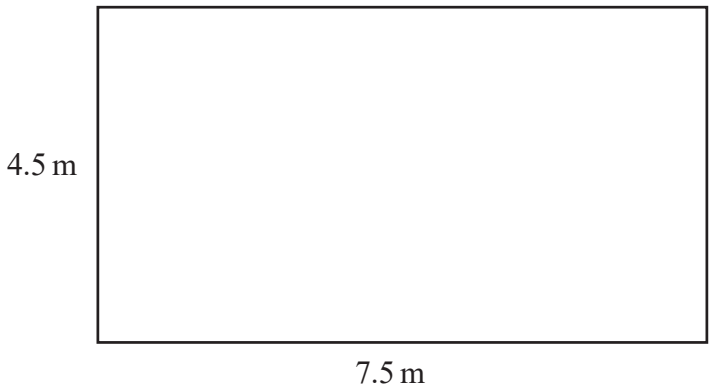
7) Change 7 m^3 into mm^3 7000000000 mm^3

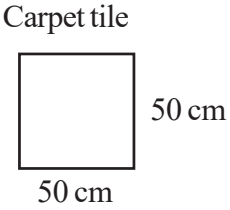
8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall? 625





9) A carpet-fitter is laying carpet tiles on a rectangular floor which measures 7.5 m by 4.5 m.
Each carpet tile measures 50 cm by 50 cm.
How many carpet tiles will he need for the floor? 135

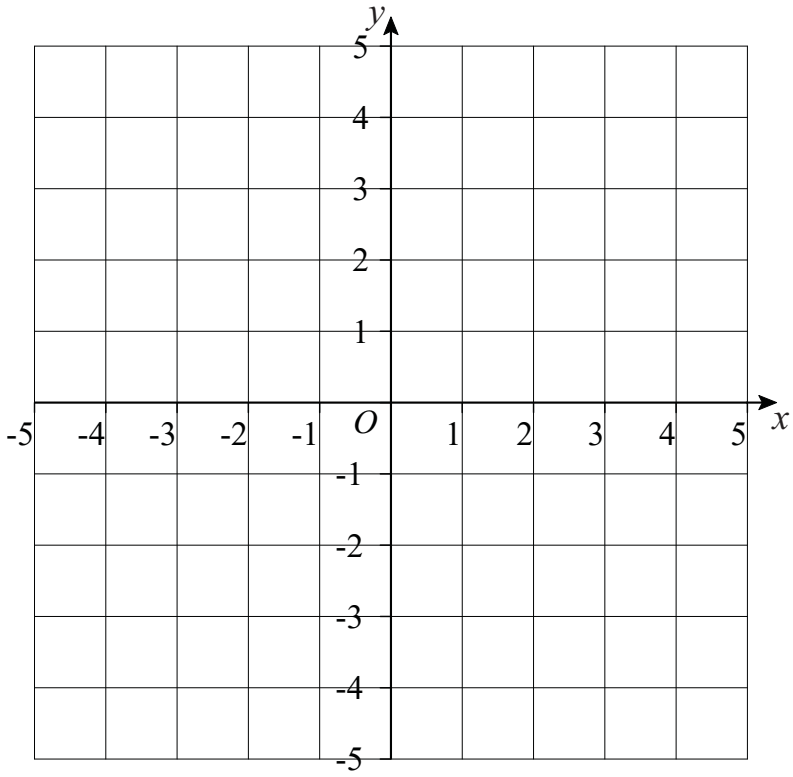




Problems on Coordinate Axes

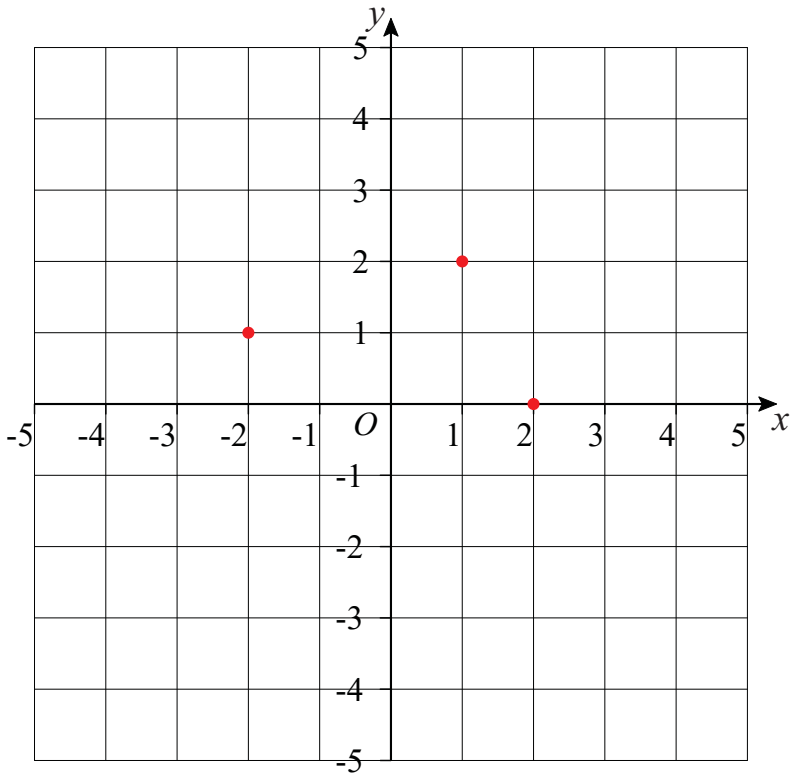
1) The points A (3, 0), B (2, 4) and C (-3, 1) are three corners of a parallelogram.

What are the coordinates of the 4th corner?



2) The diagram shows 3 vertices of a parallelogram.

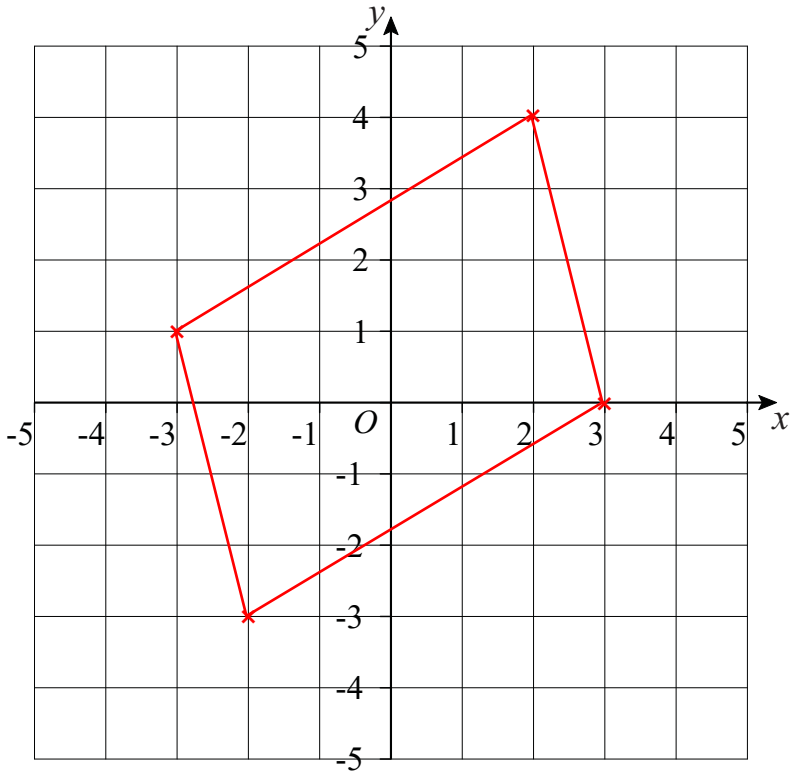
Write down the coordinates of all the possibilities for the 4th vertex.



Problems on Coordinate Axes

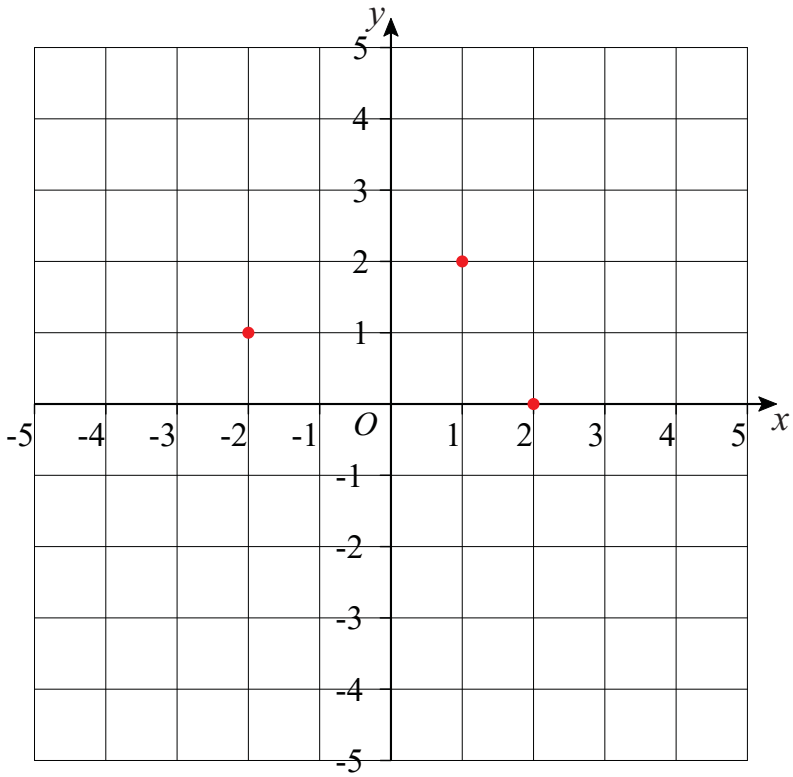
1) The points A (3, 0), B (2, 4) and C (-3, 1) are three corners of a parallelogram.

What are the coordinates of the 4th corner? (-2, -3)



2) The diagram shows 3 vertices of a parallelogram.

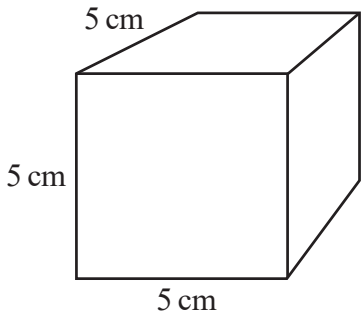
Write down the coordinates of all the possibilities for the 4th vertex. (-1, -1) or (-3, 3) or (5, 1)



Surface Area of a Prism - Cuboids

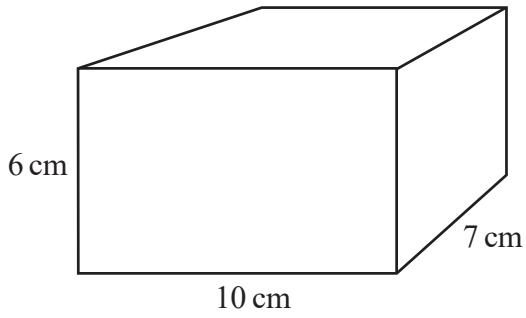
1) A cube has sides of length 5 cm.

Find the total surface area of the cube.



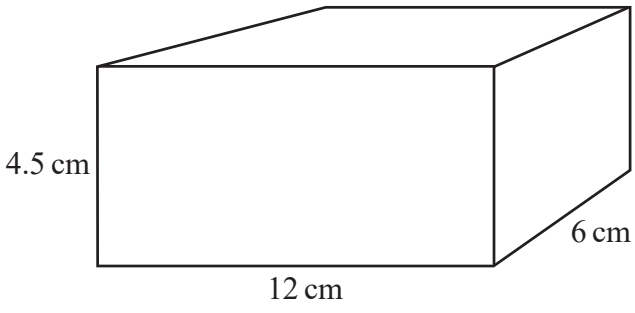
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid.



3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

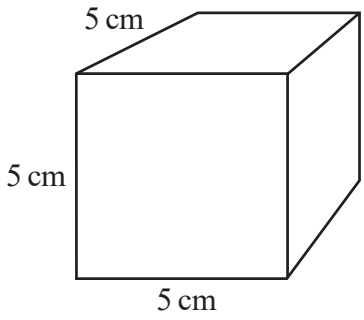
Find the total surface area of the cuboid.



Surface Area of a Prism - Cuboids

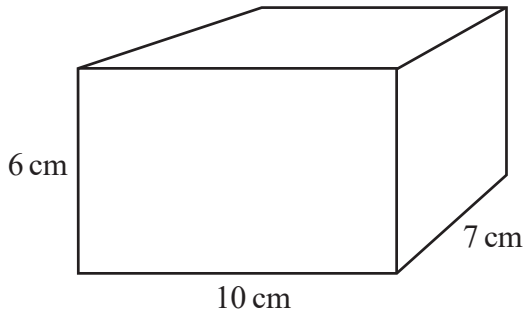
1) A cube has sides of length 5 cm.

Find the total surface area of the cube. 150 cm^2



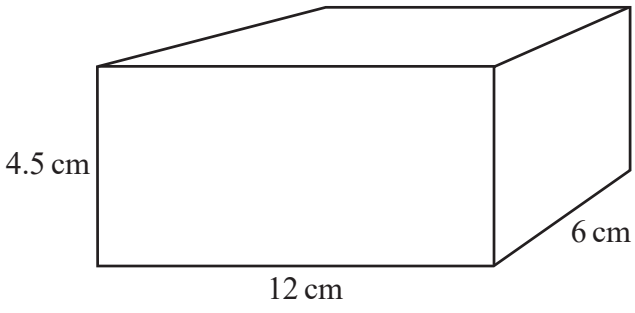
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid. 344 cm^2



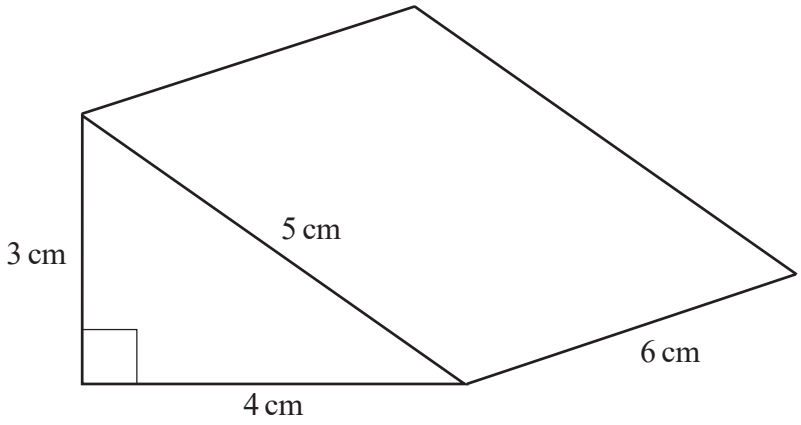
3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

Find the total surface area of the cuboid. 306 cm^2

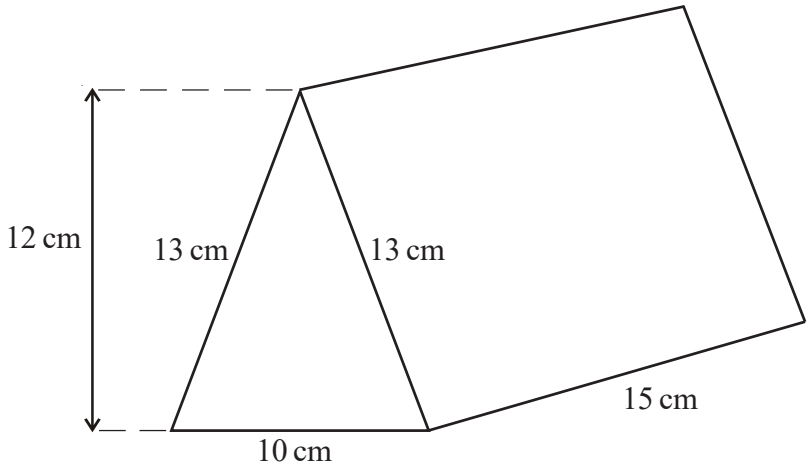


Surface Area of a Prism - Triangular Prisms

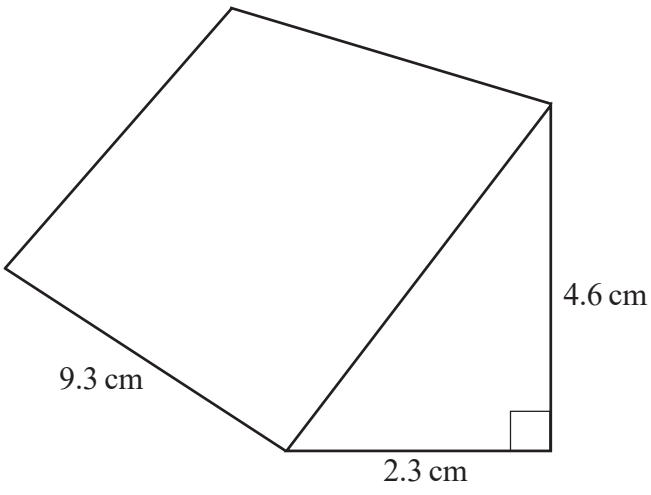
1) Find the surface area of this triangular prism.



2) Find the surface area of this triangular prism.

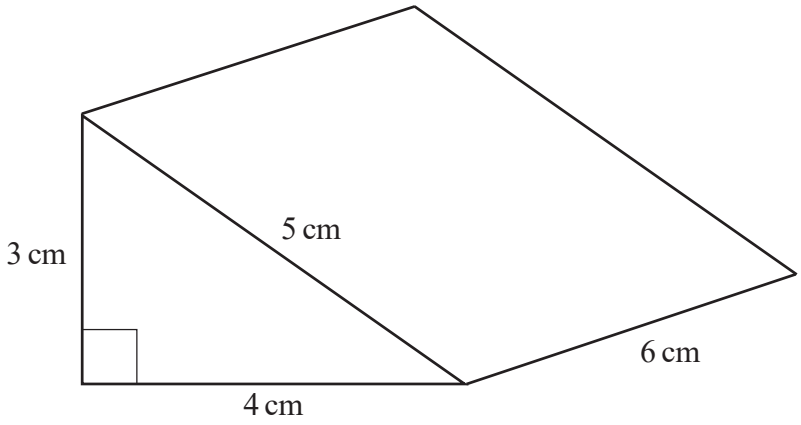


3) With the aid of Pythagoras' Theorem, find the surface area of this triangular prism.
Give your answer correct to 2 significant figures.

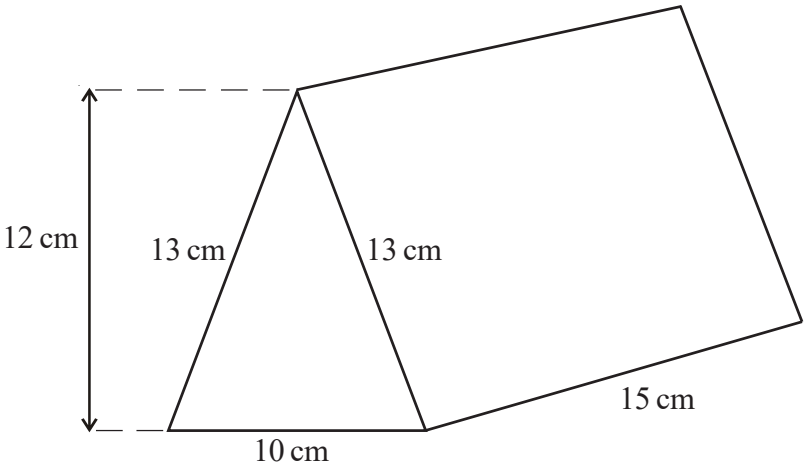


Surface Area of a Prism - Triangular Prisms

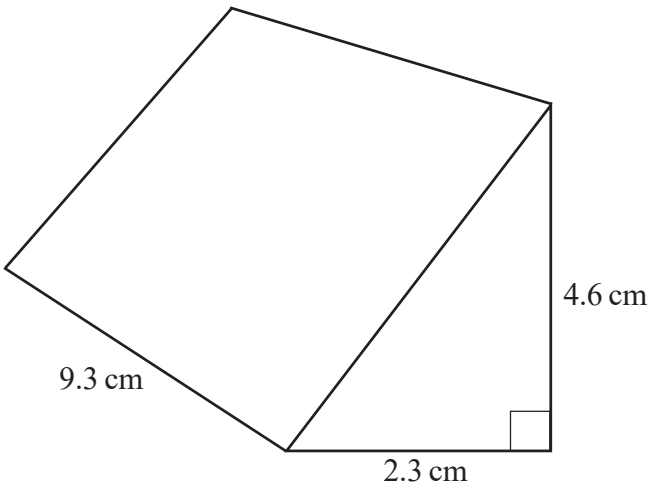
1) Find the surface area of this triangular prism. 84 cm²



2) Find the surface area of this triangular prism. 660 cm²

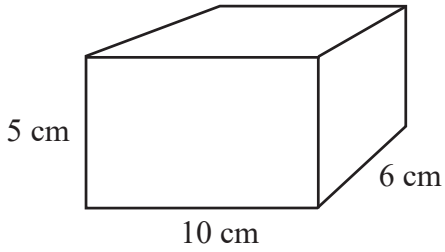


3) With the aid of Pythagoras' Theorem, find the surface area of this triangular prism.
Give your answer correct to 2 significant figures. 120 cm²

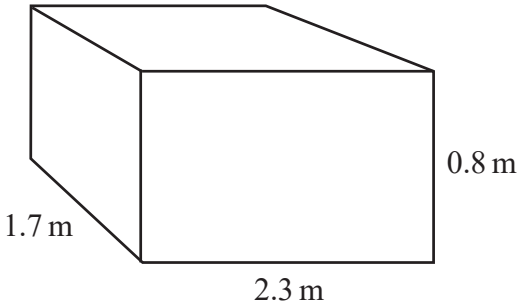


Volume of a Cuboid

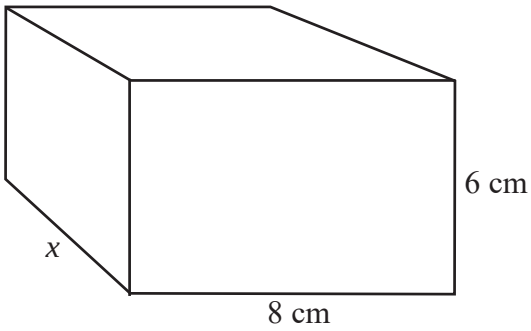
1) Find the volume of this cuboid.



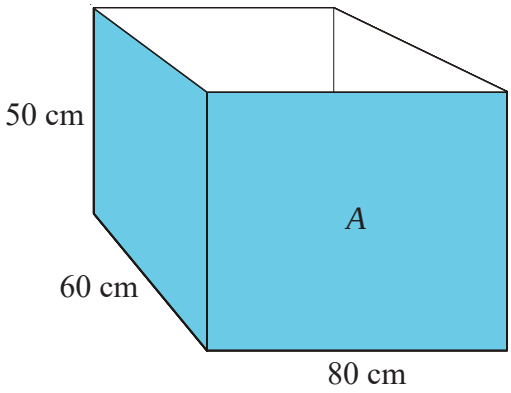
2) Find the volume of this cuboid.

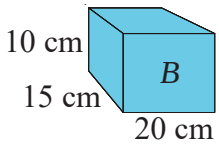


3) The volume of this cuboid is 480 cm^3.
Find the length of the side marked *x*.



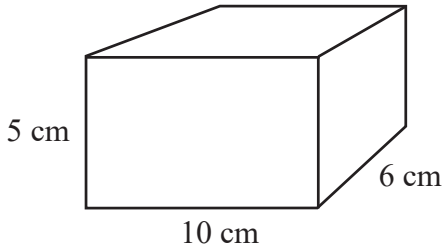
4) Boxes *A* and *B* are both cuboids.
How many of box *B* could be packed into box *A*?



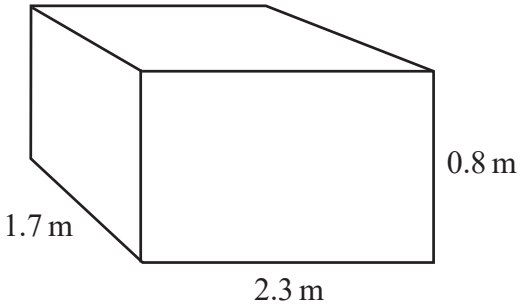


Volume of a Cuboid

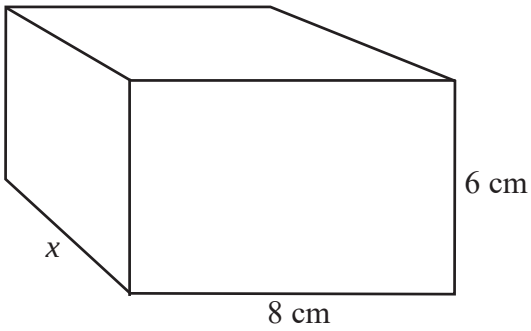
1) Find the volume of this cuboid. 300 cm^3



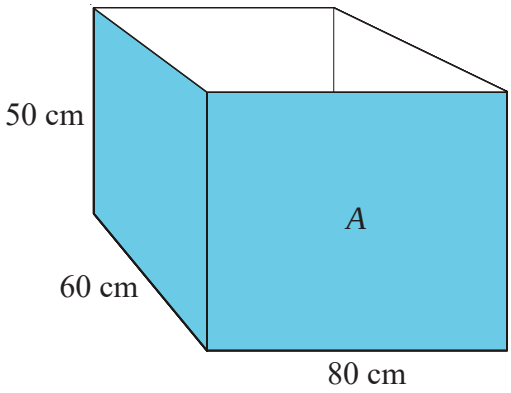
2) Find the volume of this cuboid. 3.128 m^3

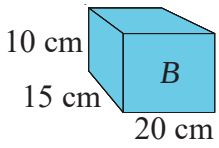


3) The volume of this cuboid is 480 cm^3.
Find the length of the side marked *x*. 10 cm



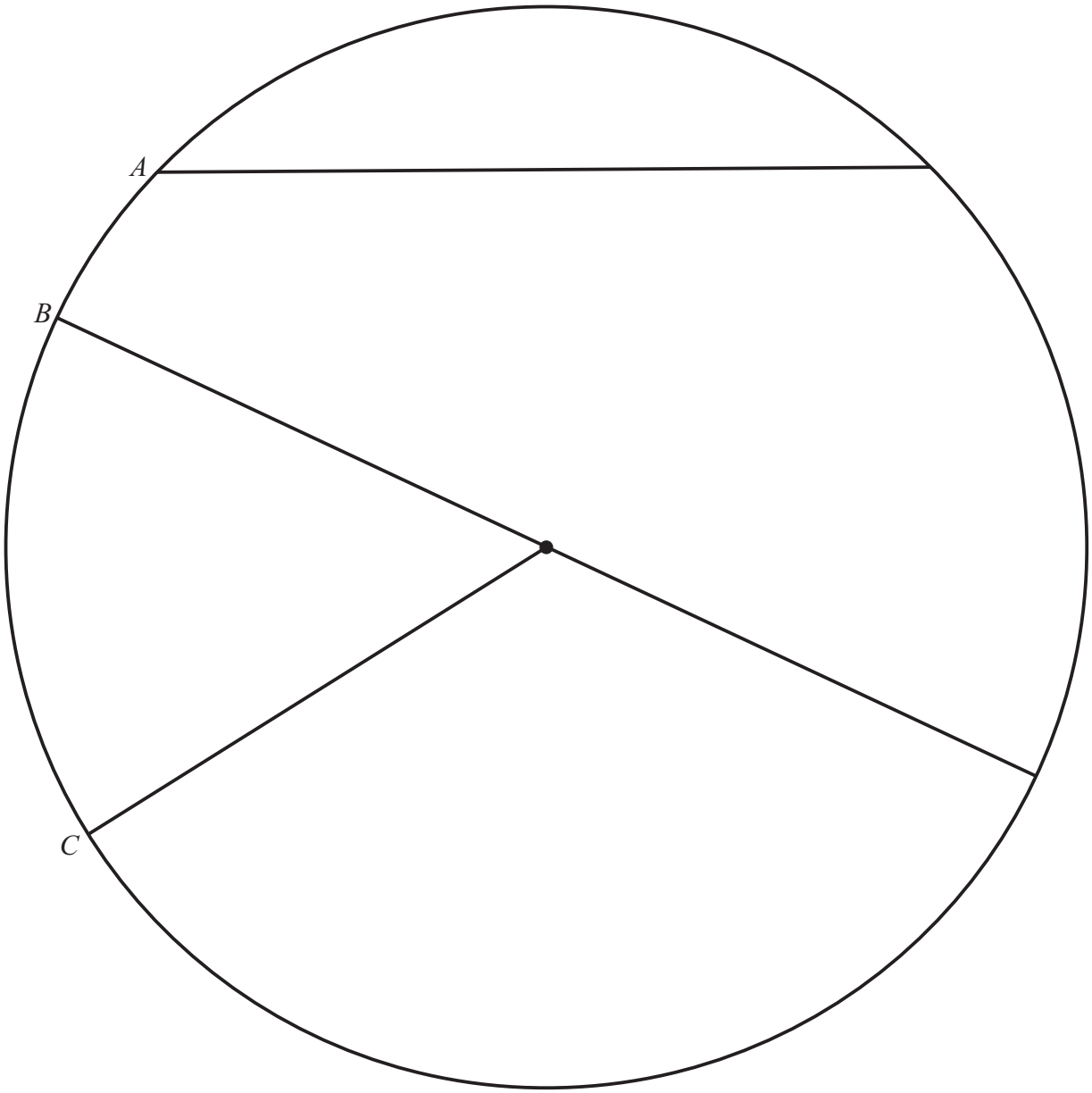
4) Boxes *A* and *B* are both cuboids.
How many of box *B* could be packed into box *A*? 80





Circle Definitions

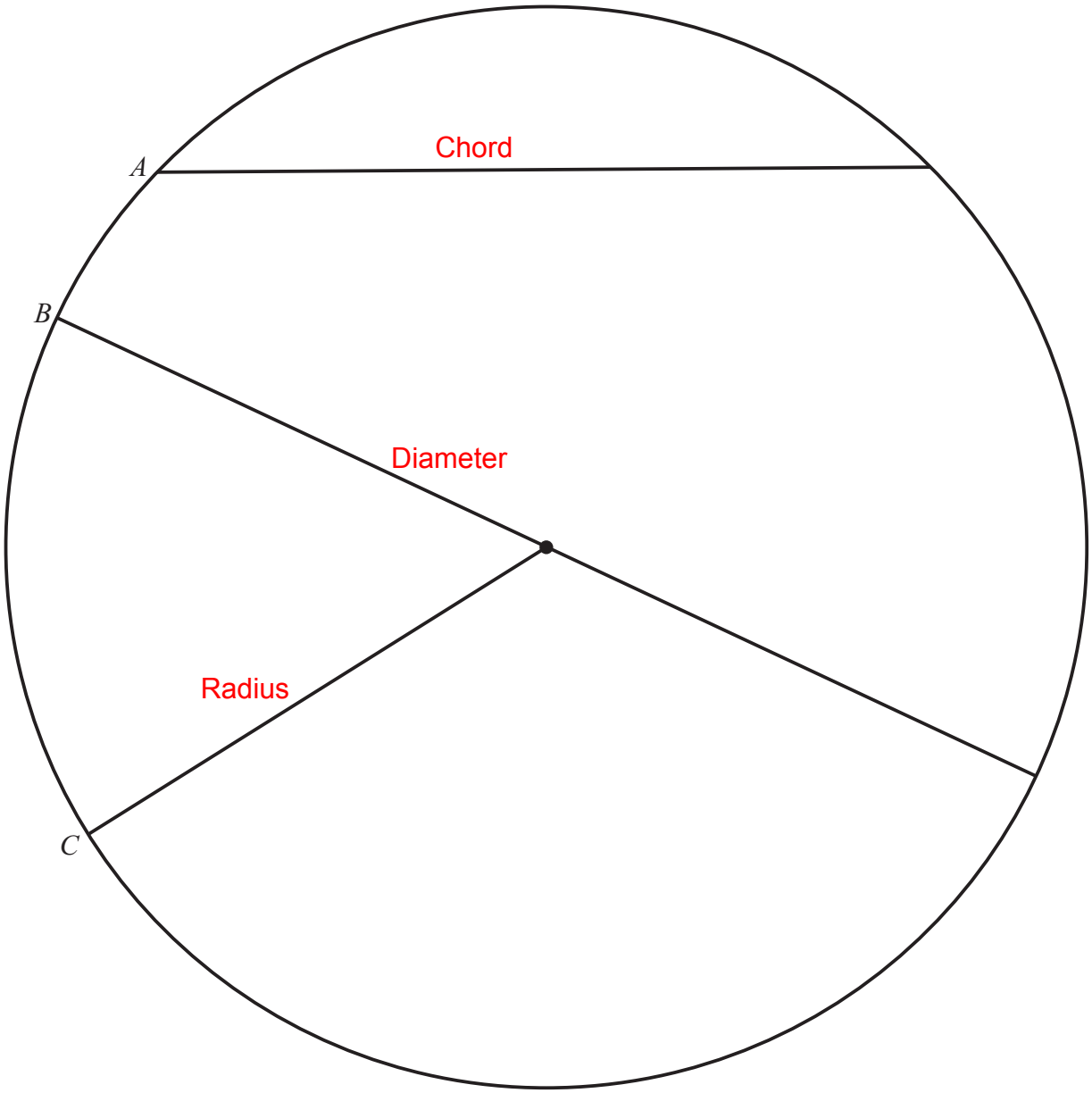
1) In the circle, write the correct names for line *A*, *B* and *C*.



2) What is the special name given to the perimeter of a circle?

Circle Definitions

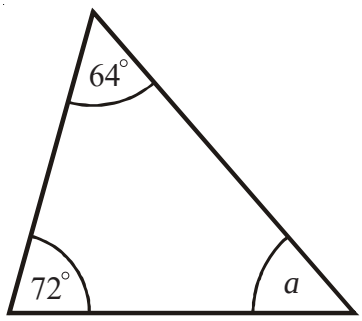
1) In the circle, write the correct names for line *A*, *B* and *C*.



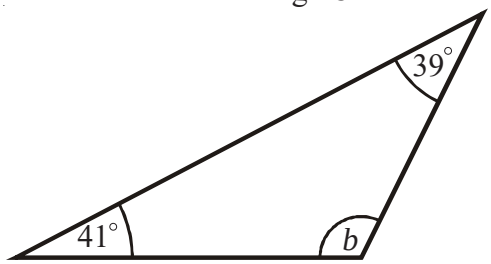
2) What is the special name given to the perimeter of a circle? Circumference

Angles in a Triangle

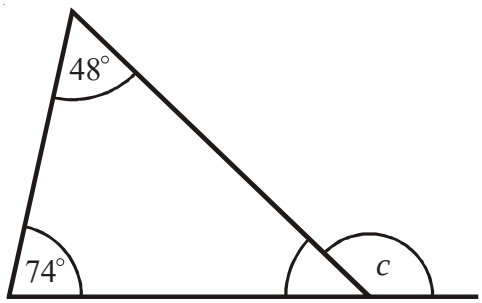
1) Work out the size of angle *a*.



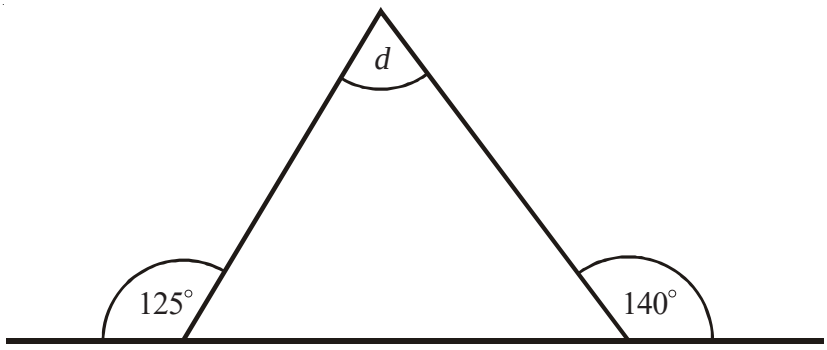
2) Work out the size of angle *b*.



3) Work out the size of angle *c*.

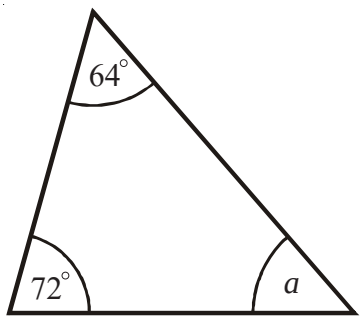


4) Work out the size of angle *d*.

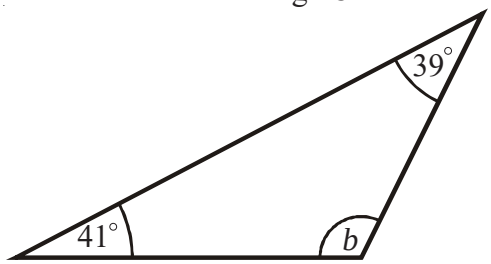


Angles in a Triangle

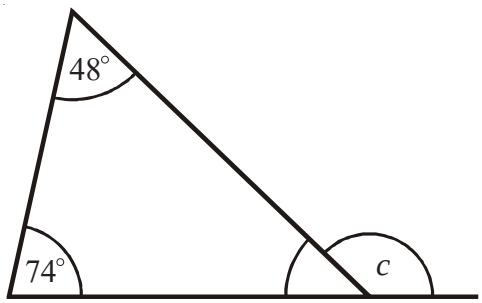
1) Work out the size of angle *a*. 44°



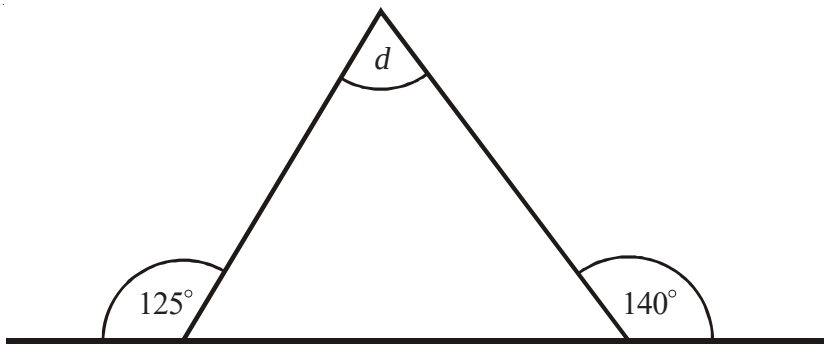
2) Work out the size of angle *b*. 100°



3) Work out the size of angle *c*. 122°



4) Work out the size of angle *d*. 85°



Properties of Special Triangles

1) *ABC* is a triangle.

a) Find the size of angle *A*.

b) Triangle *ABC* is equilateral.
Explain why.

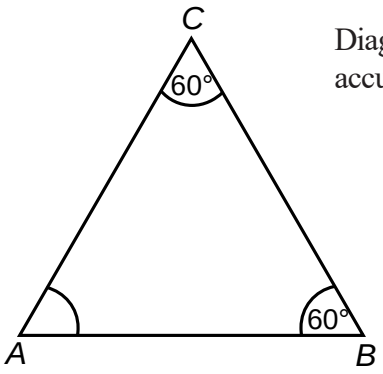


Diagram **NOT** accurately drawn

2) *BCD* is a triangle.
ABC is a straight line.
Angle *CBD* = 70°.
BD = *CD*.

a) (i) Work out the value of *x*.

(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

(ii) Give reasons for your answer.

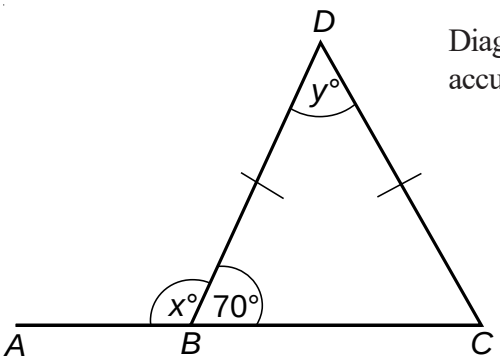


Diagram **NOT** accurately drawn

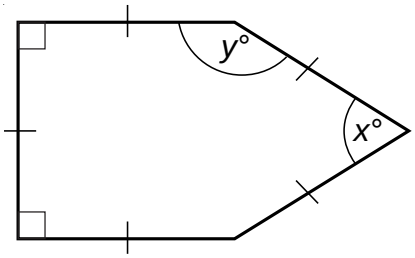
3) The diagram shows a 5-sided shape.
All the sides of the shape are equal in length.

a) (i) Find the value of *x*.

(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

(ii) Explain your answer.



Properties of Special Triangles

1) *ABC* is a triangle.

a) Find the size of angle *A*. 60°

b) Triangle *ABC* is equilateral.

Explain why. All of the angles are equal.

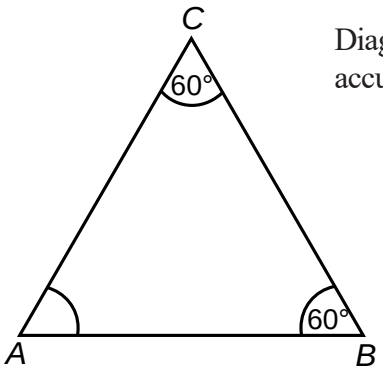


Diagram **NOT** accurately drawn

2) *BCD* is a triangle.

ABC is a straight line.

Angle *CBD* = 70°.

BD = *CD*.

a) (i) Work out the value of *x*. 110°

(ii) Give a reason for your answer.

Angles on a straight line add up to 180°.

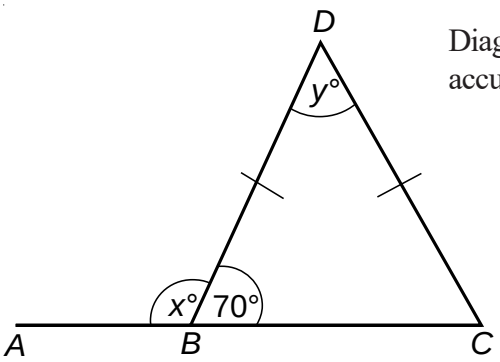


Diagram **NOT** accurately drawn

b) (i) Work out the value of *y*. 40°

(ii) Give reasons for your answer.

Base angles of an isosceles triangle are equal.
Angles in a traingle add up to 180°.

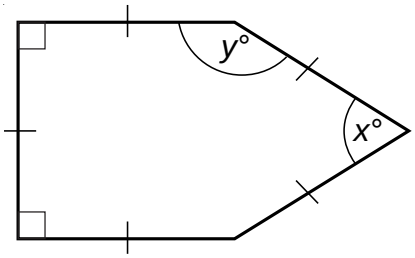
3) The diagram shows a 5-sided shape.

All the sides of the shape are equal in length.

a) (i) Find the value of *x*. 60°

(ii) Give a reason for your answer.

Equilateral triangle



b) (i) Work out the value of *y*.

150°

(ii) Explain your answer.

Angle in square + angle in equilateral triangle = 90° + 60° = 150°

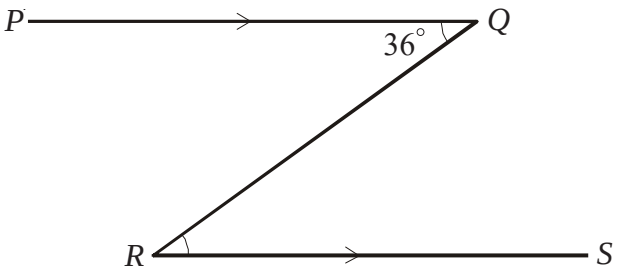
Angles and Parallel Lines

1) Line *PQ* is parallel to line *RS*.

If angle *PQR* is equal to 36°

a) What is the size of angle *QRS*?

b) Give a reason for your answer.

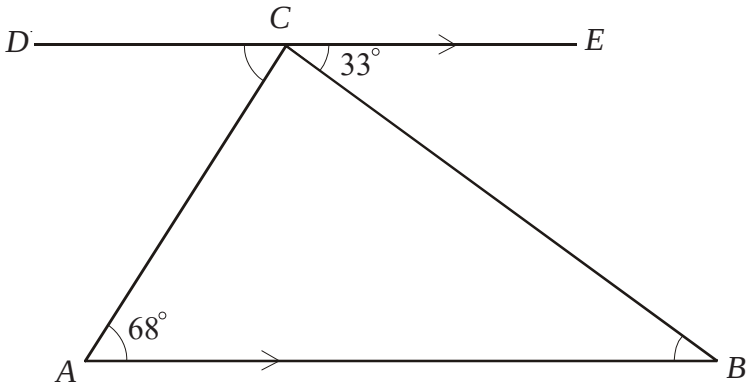


2) Line *DCE* is parallel to line *AB*

a) Find the size of angle *ABC*

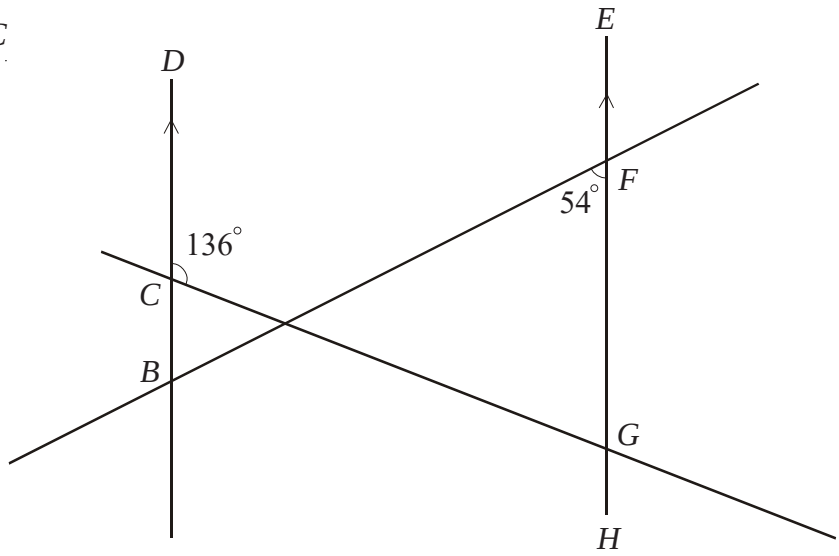
b) Find the size of angle *DCA*

c) Calculate the size of angle *ACB*



3) a) Find the size of angle *DBF*

b) Find the size of angle *HGC*



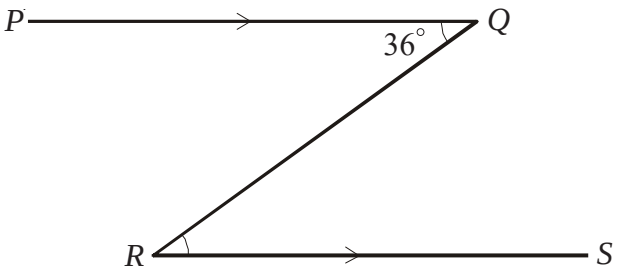
Angles and Parallel Lines

1) Line *PQ* is parallel to line *RS*.

If angle *PQR* is equal to 36°

a) What is the size of angle *QRS*? 36°

b) Give a reason for your answer. Alternate angles

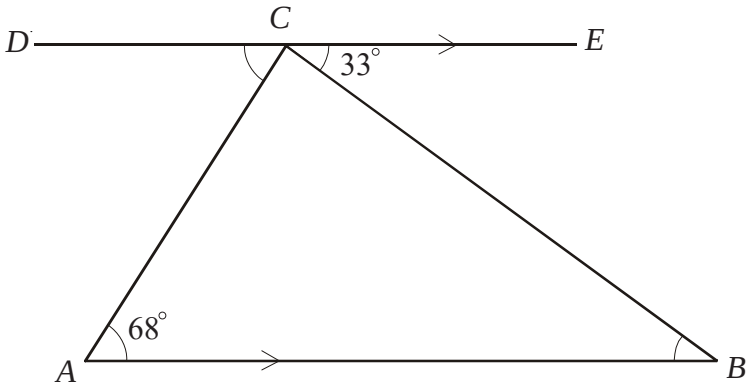


2) Line *DCE* is parallel to line *AB*

a) Find the size of angle *ABC* 33°

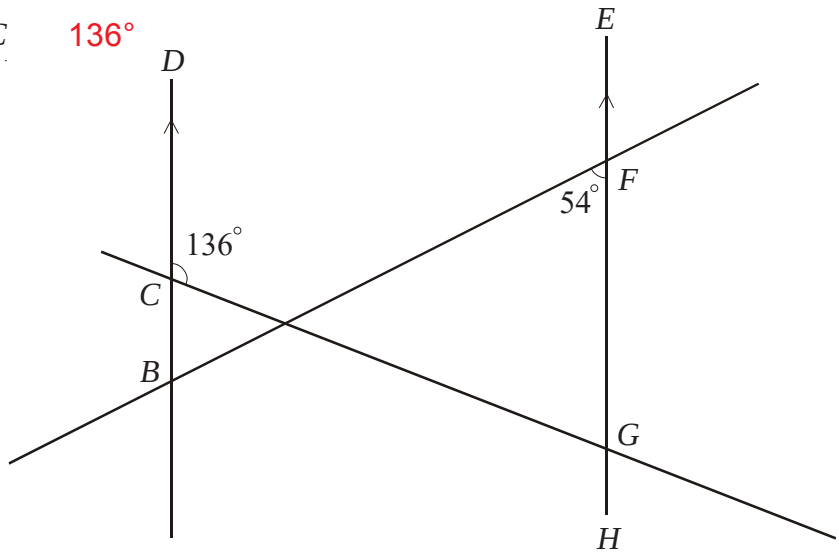
b) Find the size of angle *DCA* 68°

c) Calculate the size of angle *ACB* 79°



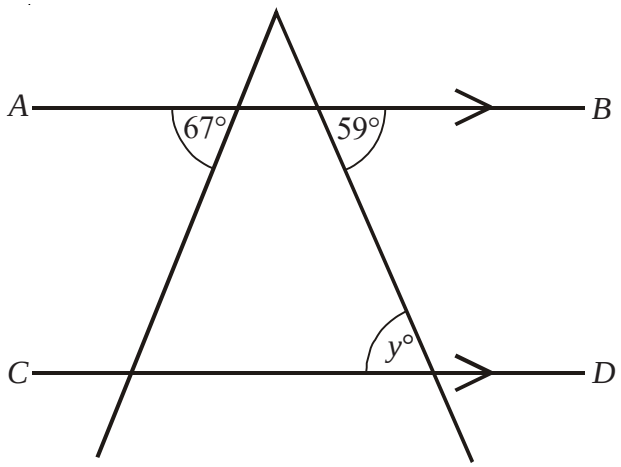
3) a) Find the size of angle *DBF* 54°

b) Find the size of angle *HGC* 136°



Angles and Parallel Lines

1)

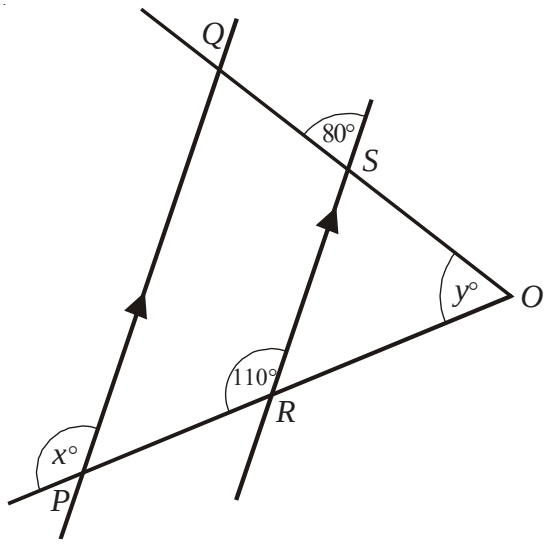


AB is parallel to *CD*.

(i) Write down the value of *y*.

(ii) Give a reason for your answer.

2)



PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

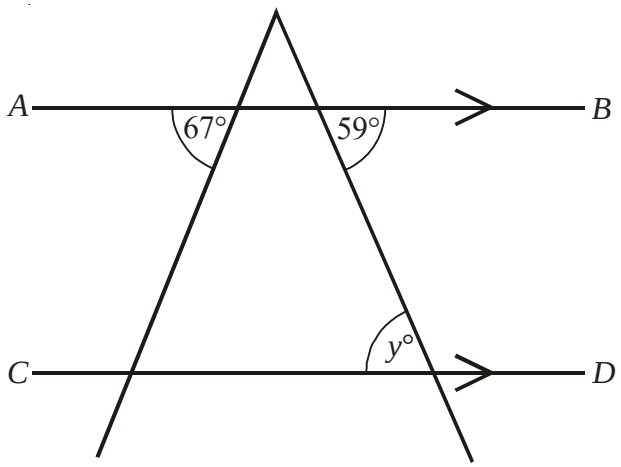
a) (i) Write down the value of *x*.

(ii) Give a reason for your answer.

b) Work out the value of *y*.

Angles and Parallel Lines

1)

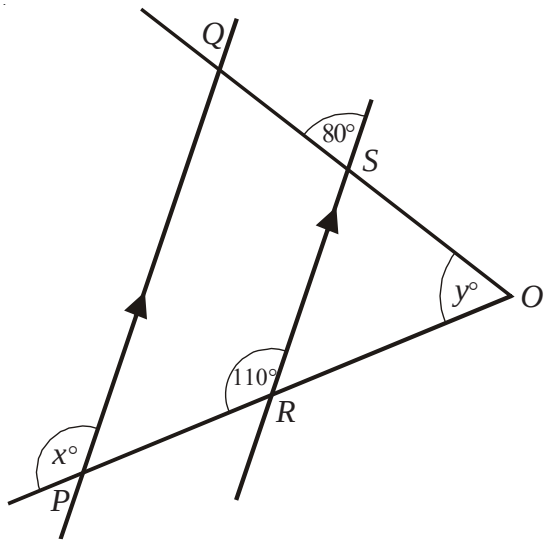


AB is parallel to *CD*.

(i) Write down the value of *y*. 59°

(ii) Give a reason for your answer. Alternate angles

2)



PQ is parallel to *RS*.

OSQ and *ORP* are straight lines.

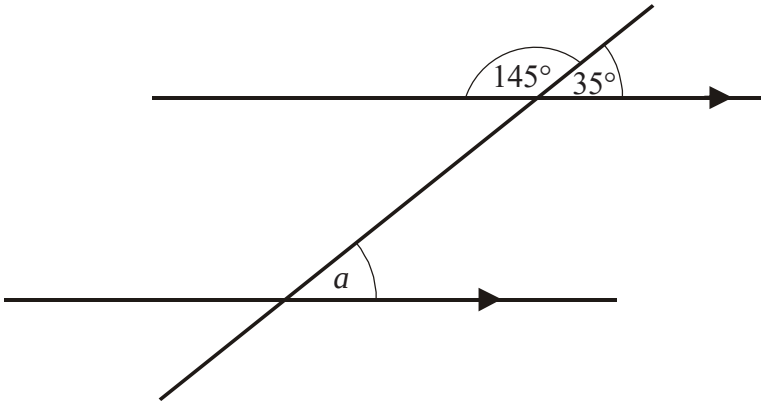
a) (i) Write down the value of *x*. 110°

(ii) Give a reason for your answer. Corresponding angles

b) Work out the value of *y*. 30°

Angles and Parallel Lines

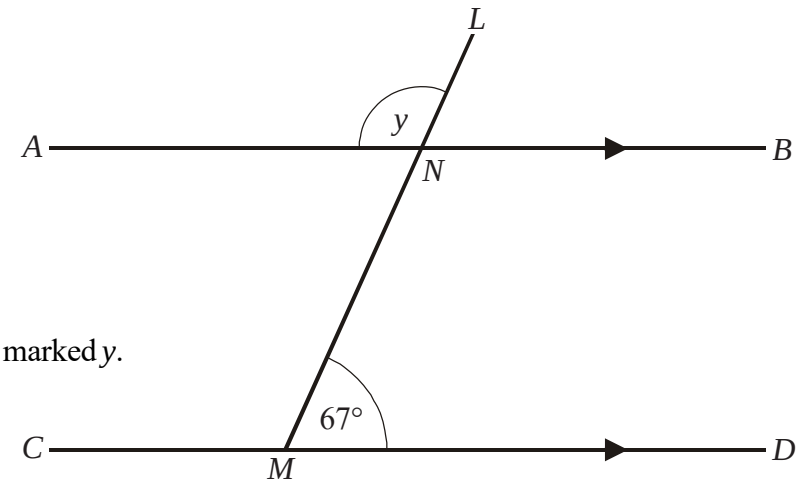
1)



(i) Write down the size of the angle marked *a*.

(ii) Give a reason for your answer.

2)

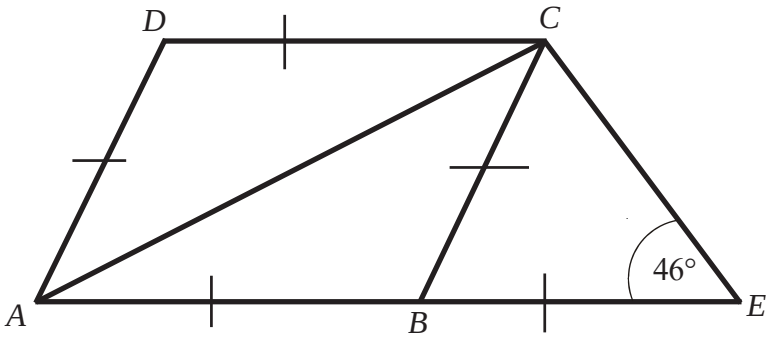


ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*.

(ii) Give reasons for your answer.

3)

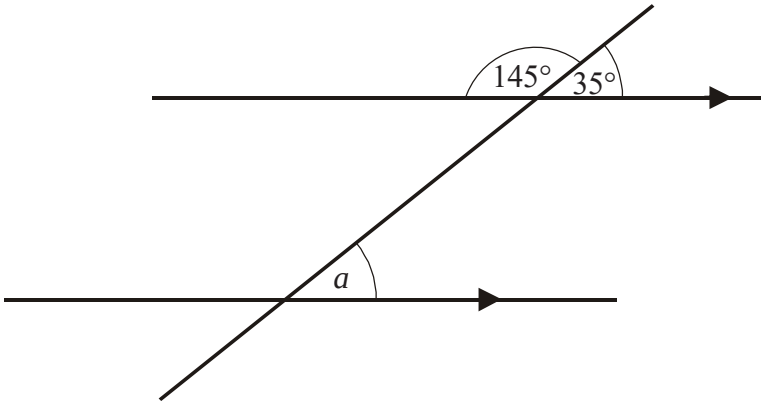


ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*.

Angles and Parallel Lines

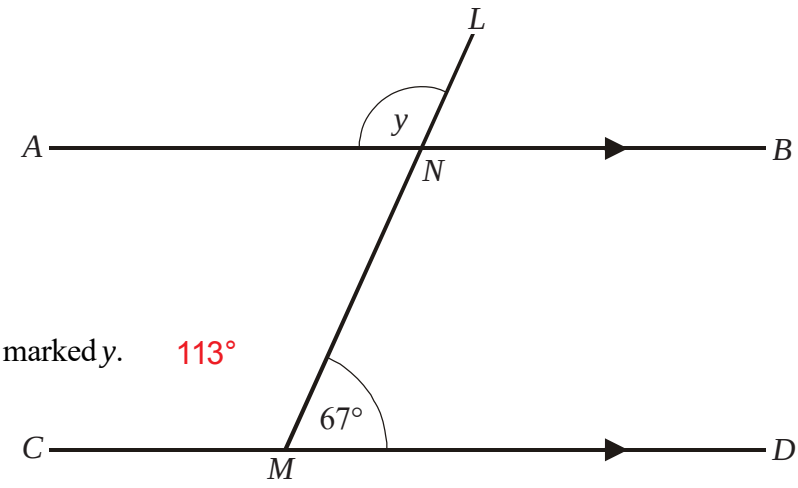
1)



(i) Write down the size of the angle marked *a*. 35°

(ii) Give a reason for your answer. Corresponding angles

2)



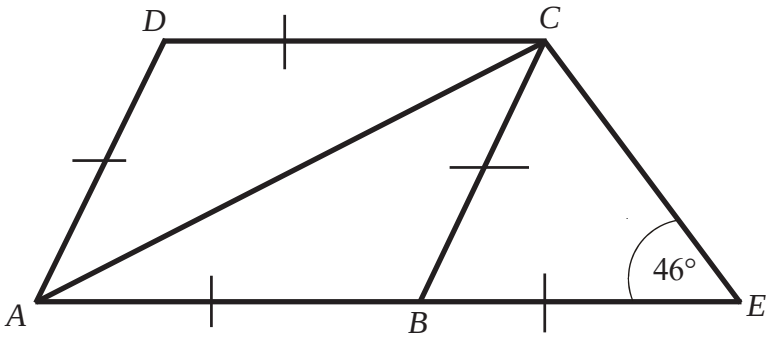
ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*. 113°

(ii) Give reasons for your answer.

Angle *LNB* = 67° (corresponding angles)
y = 113° (angles on straight line add up to 180°)

3)

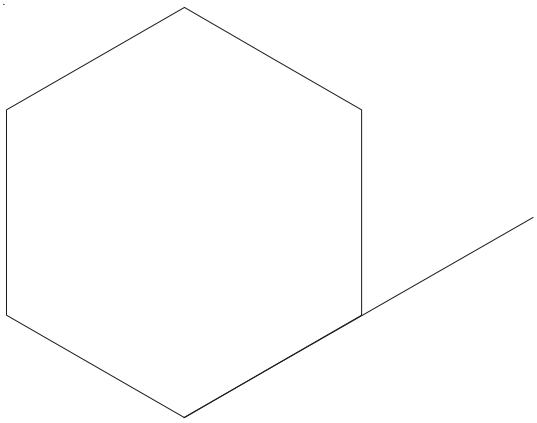


ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

Work out the size of angle *DCA*. 44°

Angle Sum of Polygons

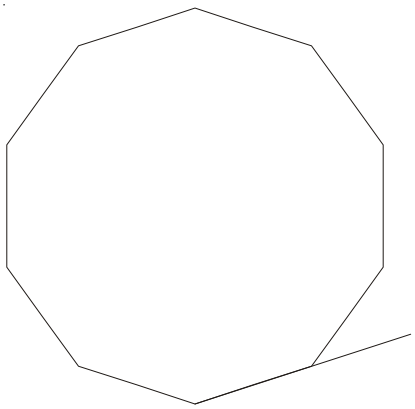
1)



a) Work out the size of an **exterior** angle of a regular hexagon.

b) Work out the size of an **interior** angle of a regular hexagon.

2)



a) Name the regular polygon, above.

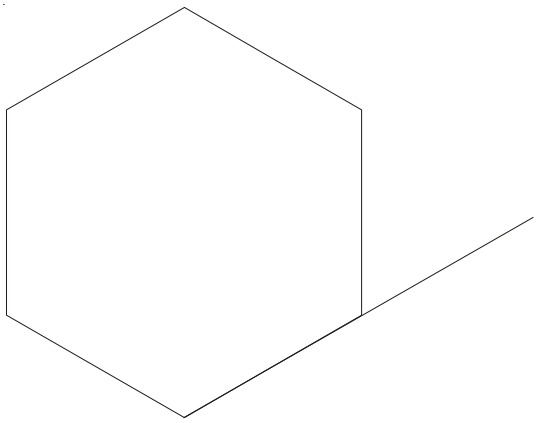
b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

3) The size of each **exterior** angle of a regular polygon is 40°.
Work out the number of sides of the regular polygon.

4) The size of each **interior** angle of a regular polygon is 120°.
Work out the number of sides of the regular polygon.

Angle Sum of Polygons

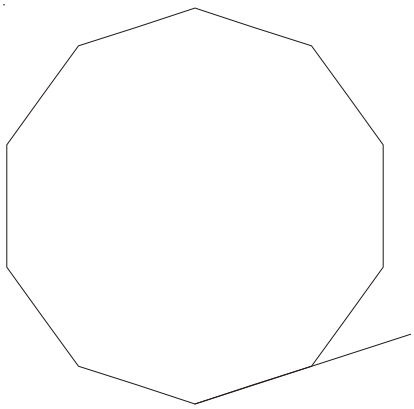
1)



a) Work out the size of an **exterior** angle of a regular hexagon. 60°

b) Work out the size of an **interior** angle of a regular hexagon. 120°

2)



a) Name the regular polygon, above. Decagon

b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.

Exterior angle = 36°
Interior angle = 144°

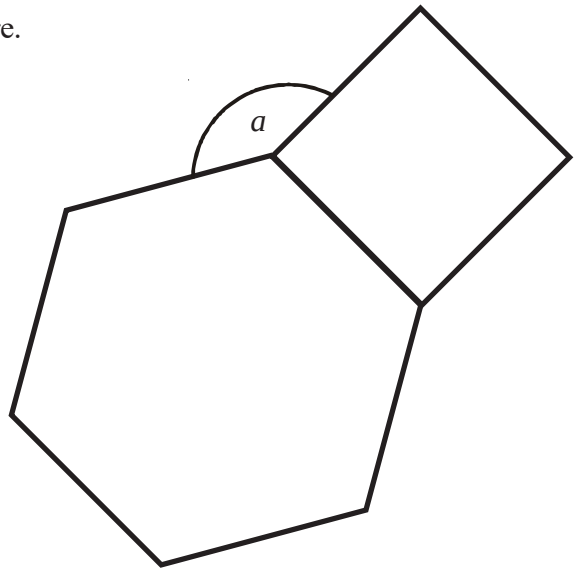
3) The size of each **exterior** angle of a regular polygon is 40°.
Work out the number of sides of the regular polygon. 9

4) The size of each **interior** angle of a regular polygon is 120°.
Work out the number of sides of the regular polygon. 6

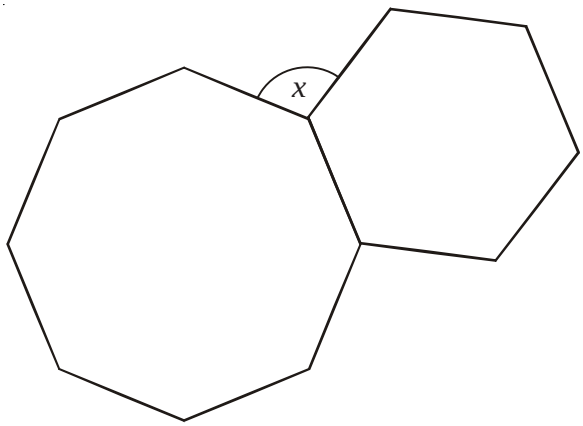
Angle Sum of Polygons

1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.



2)

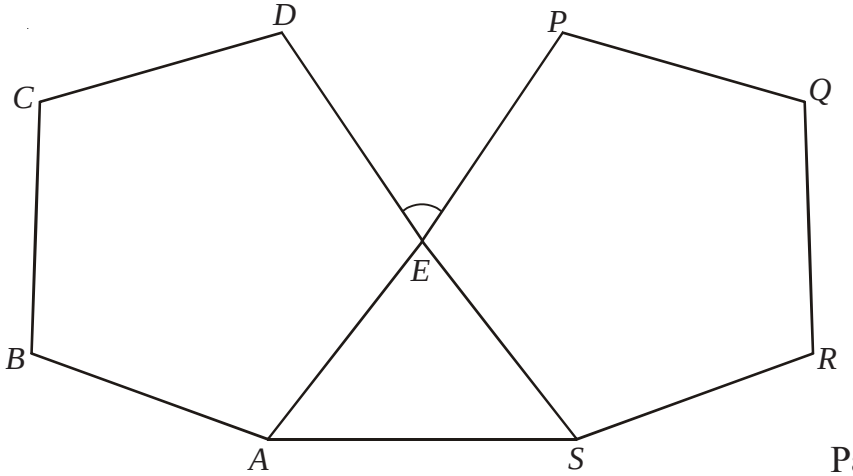


The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*.

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*.

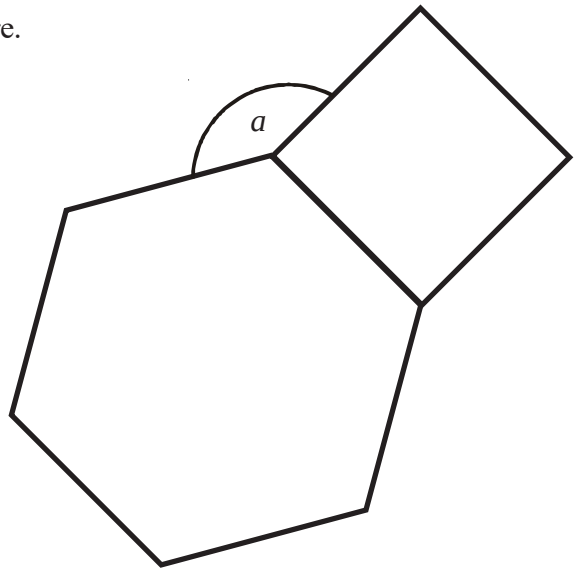


Angle Sum of Polygons

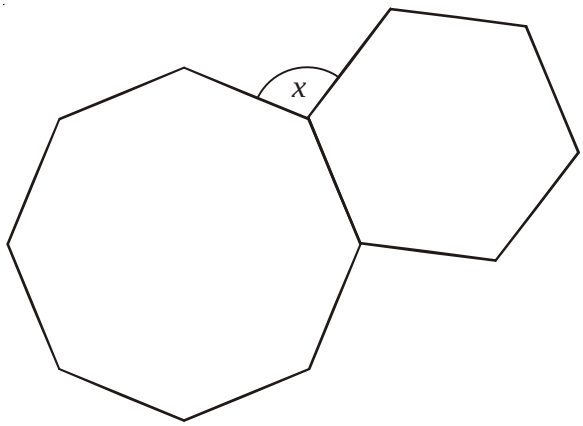
1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.

150°



2)

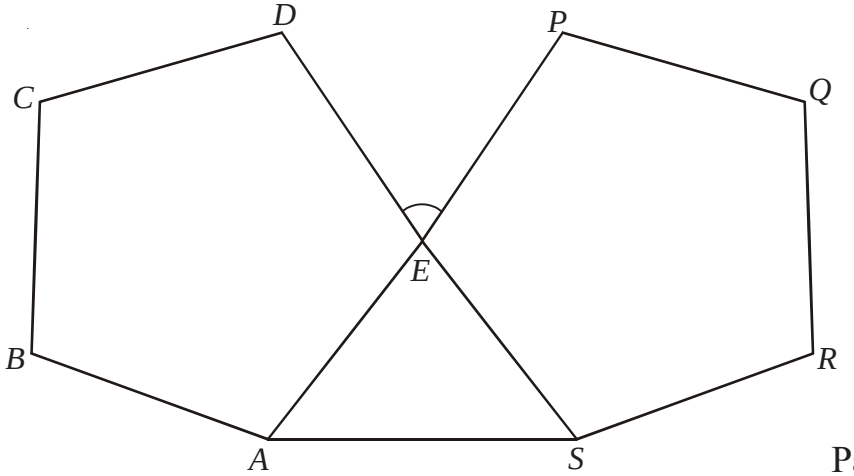


The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*. 105°

3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*. 84°



Two-Way Tables

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	**Sparkling**	**Both**	**Total**
Male	26			53
Female		20	10	
Total			16	100

a) Complete the two-way table.

b) How many males were in the survey?

c) How many females drink only still water?

d) How many people drink only sparkling water?

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	**German**	**Spanish**	**Total**
Female				
Male		7		
Total	20	18		90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French?

c) How many people study Spanish?

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

Work out the number of students who like milk chocolates the best.

Two-Way Tables

1) Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26	21	6	53
Female	17	20	10	47
Total	43	41	16	100

a) Complete the two-way table.

b) How many males were in the survey? 53

c) How many females drink only still water? 17

d) How many people drink only sparkling water? 41

2) 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female	6	11	23	40
Male	14	7	29	50
Total	20	18	52	90

50 of the 90 students are male.

29 of the 50 male students study Spanish.

a) Complete the two-way table.

b) How many females study French? 6

c) How many people study Spanish? 52

3) Karen asks 100 students if they like milk, plain or white chocolates best.

36 of the students are girls.

19 of these girls like milk chocolates best.

16 boys like white chocolates best.

8 out of the 24 students who like plain chocolates best are girls.

Work out the number of students who like milk chocolates the best. 51

Averages and the Range

1) Kaya made a list of his homework marks.

3 2 3 4 1 4 5 4

a) Write down the mode of Kaya's marks.

b) Work out his mean homework mark.

2) Lydia rolled an 8-sided dice ten times.
Here are her scores.

5 1 2 5 3 8 6 6 3 2

a) Work out Lydia's median score.

b) Work out the mean of her scores.

3) In a two-week period, a train was this many minutes late each day:

3 0 0 0 7 4 5 2 0 1 14 0 5 1

a) What was the mean average number of minutes late?

b) What was the median average number of minutes late?

4) Two small Year 10 classes, Set A and Set B, sat the same Science test.

Set A had these scores for the test:

63%, 71%, 48%, 95%, 46%, 82%, 77%, 36%, 73%

Set B had these scores:

58%, 63%, 85%, 61%, 59% 38%, 90%, 84%, 75%, 48%

How much bigger was Set B's mean average score than Set A's mean average score?
Give your answer correct to 1 decimal place.

5) A rugby team played six games.
The mean score for the six games is 15
The rugby team played one more game.
The mean score for all seven games is 16
Work out the number of points the team scored in the seventh game.

Averages and the Range

1) Kaya made a list of his homework marks.

3 2 3 4 1 4 5 4

a) Write down the mode of Kaya's marks. 4

b) Work out his mean homework mark. 3.25

2) Lydia rolled an 8-sided dice ten times.
Here are her scores.

5 1 2 5 3 8 6 6 3 2

a) Work out Lydia's median score. 4

b) Work out the mean of her scores. 4.1

3) In a two-week period, a train was this many minutes late each day:

3 0 0 0 7 4 5 2 0 1 14 0 5 1

a) What was the mean average number of minutes late? 3 minutes late

b) What was the median average number of minutes late? 1.5 minutes late

4) Two small Year 10 classes, Set A and Set B, sat the same Science test.

Set A had these scores for the test:

63%, 71%, 48%, 95%, 46%, 82%, 77%, 36%, 73%

Set B had these scores:

58%, 63%, 85%, 61%, 59% 38%, 90%, 84%, 75%, 48%

How much bigger was Set B's mean average score than Set A's mean average score?
Give your answer correct to 1 decimal place. 0.4%

5) A rugby team played six games.
The mean score for the six games is 15
The rugby team played one more game.
The mean score for all seven games is 16
Work out the number of points the team scored in the seventh game. 22

Experimental Probabilities

1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer

2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail.

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six.

4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three.

5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

a) She throws the dice once more.
Find an estimate for the probability that she will get a four.

b) If the dice is rolled 250 times, how many times would you expect to get a five?

Experimental Probabilities

1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer Two possible answers:
No, you would expect to score 1 about 100 times.
Yes, although you would expect 1 about 100 times, you could still get it 200 times.

2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail. 45 times

3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six. 200 times

4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three. 175 times

5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

a) She throws the dice once more.
Find an estimate for the probability that she will get a four. $\frac{24}{100}$ or 0.24

b) If the dice is rolled 250 times, how many times would you expect to get a five? 45 times

Possibility Spaces

1) Two dice are rolled and their scores are multiplied together.

a) Complete the possibility space to show all the possible results.

First dice

Second dice	1	2	3	4	5	6
1						
2						
3				12		
4						
5						
6			18			

b) What is the probability of getting a result that is an even number?

2) Suppose there are three cards:

A **black card** that is black on both sides,

A **white card** that is white on both sides,

A **mixed card** that is black on one side and white on the other side.

All the cards are placed into a hat and one is taken out at random.

It is placed on a table and the side facing up is black.

What is the probability that the other side of the card is also black?

Possibility Spaces

1) Two dice are rolled and their scores are multiplied together.

a) Complete the possibility space to show all the possible results.

First dice

Second dice	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

b) What is the probability of getting a result that is an even number? $\frac{27}{36}$

2) Suppose there are three cards:

A **black card** that is black on both sides,

A **white card** that is white on both sides,

A **mixed card** that is black on one side and white on the other side.

All the cards are placed into a hat and one is taken out at random.

It is placed on a table and the side facing up is black.

What is the probability that the other side of the card is also black? $\frac{1}{2}$

Index Notation

1) Write as a power of 8

a) $8^4 \times 8^3$ b) $8^{12} \div 8^7$

2) Write as a power of 3

a) $3^2 \times 3^9$ b) $3^{10} \div 3^3$

3) Simplify

a) $k^5 \times k^2$

b) $x^4 \div x^2$

c) $\dfrac{k^{11}}{k^6}$

d) $(k^8)^2$

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$

b) $(2x^2y^2)^3$

c) $(4xy^4)^2$

d) $(3xy^2)^4$

5) $2^x \times 2^y = 2^{10}$
and
$2^x \div 2^y = 2^2$

Work out the value of x and the value of y.

6) $5^x \times 5^y = 5^{12}$
and
$5^x \div 5^y = 5^6$

Work out the value of x and the value of y.

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y}

b) 2^{2x}

c) 2^{3y}

d) 2^{x+2y}

Index Notation

1) Write as a power of 8

a) $8^4 \times 8^3$ 8^7 b) $8^{12} \div 8^7$ 8^5

2) Write as a power of 3

a) $3^2 \times 3^9$ 3^{11} b) $3^{10} \div 3^3$ 3^7

3) Simplify

a) $k^5 \times k^2$ k^7

b) $x^4 \div x^2$ x^2

c) $\frac{k^{11}}{k^6}$ k^5

d) $(k^8)^2$ k^{16}

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$ $8x^3y^{15}$

b) $(2x^2y^2)^3$ $8x^6y^6$

c) $(4xy^4)^2$ $16x^2y^8$

d) $(3xy^2)^4$ $81x^4y^8$

5) $2^x \times 2^y = 2^{10}$

and

$2^x \div 2^y = 2^2$

Work out the value of x and the value of y. $x = 6, y = 4$

6) $5^x \times 5^y = 5^{12}$

and

$5^x \div 5^y = 5^6$

Work out the value of x and the value of y. $x = 9, y = 3$

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y} ab

b) 2^{2x} a^2

c) 2^{3y} b^3

d) 2^{x+2y} ab^2

Index Notation

1) a) Simplify $d \times d \times d \times d$

b) Simplify $t \times t^2$

c) Simplify $m^5 \div m^3$

2) a) Simplify $(2x^2)^3$

b) Simplify $3x^2 \times 4x^5y^4$

3) a) Simplify $t^4 \times t^5$

b) Simplify $x^8 \div x^5$

c) Simplify $(c^4)^3$

4) a) Simplify $x^6 \times x^2$

b) Simplify $\frac{x^8}{x^3}$

c) Simplify $(2t)^3$

d) Simplify $3x^2y \times 4x^5y^4$

5) a) Simplify $x^3 \times x^4$

b) Simplify $t^7 \div t^3$

c) Simplify $4x^2y^4 \times 3xy^2$

6) a) Simplify $x \times x \times x \times x$

b) Simplify $2x \times 3y$

Index Notation

1) a) Simplify $d \times d \times d \times d$ d^4

b) Simplify $t \times t^2$ t^3

c) Simplify $m^5 \div m^3$ m^2

2) a) Simplify $(2x^2)^3$ $8x^6$

b) Simplify $3x^2 \times 4x^5y^4$ $12x^7y^4$

3) a) Simplify $t^4 \times t^5$ t^9

b) Simplify $x^8 \div x^5$ x^3

c) Simplify $(c^4)^3$ c^{12}

4) a) Simplify $x^6 \times x^2$ x^8

b) Simplify $\frac{x^8}{x^3}$ x^5

c) Simplify $(2t)^3$ $8t^3$

d) Simplify $3x^2y \times 4x^5y^4$ $12x^7y^5$

5) a) Simplify $x^3 \times x^4$ x^7

b) Simplify $t^7 \div t^3$ t^4

c) Simplify $4x^2y^4 \times 3xy^2$ $12x^3y^6$

6) a) Simplify $x \times x \times x \times x$ x^4

b) Simplify $2x \times 3y$ $6xy$

Standard Form

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4

b) 6.79×10^6

c) 7.03×10^3

d) 9.2×10^2

e) 1.01×10^4

f) 4×10^5

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4}

b) 6.79×10^{-6}

c) 7.03×10^{-3}

d) 9.2×10^{-2}

e) 1.01×10^{-4}

f) 4×10^{-5}

3) Change the following to standard form.

a) 360

b) 8 900

c) 520 000

d) 60000

e) 1 003

f) 6 450 000

4) Change the following to standard form.

a) 0.071

b) 0.0008

c) 0.00076

d) 0.0928

e) 0.00009

f) 0.00000173

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$

b) 240×0.0002

c) $9 \times 1.1 \times 10^7$

d) $5 \times 4 \times 10^3$

e) $\dfrac{8 \times 10^4}{4 \times 10^2}$

f) $9 \times 10^2 \times 2 \times 10^{-5}$

g) $7 \times 10^2 \times 3 \times 10^{-4}$

h) $2 \times 3.6 \times 10^{-5}$

i) $6 \times 4.1 \times 10^3$

Standard Form

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4
43 000

b) 6.79×10^6
6 790 000

c) 7.03×10^3
7 030

d) 9.2×10^2
920

e) 1.01×10^4
10 100

f) 4×10^5
400 000

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4}
0.00043

b) 6.79×10^{-6}
0.00000679

c) 7.03×10^{-3}
0.00703

d) 9.2×10^{-2}
0.092

e) 1.01×10^{-4}
0.000101

f) 4×10^{-5}
0.00004

3) Change the following to standard form.

a) 360
3.6×10^2

b) 8 900
8.9×10^3

c) 520 000
5.2×10^5

d) 60000
6×10^4

e) 1 003
1.003×10^3

f) 6 450 000
6.45×10^6

4) Change the following to standard form.

a) 0.071
7.1×10^{-2}

b) 0.0008
8×10^{-4}

c) 0.00076
7.6×10^{-4}

d) 0.0928
9.28×10^{-2}

e) 0.00009
9×10^{-5}

f) 0.00000173
1.73×10^{-6}

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$
1.5×10^7

b) 240×0.0002
4.8×10^{-2}

c) $9 \times 1.1 \times 10^7$
9.9×10^7

d) $5 \times 4 \times 10^3$
2×10^4

e) $\dfrac{8 \times 10^4}{4 \times 10^2}$
2×10^2

f) $9 \times 10^2 \times 2 \times 10^{-5}$
1.8×10^{-2}

g) $7 \times 10^2 \times 3 \times 10^{-4}$
2.1×10^{-1}

h) $2 \times 3.6 \times 10^{-5}$
7.2×10^{-5}

i) $6 \times 4.1 \times 10^3$
2.46×10^4

Highest Common Factor (HCF)

1) Find the Highest Common Factor of 16 and 24.

2) Find the Highest Common Factor of 21 and 28.

3) Find the Highest Common Factor of 60 and 150.

4) Find the Highest Common Factor of 96 and 108.

5) (i) Write 42 and 63 as products of their prime factors.

(ii) Work out the Highest Common Factor of 42 and 63.

Highest Common Factor (HCF)

1) Find the Highest Common Factor of 16 and 24.

8

2) Find the Highest Common Factor of 21 and 28.

7

3) Find the Highest Common Factor of 60 and 150.

30

4) Find the Highest Common Factor of 96 and 108.

12

5) (i) Write 42 and 63 as products of their prime factors.

$42 = 2 \times 3 \times 7$

$63 = 3 \times 3 \times 7$

(ii) Work out the Highest Common Factor of 42 and 63.

21

Lowest Common Multiple (LCM)

1) Find the Lowest Common Multiple of 20 and 60.

2) Find the Lowest Common Multiple of 28 and 72.

3) Find the Lowest Common Multiple of 70 and 240.

4) Find the Lowest Common Multiple of 35 and 55.

5) (i) Write 42 and 63 as products of their prime factors.

(ii) Work out the Lowest Common Multiple of 42 and 63.

Lowest Common Multiple (LCM)

1) Find the Lowest Common Multiple of 20 and 60.

60

2) Find the Lowest Common Multiple of 28 and 72.

504

3) Find the Lowest Common Multiple of 70 and 240.

1680

4) Find the Lowest Common Multiple of 35 and 55.

385

5) (i) Write 42 and 63 as products of their prime factors.

$42 = 2 \times 3 \times 7$
$63 = 3 \times 3 \times 7$

(ii) Work out the Lowest Common Multiple of 42 and 63.

126

Product of Primes/HCF/LCM

1) a) Express 84 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 84 and 35.

2) Express 72 as the product of its prime factors.

3) Express 180 as the product of its prime factors.

4) a) Express 66 as a product of its prime factors.

   b) Express 132^2 as a product of its prime factors.

5) Express 252 as a product of its prime factors.

6) Find the Lowest Common Multiple (LCM) of 24 and 36.

7) a) Write 56 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 56 and 42.

8) a) Express 45 as a product of its prime factors.

   b) Find the Highest Common Factor (HCF) of 45 and 30.

9) a) Find the Highest Common Factor (HCF) of 24 and 30.

   b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6.

Product of Primes/HCF/LCM

1) a) Express 84 as a product of its prime factors. $2 \times 2 \times 3 \times 7$

b) Find the Highest Common Factor (HCF) of 84 and 35. 7

2) Express 72 as the product of its prime factors. $2 \times 2 \times 2 \times 3 \times 3$

3) Express 180 as the product of its prime factors. $2 \times 2 \times 3 \times 3 \times 5$

4) a) Express 66 as a product of its prime factors. $2 \times 3 \times 11$

b) Express 132^2 as a product of its prime factors. $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 11 \times 11$

5) Express 252 as a product of its prime factors. $2 \times 2 \times 3 \times 3 \times 7$

6) Find the Lowest Common Multiple (LCM) of 24 and 36. 72

7) a) Write 56 as a product of its prime factors. $2 \times 2 \times 2 \times 7$

b) Find the Highest Common Factor (HCF) of 56 and 42. 14

8) a) Express 45 as a product of its prime factors. $3 \times 3 \times 5$

b) Find the Highest Common Factor (HCF) of 45 and 30. 15

9) a) Find the Highest Common Factor (HCF) of 24 and 30. 6

b) Find the Lowest Common Multiple (LCM) of 4, 5 and 6. 60

Introduction to Bounds

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

   a) Write down the least possible mass of the necklace.

   b) Write down the greatest possible mass of the necklace.

2) Each of these measurements was made correct to one decimal place.
   Write the maximum and minimum possible measurement in each case.

   a) 4.6 cm b) 0.8 kg c) 12.5 litres d) 25.0 km/h

   e) 10.3 s f) 36.1 m g) 136.7 m/s h) 0.1 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

   a) Write down the least possible length of each side.

   b) Write down the greatest possible length of each side.

   c) Write down the greatest possible perimeter of the octagon.

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
   Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.
   Explain why it might not be possible for her to fit the pen in the pencil case.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

   a) Calculate the lower bound for the perimeter of the square.

   b) Calculate the upper bound for the area of the square.

Introduction to Bounds

1) A silver necklace has a mass of 123 grams, correct to the nearest gram.

   a) Write down the least possible mass of the necklace. 122.5 g

   b) Write down the greatest possible mass of the necklace. 123.5 g

2) Each of these measurements was made correct to one decimal place.
   Write the maximum and minimum possible measurement in each case.

a) 4.6 cm max: 4.65 cm min: 4.55 cm	b) 0.8 kg max: 0.85 kg min: 0.75 kg	c) 12.5 litres max: 12.55 *l* min: 12.45 *l*	d) 25.0 km/h max: 25.05 km/h min: 24.95 km/h
e) 10.3 s max: 10.35 s min: 10.25 s	f) 36.1 m max: 36.15 m min: 36.05 m	g) 136.7 m/s max: 136.75 m/s min: 136.65 m/s	h) 0.1 g max: 0.15 g min: 0.05 g

3) Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

   a) Write down the least possible length of each side. 20.55 cm

   b) Write down the greatest possible length of each side. 20.65 cm

   c) Write down the greatest possible perimeter of the octagon. 165.2 cm

4) A girl has a pen that is of length 12 cm, measured to the nearest centimetre.
   Her pencil case has a diagonal of length 12.5 cm, measured to the nearest millimetre.

   Explain why it might not be possible for her to fit the pen in the pencil case.

   12 cm to the nearest cm has a maximum possible length of 12.5 cm.
   12.5 cm to the nearest mm has a minimum possible length of 12.45 cm.
   A 12.5 cm pencil won't fit into a pencil case with a diagonal length of 12.45 cm.

5) A square has sides of length 7 cm, correct to the nearest centimetre.

   a) Calculate the lower bound for the perimeter of the square. 26 cm

   b) Calculate the upper bound for the area of the square. 56.25 cm^2

Sharing Using Ratio

1) Tom and Julie share £48 in the ratio 5 : 3
Work out how much more money Tom gets than Julie gets.

2) Ben and Sue share £60 in the ratio 2 : 3
Work out how much each person gets.

3) A box contains milk chocolates and plain chocolates only.
The number of milk chocolates to the number of plain chocolates is in the ratio 2 : 1
There are 24 milk chocolates.
Work out the total number of chocolates.

4) Andy, Ben and Claire share £54
Ben gets three times as much money as Andy.
Claire gets twice as much money as Ben.

How much money does Claire get?

5) There are some marbles in a bag.
18 of the marbles are blue.
12 of the marbles are red.
a) Write down the ratio of the number of blue marbles to the number of red marbles.
Give your ratio in its simplest form.

There are some apples and pears in a box.
The total number of apples and pears is 54.
The ratio of the number of apples to the number of pears is 1 : 5
b) Work out the number of pears in the box.

6) A piece of string is 180 cm long.
Jim cuts it into three pieces in the ratio 2 : 3 : 4
Work out the length of the longest piece.

7) Sally is 13 years old.
Tammy is 12 years old.
Danny is 10 years old.

Sally, Tammy and Danny share £28 in the ratio of their ages.
Tammy gives a third of her share to her mother.
How much should Tammy now have?

Sharing Using Ratio

1) Tom and Julie share £48 in the ratio 5 : 3
Work out how much more money Tom gets than Julie gets. £12

2) Ben and Sue share £60 in the ratio 2 : 3
Work out how much each person gets. Ben gets £24 and Sue gets £36

3) A box contains milk chocolates and plain chocolates only.
The number of milk chocolates to the number of plain chocolates is in the ratio 2 : 1
There are 24 milk chocolates.
Work out the total number of chocolates. 36 chocolates altogether

4) Andy, Ben and Claire share £54
Ben gets three times as much money as Andy.
Claire gets twice as much money as Ben.

How much money does Claire get? £32.40

5) There are some marbles in a bag.
18 of the marbles are blue.
12 of the marbles are red.
a) Write down the ratio of the number of blue marbles to the number of red marbles.
Give your ratio in its simplest form. 3 : 2

There are some apples and pears in a box.
The total number of apples and pears is 54.
The ratio of the number of apples to the number of pears is 1 : 5
b) Work out the number of pears in the box. 45 pears

6) A piece of string is 180 cm long.
Jim cuts it into three pieces in the ratio 2 : 3 : 4
Work out the length of the longest piece. 80 cm

7) Sally is 13 years old.
Tammy is 12 years old.
Danny is 10 years old.

Sally, Tammy and Danny share £28 in the ratio of their ages.
Tammy gives a third of her share to her mother.
How much should Tammy now have? £6.40

Ratios, Fractions and Graphs

1) In a box of chocolates, the ratio of plain chocolates to milk chocolates is 2 : 5.

   a) What fraction of the chocolates are plain ones?

   b) What fraction of the chocolates are milk ones?

2) If the ratio of $x : y$ is 3 : 7, which of the following statements are correct?

   a) x is $\frac{3}{7}$ of $(x + y)$

   b) x is $\frac{3}{10}$ of $(x + y)$

   c) y is $\frac{7}{10}$ of x

   d) y is $\frac{7}{10}$ of $(x + y)$

3) Pounds can be converted to kilograms using the ratio 11 : 5.

   a) Use the squares, below, to draw a conversion graph to illustrate this.

   b) Convert 24 pounds to kilograms.

   c) Convert 14 kilograms to pounds.

Ratios, Fractions and Graphs

1) In a box of chocolates, the ratio of plain chocolates to milk chocolates is 2 : 5.

   a) What fraction of the chocolates are plain ones? $\frac{2}{7}$

   b) What fraction of the chocolates are milk ones? $\frac{5}{7}$

2) If the ratio of $x : y$ is 3 : 7, which of the following statements are correct? b and d

   a) x is $\frac{3}{7}$ of $(x + y)$

   b) x is $\frac{3}{10}$ of $(x + y)$

   c) y is $\frac{7}{10}$ of x

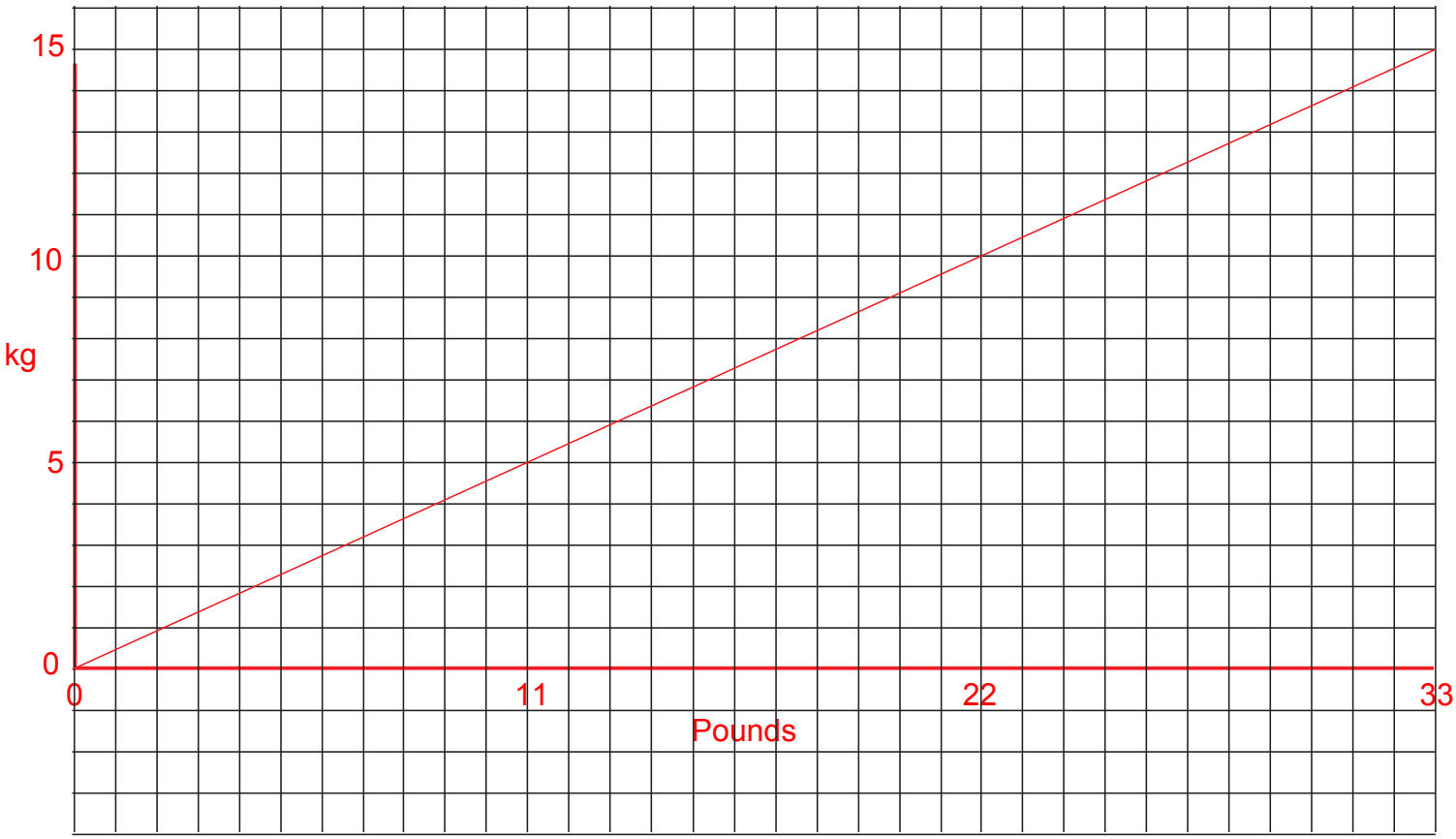
   d) y is $\frac{7}{10}$ of $(x + y)$

3) Pounds can be converted to kilograms using the ratio 11 : 5.

   a) Use the squares, below, to draw a conversion graph to illustrate this.

   b) Convert 24 pounds to kilograms. 11 kg

   c) Convert 14 kilograms to pounds. 30.8 lb



Increase/Decrease by a Percentage

1) Increase:
   a) 500 by 10%
   b) 320 by 10%
   c) 80 by 15%
   d) 75 by 20%

2) Decrease:
   a) 400 by 10%
   b) 380 by 10%
   c) 140 by 15%
   d) 35 by 20%

3) The price of a laptop is increased by 15%.
   The old price of the laptop was £300.
   Work out the new price.

4) The price of a £6800 car is reduced by 10%.
   What is the new price?

5) Increase:
   a) 65 by 12%
   b) 120 by 23%
   c) 600 by 17.5%
   d) 370 by 17.5%

6) Decrease:
   a) 42 by 15%
   b) 79 by 12%
   c) 52 by 8.5%
   d) 8900 by 18%

7) The price of a mobile phone is £78.40 plus VAT.
   VAT is charged at a rate of 17.5%.
   What is the total price of the mobile phone?

8) In a sale, normal prices are reduced by 7%.
   The normal price of a camera is £89.
   Work out the sale price of the camera.

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
   Peter intends to buy a car which usually costs £6800.
   He intends to pay by cash.
   Work out how much he will pay.

10) A month ago, John weighed 97.5 kg.
    He now weighs 4.5% more.
    Work out how much John now weighs.
    Give your answer to 1 decimal place.

Increase/Decrease by a Percentage

1) Increase:

a) 500 by 10%
550

b) 320 by 10%
352

c) 80 by 15%
92

d) 75 by 20%
90

2) Decrease:

a) 400 by 10%
360

b) 380 by 10%
342

c) 140 by 15%
119

d) 35 by 20%
28

3) The price of a laptop is increased by 15%.
The old price of the laptop was £300.
Work out the new price. £345

4) The price of a £6800 car is reduced by 10%.
What is the new price? £6120

5) Increase:

a) 65 by 12% 72.8

b) 120 by 23% 147.6

c) 600 by 17.5% 705

d) 370 by 17.5% 434.75

6) Decrease:

a) 42 by 15% 35.7

b) 79 by 12% 69.52

c) 52 by 8.5% 47.58

d) 8900 by 18% 7 298

7) The price of a mobile phone is £78.40 plus VAT.
VAT is charged at a rate of 17.5%.
What is the total price of the mobile phone? £92.12

8) In a sale, normal prices are reduced by 7%.
The normal price of a camera is £89.
Work out the sale price of the camera. £82.77

9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
Peter intends to buy a car which usually costs £6800.
He intends to pay by cash.
Work out how much he will pay. £5440

10) A month ago, John weighed 97.5 kg.
He now weighs 4.5% more.
Work out how much John now weighs. 101.9 kg
Give your answer to 1 decimal place.

Simple Interest

1) Meg has £1200 in her savings account.
The account pays 5% simple interest per year.

How much interest will she earn in 4 years?

2) Dan has £4000 in his savings account.
This account pays 2% interest per year.

How much interest will he earn in 6 years?

3) Chris borrows £6000 at a simple interest rate of 10% per year.
He pays the money back after 4 years.

How much does he pay back in total?

4) Lisa borrows £3000 at a simple interest rate of 2.5% per year.
She pays the money back after 3 years.

How much does she pay back in total?

5) Kate borrows £2000 at a simple interest rate of 16% per year.
She pays the money back after 3 months.

How much does she pay back in total?

6) Neil invested £8000 in a savings account for 2 years.
He earned £640 simple interest over the two years.

What was the interest rate?

Simple Interest

1) Meg has £1200 in her savings account.
The account pays 5% simple interest per year.

How much interest will she earn in 4 years?

£240

2) Dan has £4000 in his savings account.
This account pays 2% interest per year.

How much interest will he earn in 6 years?

£480

3) Chris borrows £6000 at a simple interest rate of 10% per year.
He pays the money back after 4 years.

How much does he pay back in total?

£8400

4) Lisa borrows £3000 at a simple interest rate of 2.5% per year.
She pays the money back after 3 years.

How much does she pay back in total?

£3225

5) Kate borrows £2000 at a simple interest rate of 16% per year.
She pays the money back after 3 months.

How much does she pay back in total?

£2080

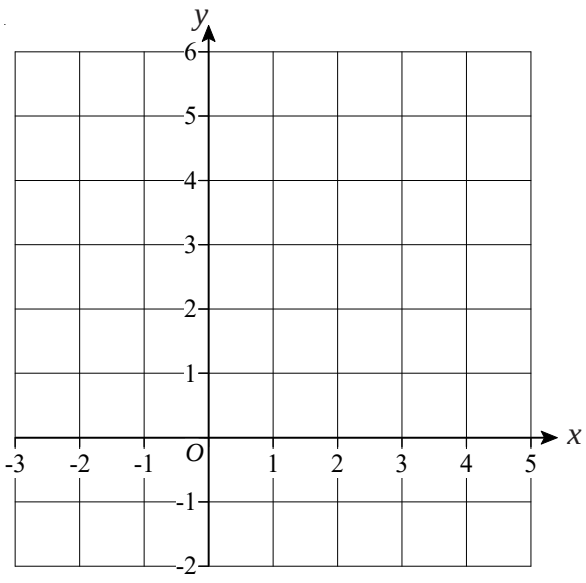
6) Neil invested £8000 in a savings account for 2 years.
He earned £640 simple interest over the two years.

What was the interest rate?

4%

Midpoint of a Line on a Graph

1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and *B* has coordinates (4, -1).



2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and *B* has coordinates (8, 6).

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and *B* has coordinates (2, 4).

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and *B* has coordinates (7, 5).

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and *B* has coordinates (7, 4).

6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and *B* has coordinates (-2, -1).

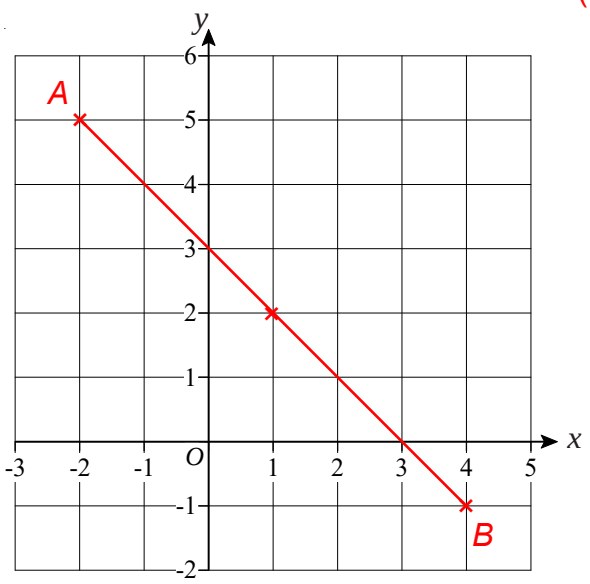
7) The midpoint of *A* and *B* is at (1, 3).
The coordinates of *A* are (-2, 4).
Work out the coordinates of *B*.

8) The midpoint of *A* and *B* is at (3.5, 2.5).
The coordinates of *A* are (2, 5).
Work out the coordinates of *B*.

Midpoint of a Line on a Graph

1) Find the midpoint of *A* and *B* where *A* has coordinates (-2, 5) and *B* has coordinates (4, -1).

(1, 2)



2) Find the midpoint of *A* and *B* where *A* has coordinates (2, 0) and *B* has coordinates (8, 6). (5, 3)

3) Find the midpoint of *A* and *B* where *A* has coordinates (-4, -2) and *B* has coordinates (2, 4). (-1, 1)

4) Find the midpoint of *A* and *B* where *A* has coordinates (-3, -2) and *B* has coordinates (7, 5). (2, 1.5)

5) Find the midpoint of *A* and *B* where *A* has coordinates (2, -5) and *B* has coordinates (7, 4). (4.5, -0.5)

6) Find the midpoint of *A* and *B* where *A* has coordinates (-7, -4) and *B* has coordinates (-2, -1). (-4.5, -2.5)

7) The midpoint of *A* and *B* is at (1, 3).
The coordinates of *A* are (-2, 4).
Work out the coordinates of *B*. (4, 2)

8) The midpoint of *A* and *B* is at (3.5, 2.5).
The coordinates of *A* are (2, 5).
Work out the coordinates of *B*. (5, 0)

Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x + 3)$

b) $3(2x + 4)$

c) $5(3p – 2q)$

d) $4(x^2 + 2y^2)$

e) $6(r – r^2)$

2) Expand these brackets

a) $x(x – 2)$

b) $x(3x + 5)$

c) $p(3p – 7q)$

d) $y(y + 6y^2)$

e) $x(r + r^2)$

3) Expand these brackets

a) $2x(x – 5)$

b) $4x(2x + 3)$

c) $5p(4p – 2q)$

d) $2y(3y + 4x^2)$

e) $x(x + r^2)$

4) Expand these brackets

a) $x(x^2 – 2)$

b) $3x(2x^3 + 1)$

c) $5p^2(4p – 2)$

d) $2y^2(3y^3 + 4y)$

e) $2xy(x + y^2)$

5) Expand and simplify

a) $2(x + y) + 3(x + y)$

b) $3(2x + y) + 2(5x + 3y)$

c) $5(x + y) + 3(2x + y)$

d) $3(2c + d) + 2(c + d)$

e) $4(2p + q) + 3(2p + q)$

6) Expand and simplify

a) $2(x + y) + 3(x – y)$

b) $5(2x + y) + 2(3x – 2y)$

c) $4(x – y) + 3(2x + y)$

d) $6(2c – d) + 2(c – d)$

e) $2(5p – q) + 3(p – 2q)$

7) Expand and simplify

a) $3(x + 2y) – 3(x – y)$

b) $5(2x – y) – 2(3x – 2y)$

c) $7(x – 2y) – 3(2x + y)$

d) $6(2x – y) – 2(x + 2y)$

e) $2(5p – q) – (p – 3q)$

Expanding and Simplifying Brackets

1) Expand these brackets

a) $2(x + 3)$ $2x + 6$

b) $3(2x + 4)$ $6x + 12$

c) $5(3p - 2q)$ $15p - 10q$

d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

e) $6(r - r^2)$ $6r - 6r^2$

2) Expand these brackets

a) $x(x - 2)$ $x^2 - 2x$

b) $x(3x + 5)$ $3x^2 + 5x$

c) $p(3p - 7q)$ $3p^2 - 7pq$

d) $y(y + 6y^2)$ $y^2 + 6y^3$

e) $x(r + r^2)$ $xr + xr^2$

3) Expand these brackets

a) $2x(x - 5)$ $2x^2 - 10x$

b) $4x(2x + 3)$ $8x^2 + 12x$

c) $5p(4p - 2q)$ $20p^2 - 10pq$

d) $2y(3y + 4x^2)$ $6y^2 + 8x^2y$

e) $x(x + r^2)$ $x^2 + r^2x$

4) Expand these brackets

a) $x(x^2 - 2)$ $x^3 - 2x$

b) $3x(2x^3 + 1)$ $6x^4 + 3x$

c) $5p^2(4p - 2)$ $20p^3 - 10p^2$

d) $2y^2(3y^3 + 4y)$ $6y^5 + 8y^3$

e) $2xy(x + y^2)$ $2x^2y + 2xy^3$

5) Expand and simplify

a) $2(x + y) + 3(x + y)$ $5x + 5y$

b) $3(2x + y) + 2(5x + 3y)$ $16x + 9y$

c) $5(x + y) + 3(2x + y)$ $11x + 8y$

d) $3(2c + d) + 2(c + d)$ $8c + 5d$

e) $4(2p + q) + 3(2p + q)$ $14p + 7q$

6) Expand and simplify

a) $2(x + y) + 3(x - y)$ $5x - y$

b) $5(2x + y) + 2(3x - 2y)$ $16x + y$

c) $4(x - y) + 3(2x + y)$ $10x - y$

d) $6(2c - d) + 2(c - d)$ $14c - 8d$

e) $2(5p - q) + 3(p - 2q)$ $13p - 8q$

7) Expand and simplify

a) $3(x + 2y) - 3(x - y)$ $9y$

b) $5(2x - y) - 2(3x - 2y)$ $4x - y$

c) $7(x - 2y) - 3(2x + y)$ $x - 17y$

d) $6(2x - y) - 2(x + 2y)$ $10x - 10y$

e) $2(5p - q) - (p - 3q)$ $9p + q$

Expanding and Simplifying Brackets

1) Expand and simplify

a) $(x + 3)(x + 2)$

b) $(x + 5)(x + 3)$

c) $(x + 1)(x + 4)$

d) $(x + 6)(x + 4)$

e) $(x + 5)(x + 7)$

2) Expand and simplify

a) $(x + 5)(x – 2)$

b) $(x – 7)(x + 2)$

c) $(x – 1)(x + 3)$

d) $(x + 4)(x – 3)$

e) $(x – 5)(x + 5)$

3) Expand and simplify

a) $(x – 3)(x – 4)$

b) $(x – 2)(x – 6)$

c) $(x – 1)(x – 1)$

d) $(x – 7)(x – 2)$

e) $(x – 4)(x – 5)$

4) Expand and simplify

a) $(x – 7)(x + 1)$

b) $(p – 6)(p + 4)$

c) $(e – 3)(e – 7)$

d) $(x + 8)(x + 1)$

e) $(x – 5)(x – 5)$

5) Expand and simplify

a) $(2x + 3)(2x + 1)$

b) $(3p – 4)(2p + 5)$

c) $(e – 3)(3e – 4)$

d) $(4x – 6)(2x + 1)$

e) $(2x – 3)(2x + 3)$

6) Expand and simplify

a) $(2x + y)(3x + 2y)$

b) $(3p – 2q)(4p + 5q)$

c) $(4e – 3f)(2e – 2f)$

d) $(6x – y)(6x + y)$

e) $(3x – 2y)(x – 5y)$

Expanding and Simplifying Brackets

1) Expand and simplify

a) $(x + 3)(x + 2)$ $x^2 + 5x + 6$

b) $(x + 5)(x + 3)$ $x^2 + 8x + 15$

c) $(x + 1)(x + 4)$ $x^2 + 5x + 4$

d) $(x + 6)(x + 4)$ $x^2 + 10x + 24$

e) $(x + 5)(x + 7)$ $x^2 + 12x + 35$

2) Expand and simplify

a) $(x + 5)(x - 2)$ $x^2 + 3x - 10$

b) $(x - 7)(x + 2)$ $x^2 - 5x - 14$

c) $(x - 1)(x + 3)$ $x^2 + 2x - 3$

d) $(x + 4)(x - 3)$ $x^2 + x - 12$

e) $(x - 5)(x + 5)$ $x^2 - 25$

3) Expand and simplify

a) $(x - 3)(x - 4)$ $x^2 - 7x + 12$

b) $(x - 2)(x - 6)$ $x^2 - 8x + 12$

c) $(x - 1)(x - 1)$ $x^2 - 2x + 1$

d) $(x - 7)(x - 2)$ $x^2 - 9x + 14$

e) $(x - 4)(x - 5)$ $x^2 - 9x + 20$

4) Expand and simplify

a) $(x - 7)(x + 1)$ $x^2 - 6x - 7$

b) $(p - 6)(p + 4)$ $p^2 - 2p - 24$

c) $(e - 3)(e - 7)$ $e^2 - 10e + 21$

d) $(x + 8)(x + 1)$ $x^2 + 9x + 8$

e) $(x - 5)(x - 5)$ $x^2 - 10x + 25$

5) Expand and simplify

a) $(2x + 3)(2x + 1)$ $4x^2 + 8x + 3$

b) $(3p - 4)(2p + 5)$ $6p^2 + 7p - 20$

c) $(e - 3)(3e - 4)$ $3e^2 - 13e + 12$

d) $(4x - 6)(2x + 1)$ $8x^2 - 8x - 6$

e) $(2x - 3)(2x + 3)$ $4x^2 - 9$

6) Expand and simplify

a) $(2x + y)(3x + 2y)$ $6x^2 + 7xy + 2y^2$

b) $(3p - 2q)(4p + 5q)$ $12p^2 + 7pq - 10q^2$

c) $(4e - 3f)(2e - 2f)$ $8e^2 - 14ef + 6f^2$

d) $(6x - y)(6x + y)$ $36x^2 - y^2$

e) $(3x - 2y)(x - 5y)$ $3x^2 - 17xy + 10y^2$

Solving Equations

1) Solve $2x - 3 = 17$

2) Solve $3x + 2 = 14$

3) Solve $5x - 7 = 33$

4) Solve $4x + 7 = 19$

5) Solve $x + x + x + x = 20$

6) Solve $x + 3x = 24$

7) Solve $2(x + 3) = 8$

8) Solve $2(3x - 4) = 22$

9) Solve $5(t - 1) = 20$

10) Solve $3(2x + 5) = 36$

11) Solve $2x + 7 = x + 11$

12) Solve $5y - 2 = 3y + 10$

13) Solve $2x + 1 = 5x - 20$

14) Solve $p - 3 = 3p - 11$

15) Solve $2d + 5 = 20 - 3d$

16) Solve $4 - e = 2e - 8$

17) Solve $2(x + 3) = x + 9$

18) Solve $x - 7 = 3(2x - 4)$

19) Solve $5(x + 3) = 2(x + 6)$

20) Solve $4(2y + 1) = 2(12 - y)$

21) Solve $7 - 3x = 2(x + 1)$

22) Solve $\frac{x}{2} = 5$

23) Solve $\frac{x}{5} = 6$

24) Solve $\frac{2x}{3} = 4$

25) Solve $\frac{5x}{2} = 15$

26) Solve $\frac{x - 2}{3} = 1$

27) Solve $\frac{x + 5}{2} = 7$

28) Solve $\frac{2x + 1}{4} = 2$

29) Solve $\frac{5x - 3}{3} = 4$

30) Solve $\frac{x + 2}{3} = x + 4$

31) Solve $\frac{3x - 1}{4} = 2x - 3$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$

Solving Equations

1) Solve $2x - 3 = 17$
$x = 10$

2) Solve $3x + 2 = 14$
$x = 4$

3) Solve $5x - 7 = 33$
$x = 8$

4) Solve $4x + 7 = 19$
$x = 3$

5) Solve $x + x + x + x = 20$
$x = 5$

6) Solve $x + 3x = 24$
$x = 6$

7) Solve $2(x + 3) = 8$
$x = 1$

8) Solve $2(3x - 4) = 22$
$x = 5$

9) Solve $5(t - 1) = 20$
$t = 5$

10) Solve $3(2x + 5) = 36$
$x = 3.5$

11) Solve $2x + 7 = x + 11$
$x = 4$

12) Solve $5y - 2 = 3y + 10$
$y = 6$

13) Solve $2x + 1 = 5x - 20$
$x = 7$

14) Solve $p - 3 = 3p - 11$
$p = 4$

15) Solve $2d + 5 = 20 - 3d$
$d = 3$

16) Solve $4 - e = 2e - 8$
$e = 4$

17) Solve $2(x + 3) = x + 9$
$x = 3$

18) Solve $x - 7 = 3(2x - 4)$
$x = 1$

19) Solve $5(x + 3) = 2(x + 6)$
$x = -1$

20) Solve $4(2y + 1) = 2(12 - y)$
$y = 2$

21) Solve $7 - 3x = 2(x + 1)$
$x = 1$

22) Solve $\frac{x}{2} = 5$
$x = 10$

23) Solve $\frac{x}{5} = 6$
$x = 30$

24) Solve $\frac{2x}{3} = 4$
$x = 6$

25) Solve $\frac{5x}{2} = 15$
$x = 6$

26) Solve $\frac{x - 2}{3} = 1$
$x = 5$

27) Solve $\frac{x + 5}{2} = 7$
$x = 9$

28) Solve $\frac{2x + 1}{4} = 2$
$x = 3.5$

29) Solve $\frac{5x - 3}{3} = 4$
$x = 3$

30) Solve $\frac{x + 2}{3} = x + 4$
$x = -5$

31) Solve $\frac{3x - 1}{4} = 2x - 3$
$x = 2.2$

32) Solve $\frac{4x + 3}{5} = \frac{2x - 1}{2}$
$x = 5.5$

Rearranging Simple Formulae

1) Make c the subject of the formula.

$a = b + cd$

2) Make t the subject of the formula.

$u = v + 2t$

3) Make n the subject of the formula.

$M = 3n + 5$

4) Make z the subject of the formula.

$x = 3y + z$

5) $r = 5s + 3t$

a) Make t the subject of the formula.

b) Make s the subject of the formula.

6) Rearrange $y = 3x + 1$ to make x the subject.

7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject.

8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject.

Rearranging Simple Formulae

1) Make c the subject of the formula.

$a = b + cd$

$c = \frac{a - b}{d}$

2) Make t the subject of the formula.

$u = v + 2t$

$t = \frac{u - v}{2}$

3) Make n the subject of the formula.

$M = 3n + 5$

$n = \frac{M - 5}{3}$

4) Make z the subject of the formula.

$x = 3y + z$

$z = x - 3y$

5) $r = 5s + 3t$

a) Make t the subject of the formula. $t = \frac{r - 5s}{3}$

b) Make s the subject of the formula. $s = \frac{r - 3t}{5}$

6) Rearrange $y = 3x + 1$ to make x the subject.

$x = \frac{y - 1}{3}$

7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject.

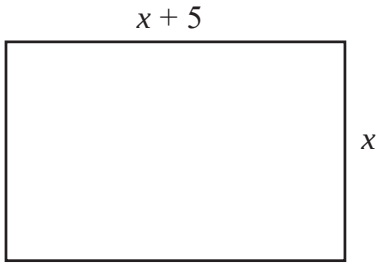
$x = 2(y - 2)$

8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject.

$x = 3(y - 1)$

Forming Formulae and Equations

1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.



a) Find an expression, in terms of x, for the perimeter of the rectangle.
Give your answer in its simplest form.

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle.

2)

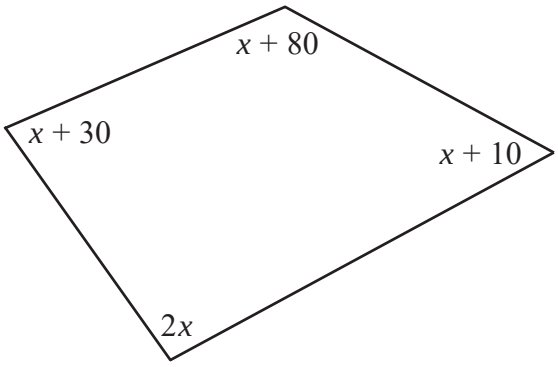


*Diagram **NOT** accurately drawn*

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$

a) Use this information to write down an equation in terms of x.

b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral.

3) Sarah buys 6 cups and 6 mugs

A cup costs £x

A mug costs £$(x + 3)$

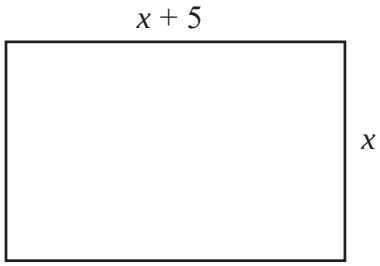
a) Write down an expression, in terms of x, for the total cost, in pounds, of 6 cups and 6 mugs.

b) If the total cost of 6 cups and 6 mugs is £48, write an equation in terms of x.

c) Solve your equation to find the cost of a cup and the cost of a mug.

Forming Formulae and Equations

1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.



a) Find an expression, in terms of x, for the perimeter of the rectangle.
Give your answer in its simplest form. $4x + 10$

The perimeter of the rectangle is 38 centimetres.

b) Work out the length of the rectangle. 12 cm

2)

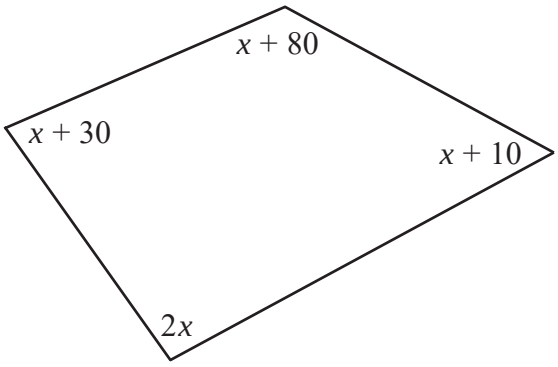


*Diagram **NOT** accurately drawn*

The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
$2x$
$x + 80$
$x + 30$

a) Use this information to write down an equation in terms of x. $5x + 120 = 360$

b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral. 58°

3) Sarah buys 6 cups and 6 mugs
A cup costs £x
A mug costs £$(x + 3)$

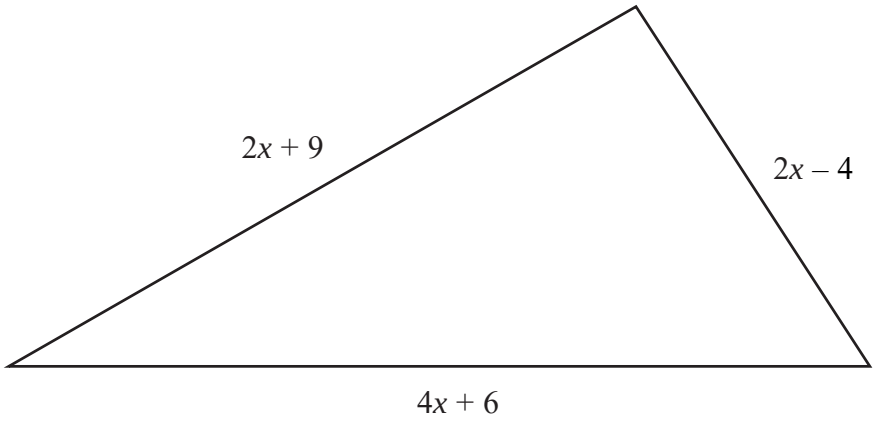
a) Write down an expression, in terms of x, for the total cost, in pounds, of 6 cups and 6 mugs. $12x + 18$

b) If the total cost of 6 cups and 6 mugs is £48, write an equation in terms of x. $12x + 18 = 48$

c) Solve your equation to find the cost of a cup and the cost of a mug.
Cup: £2.50, Mug: £5.50

Forming Formulae and Equations

1)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

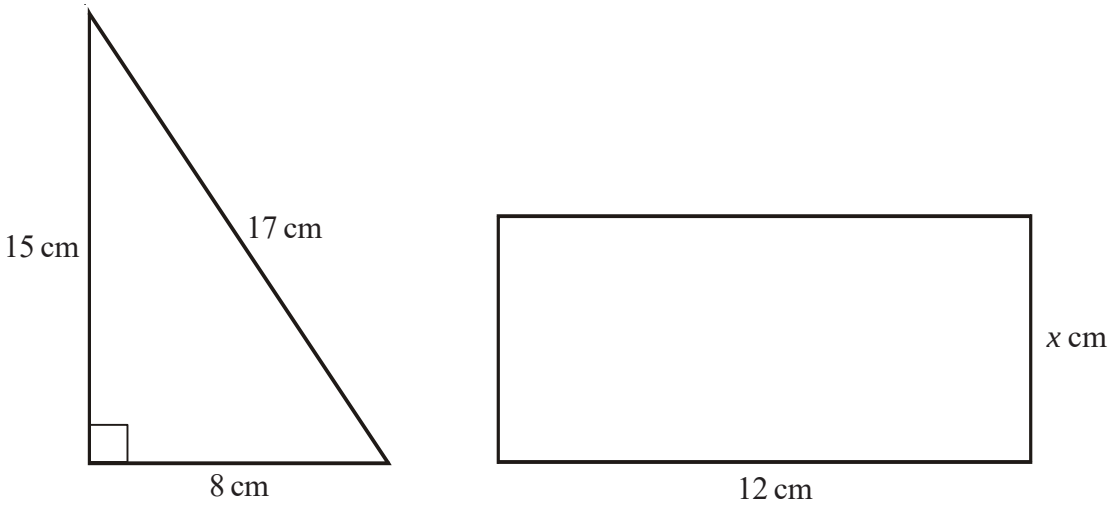
$2x + 9$
$2x - 4$
$4x + 6$

a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form.

The perimeter of the triangle is 39 cm.

b) Find the value of x.

2) The diagram shows a right-angled triangle and a rectangle.

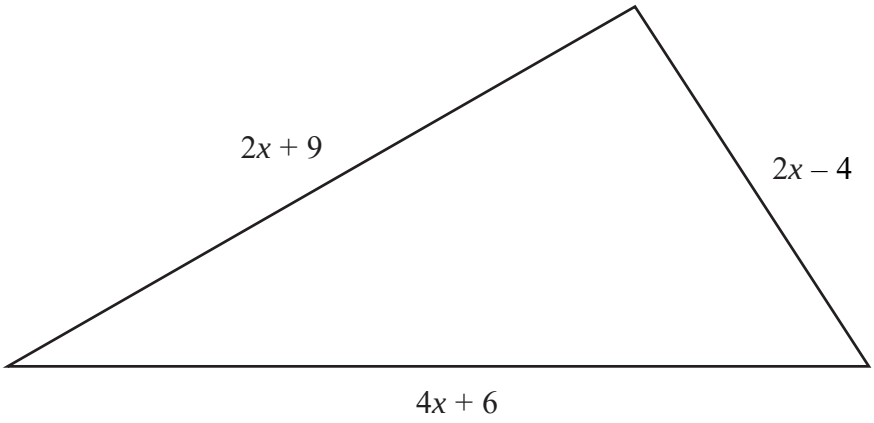


The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x.

Forming Formulae and Equations

1)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

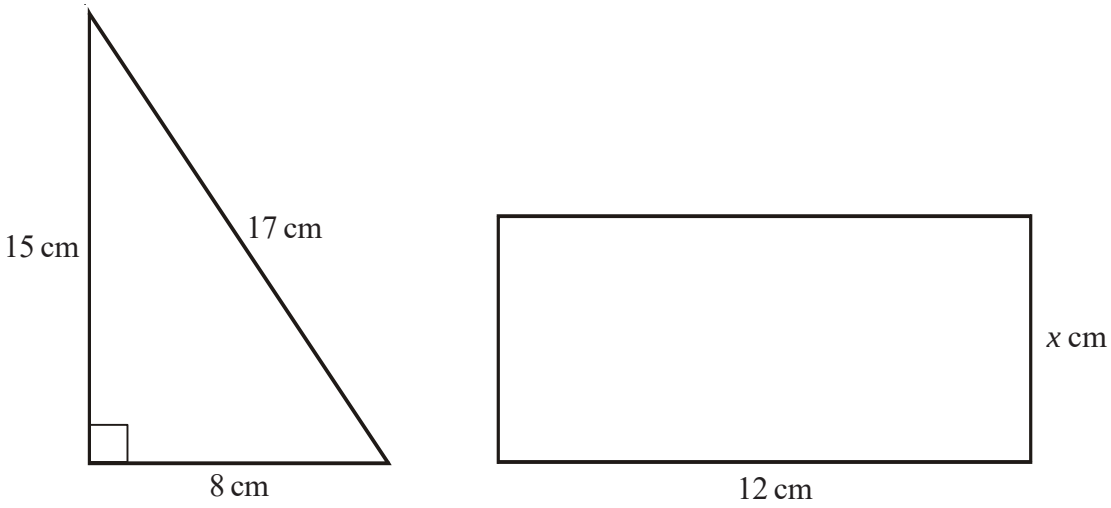
$2x + 9$
$2x - 4$
$4x + 6$

a) Find an expression, in terms of x, for the perimeter of the triangle.
Give your expression in its simplest form. $8x + 11$

The perimeter of the triangle is 39 cm.

b) Find the value of x. 3.5

2) The diagram shows a right-angled triangle and a rectangle.



The area of the right-angled triangle is equal to the area of the rectangle.

Find the value of x. 5

Forming Formulae and Equations

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y.

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

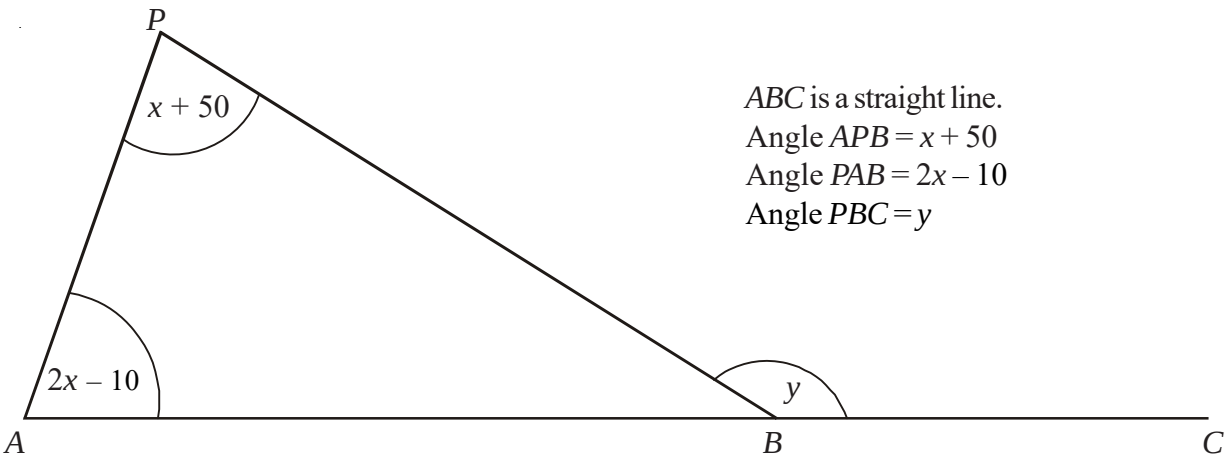
Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b.

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers.

4)



ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$

a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

b) Given that y equals 145 degrees

(i) Work out the value of x.

(ii) Work out the size of the largest angle in triangle APB.

Forming Formulae and Equations

1) A shop sells small boxes and large boxes for storing CDs.

A small box stores x CDs.
A large box stores y CDs.

Emma buys 8 small boxes and 5 large boxes.

Emma can store a total of T CDs in these boxes.

Write down a formula for T in terms of x and y. $T = 8x + 5y$

2) Batteries are sold in packets and boxes.

Each packet contains 4 batteries.
Each box contains 20 batteries.

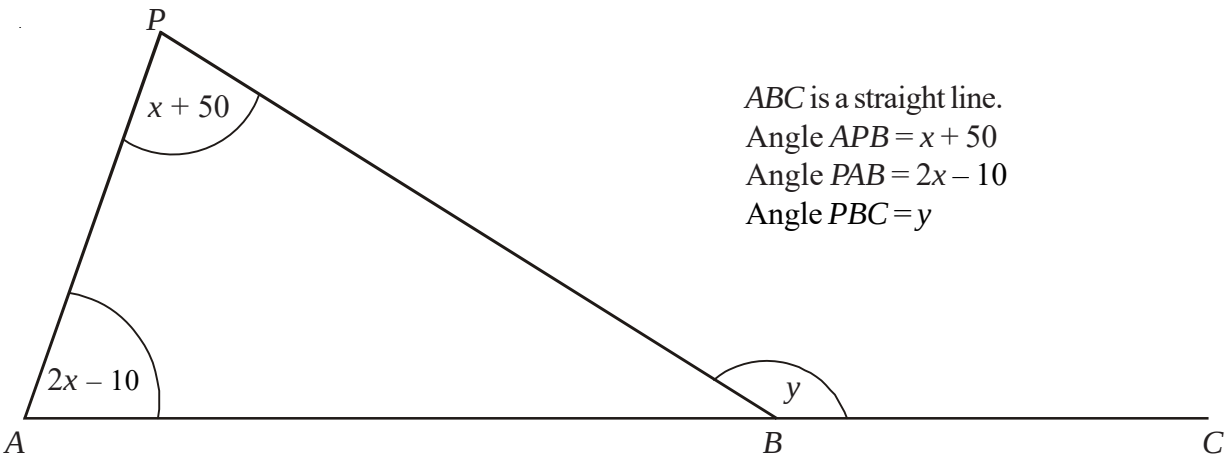
Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

Write down a formula for N in terms of p and b. $N = 4p + 20b$

3) Compasses cost c pence each.
Rulers cost r pence each.

Write down an expression for the total cost, in pence, of 2 compasses and 4 rulers. $2c + 4r$

4)



ABC is a straight line.
Angle $APB = x + 50$
Angle $PAB = 2x - 10$
Angle $PBC = y$

a) Show that $y = 3x + 40$
Give reasons for each stage of your working.

Angle PAB + Angle $APB = 3x + 40$
Angle $PBA = 180 - (3x + 40)$
$= 140 - 3x$
Angle y = 180 – angle PBA
$= 180 - (140 - 3x)$
$= 40 + 3x$
$= 3x + 40$

b) Given that y equals 145 degrees

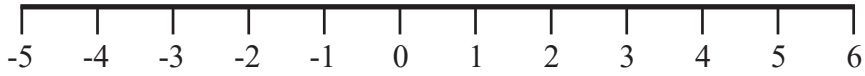
(i) Work out the value of x. $35°$

(ii) Work out the size of the largest angle in triangle APB. $85°$

Inequalities on a Number Line

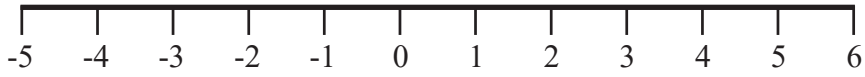
1) Represent this inequality on the number line

$-3 < x \leqslant 2$

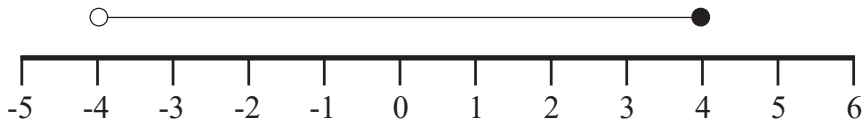


2) Represent this inequality on the number line

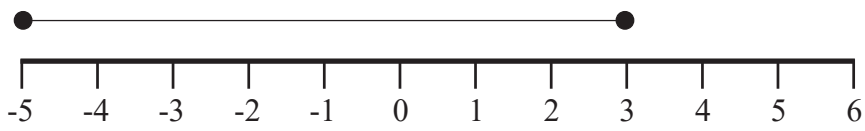
$-1 \leqslant x < 5$



3) Write down the inequality shown



4) Write down the inequality shown



5) If y is an integer, write down all the possible values of

$-2 < y \leqslant 5$

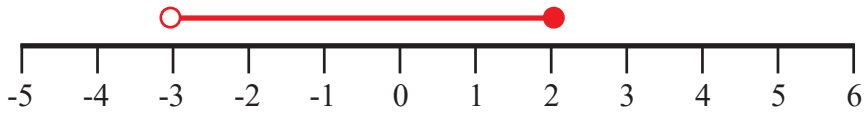
6) If x is an integer, write down all the possible values of

$-9 < x < -5$

Inequalities on a Number Line

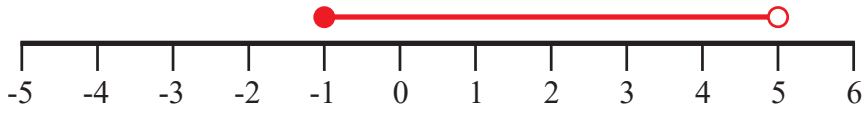
1) Represent this inequality on the number line

$-3 < x \leqslant 2$

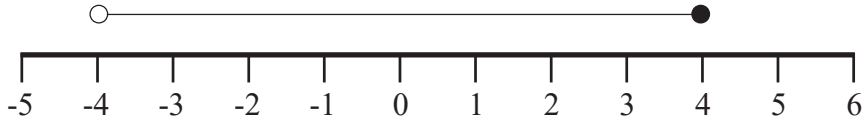


2) Represent this inequality on the number line

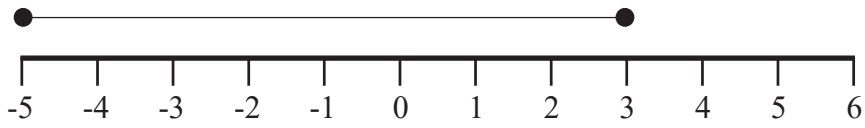
$-1 \leqslant x < 5$



3) Write down the inequality shown $-4 < x \leq 4$



4) Write down the inequality shown $-5 \leq x \leq 3$



5) If y is an integer, write down all the possible values of

$-2 < y \leqslant 5$

-1, 0, 1, 2, 3, 4, 5

6) If x is an integer, write down all the possible values of

$-9 < x < -5$

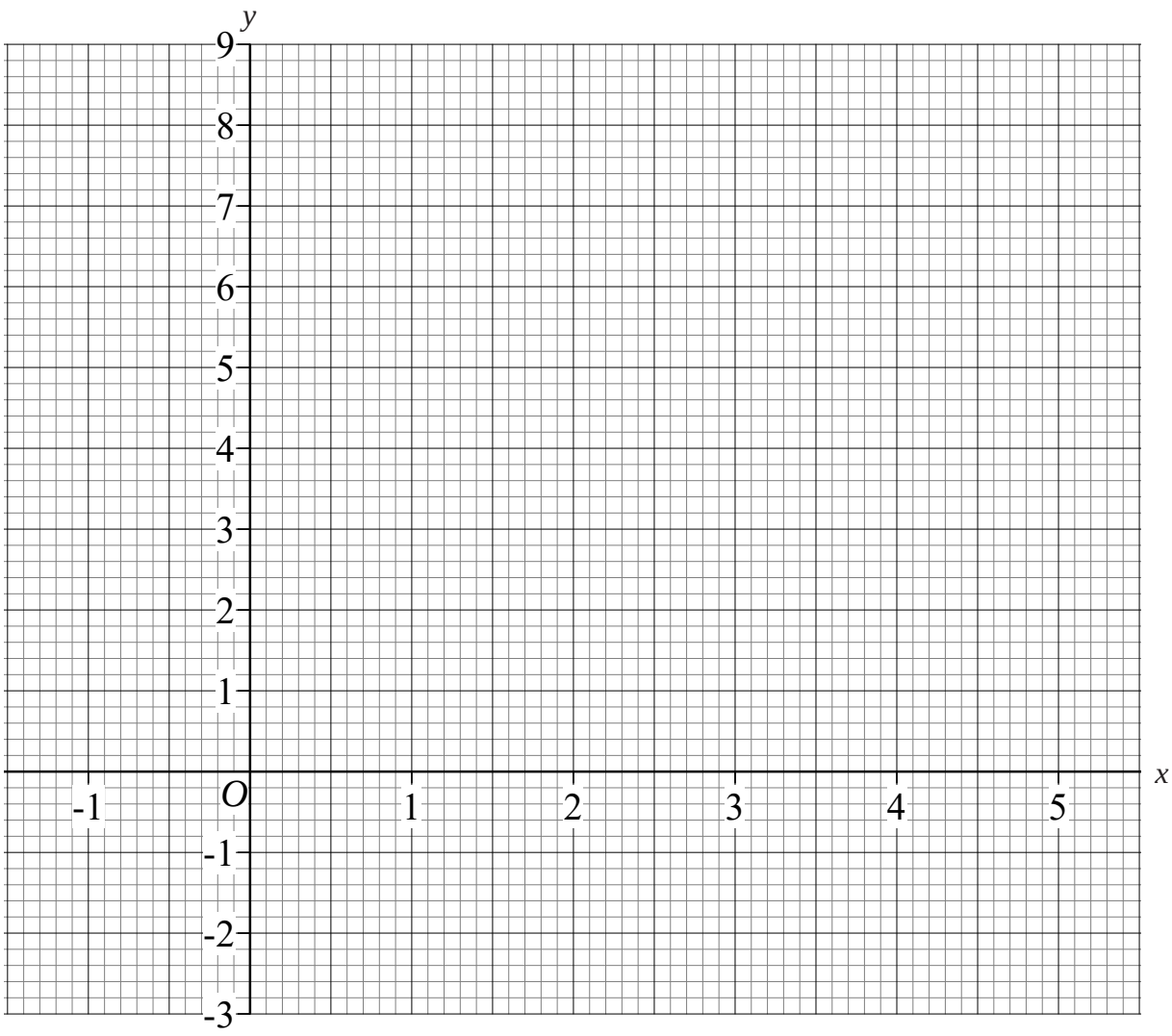
-8, -7, -6

Drawing Quadratic Graphs

1) Complete the table of values for $y = x^2 - 4x + 3$

x	-1	0	1	2	3	4	5
y		3	0		0		8

On the grid, draw the graph of $y = x^2 - 4x + 3$

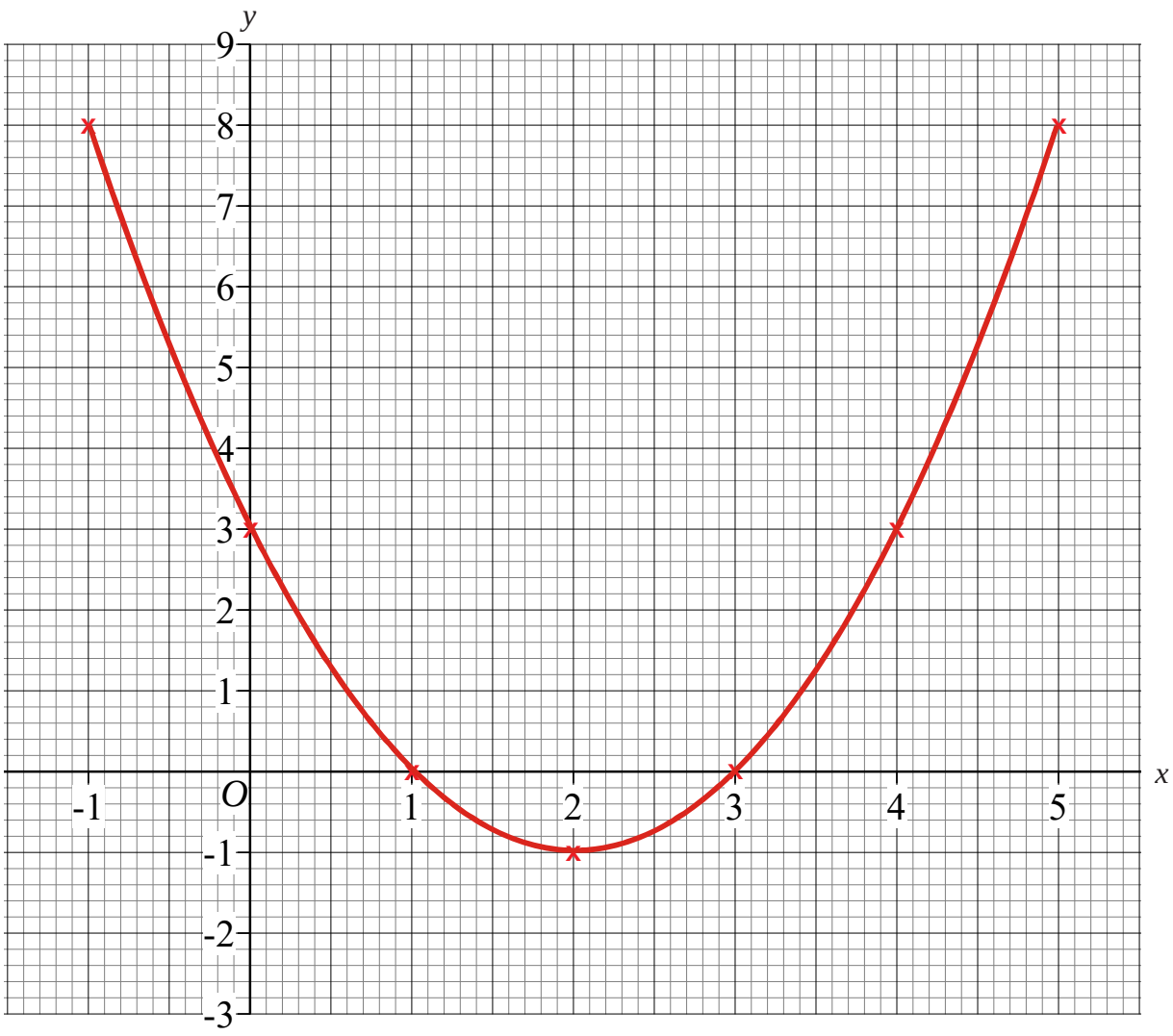


Drawing Quadratic Graphs

1) Complete the table of values for $y = x^2 - 4x + 3$

x	-1	0	1	2	3	4	5
y	8	3	0	-1	0	3	8

On the grid, draw the graph of $y = x^2 - 4x + 3$

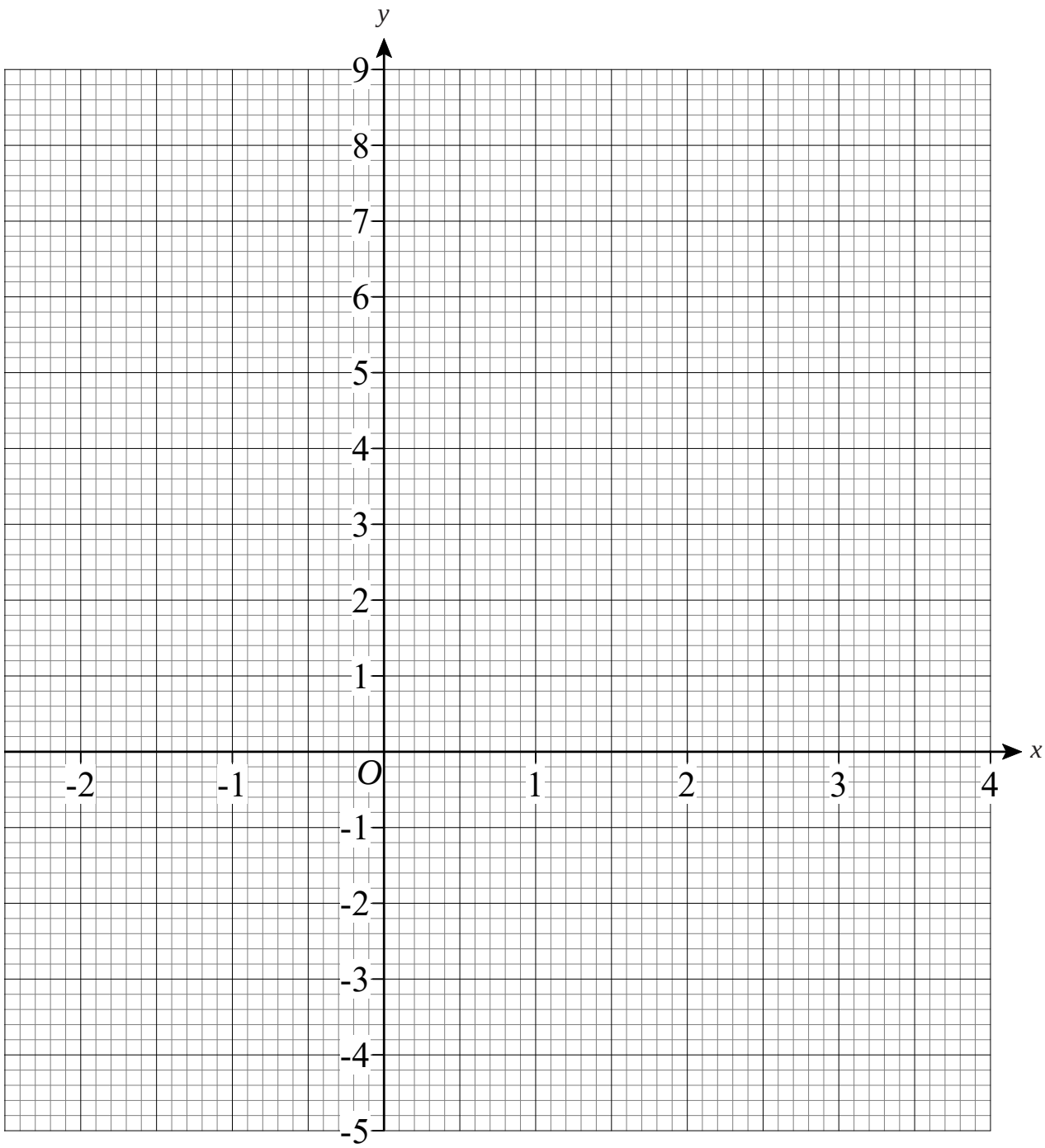


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2	3	4
y		2	-2	-4		-2	

b) On the grid, draw the graph of $y = x^2 - 3x - 2$



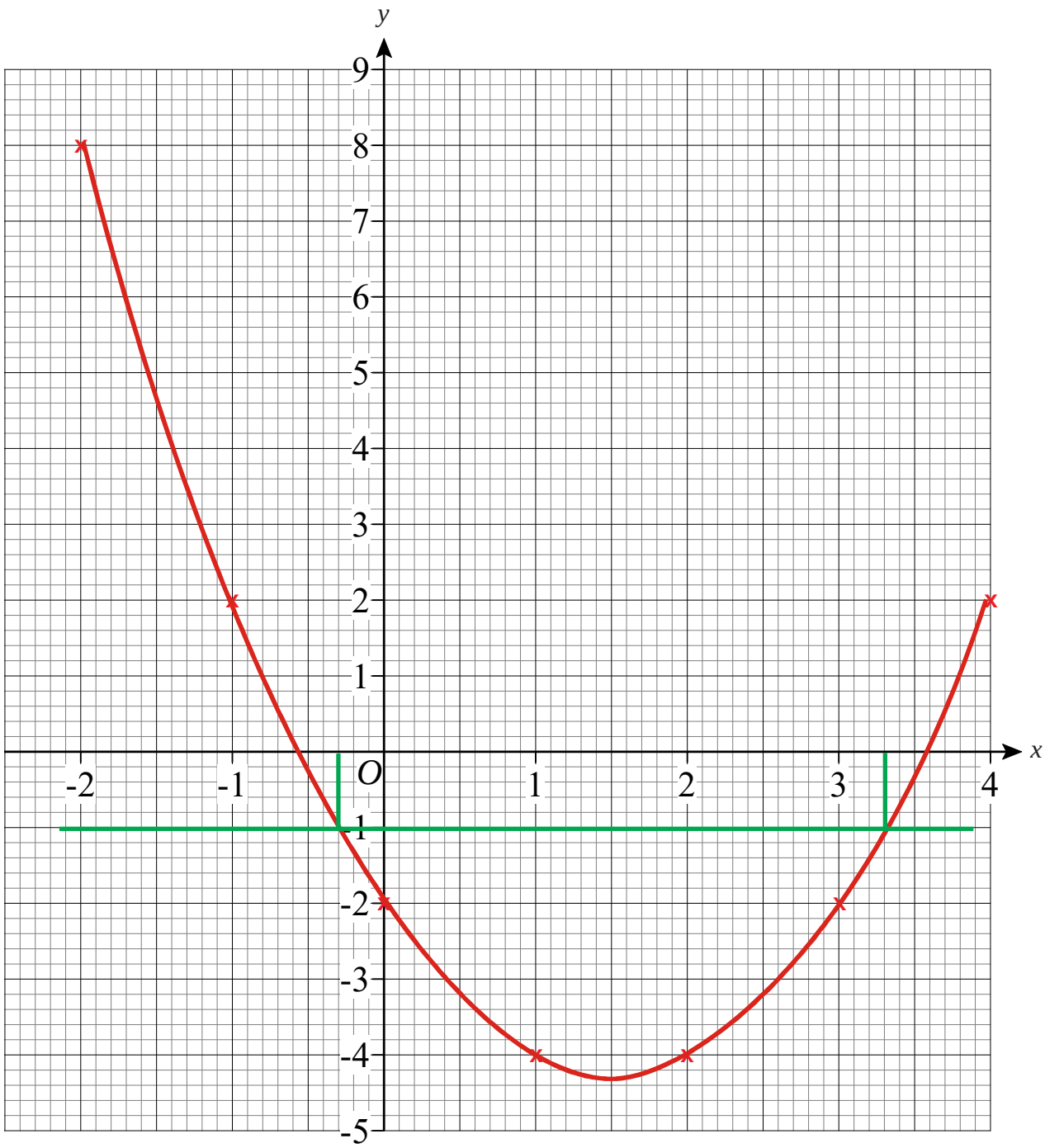
c) Use your graph to estimate the values of x when $y = -1$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 - 3x - 2$

x	-2	-1	0	1	2	3	4
y	8	2	-2	-4	-4	-2	2

b) On the grid, draw the graph of $y = x^2 - 3x - 2$



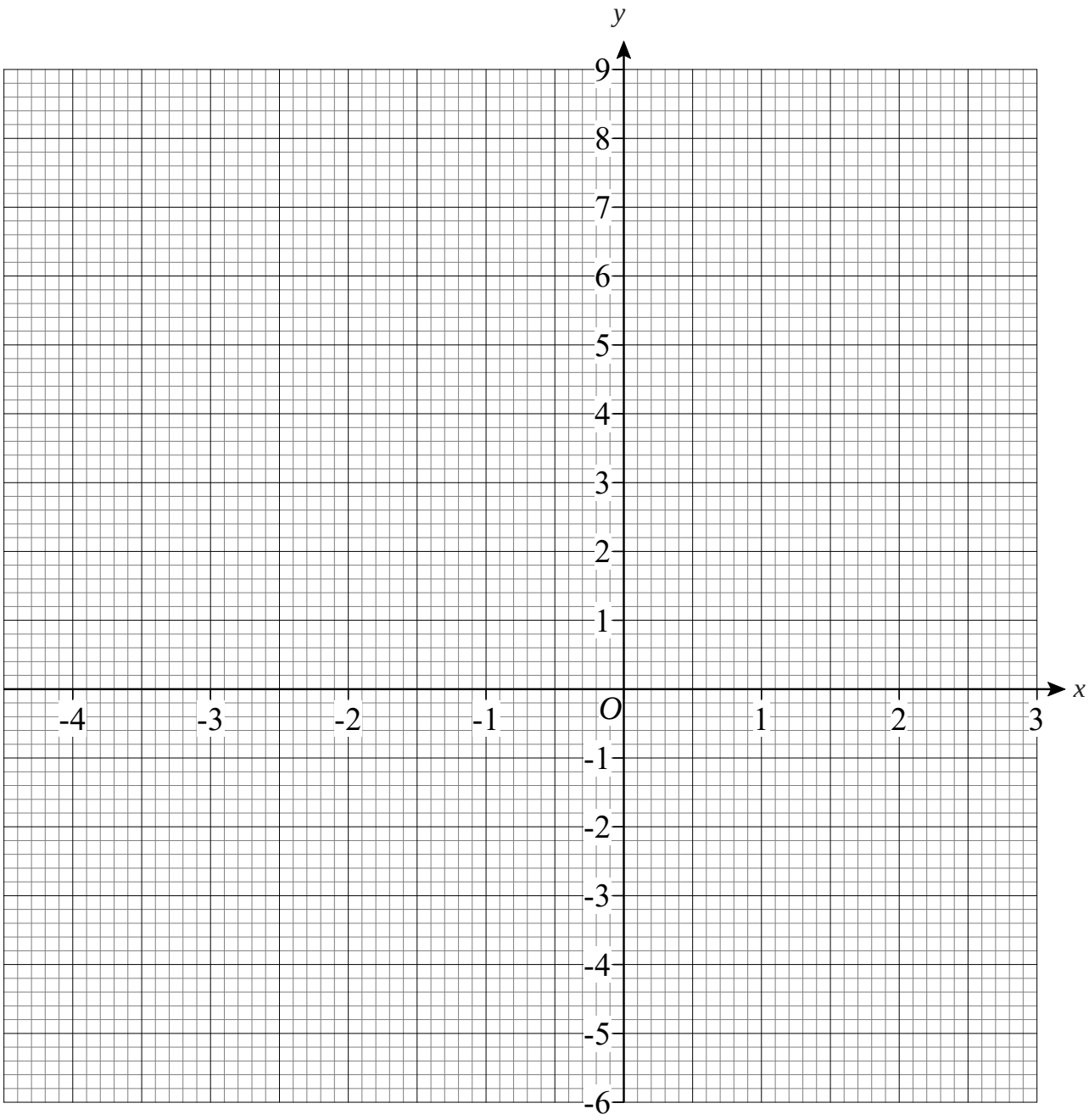
c) Use your graph to estimate the values of x when $y = -1$ $x = -0.3$ and $x = 3.3$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8		-2	-4				8

b) On the grid, draw the graph of $y = x^2 + x - 4$

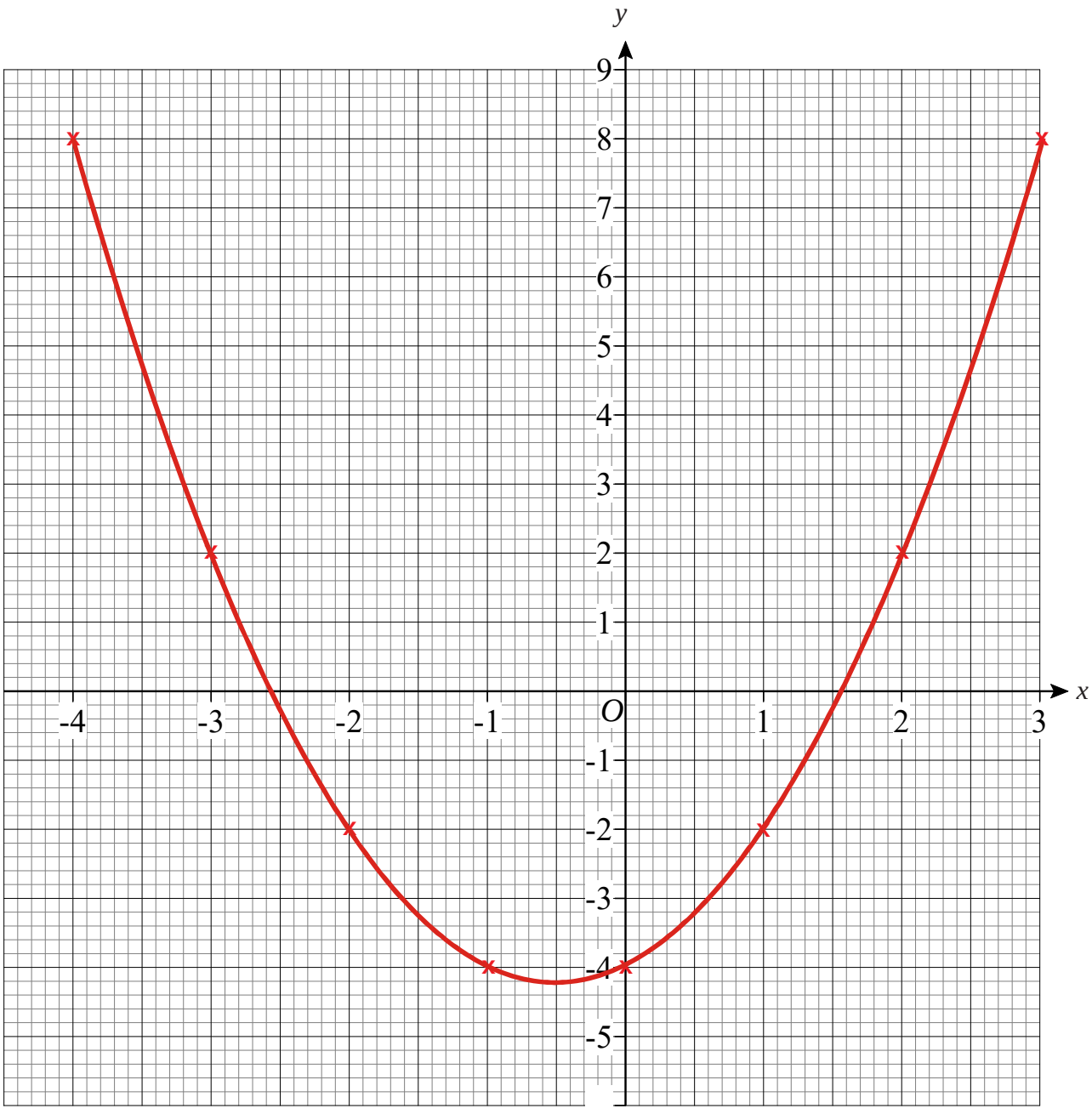


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8	2	-2	-4	-4	-2	2	8

b) On the grid, draw the graph of $y = x^2 + x - 4$

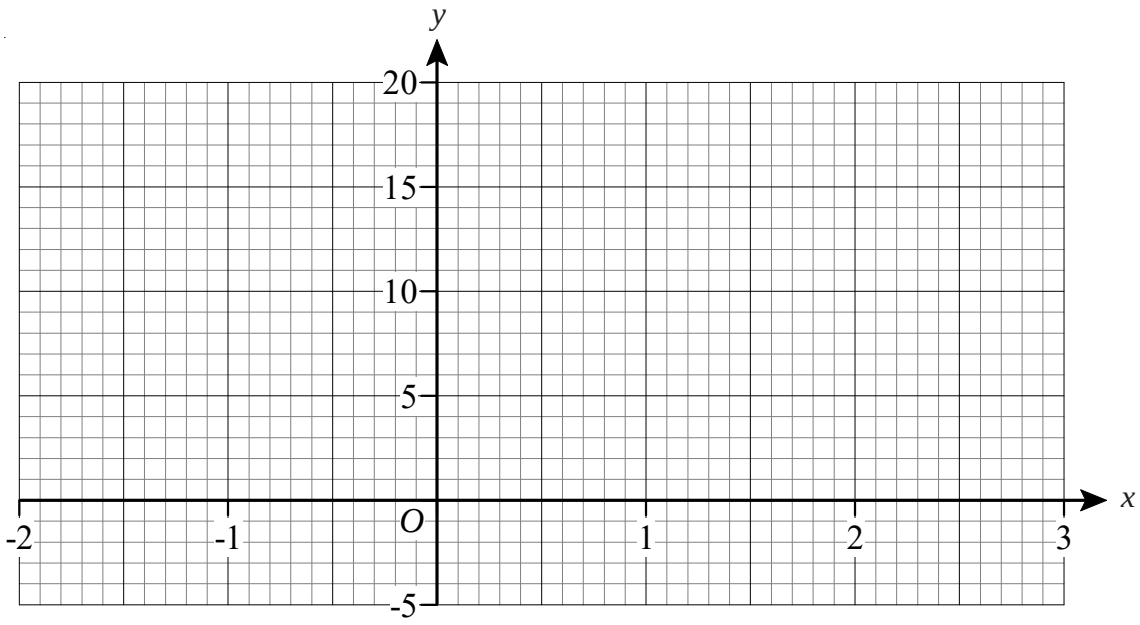


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14		0			9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3



c) Use the graph to find the value of y when $x = -1.5$

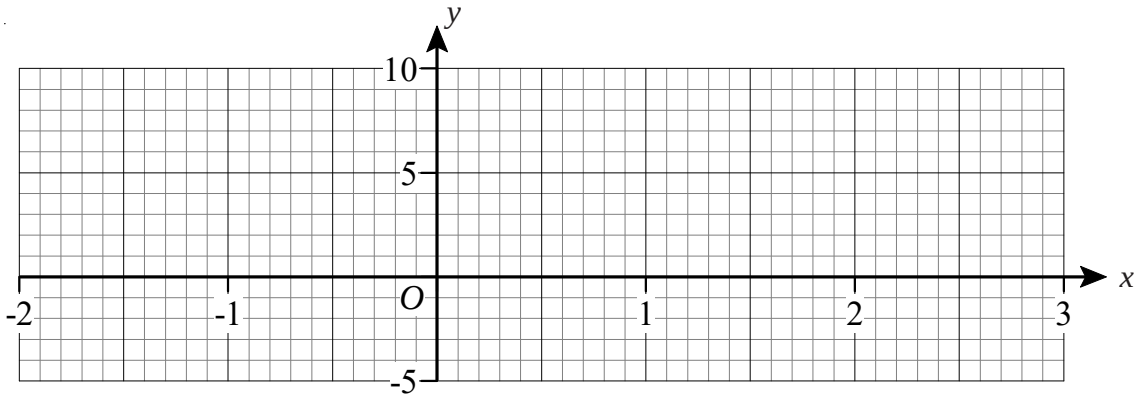
d) Use the graph to find the values of x when $y = 4$

---

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8		0			

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3



c) (i) On the same axes draw the straight line $y = 2.5$

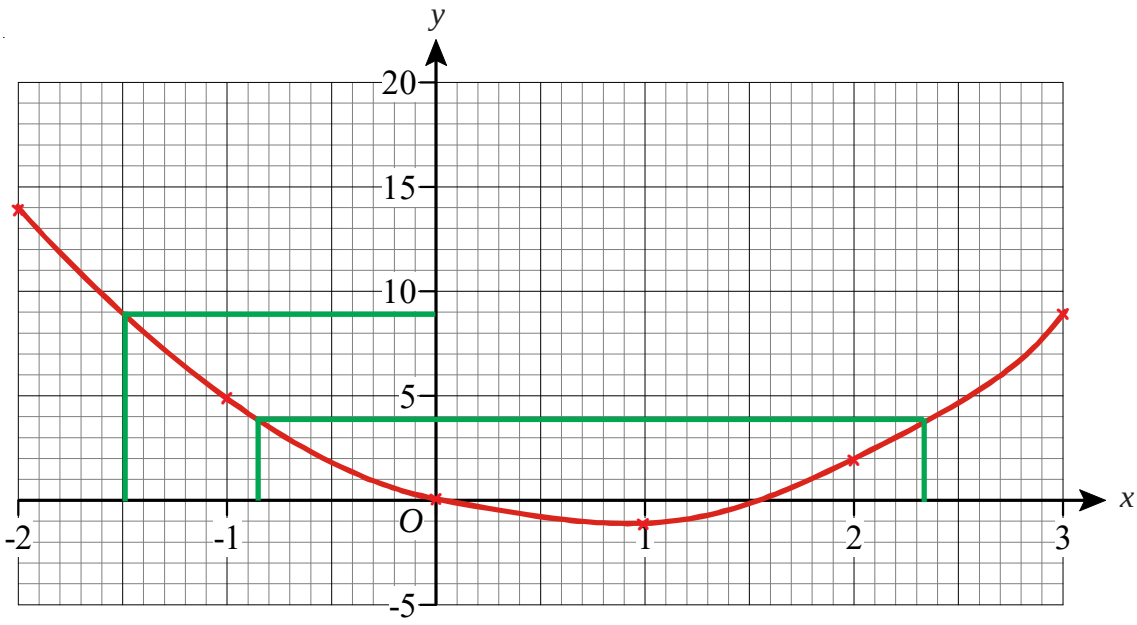
(ii) Write down the values of x for which $x^2 - 2x = 2.5$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14	5	0	-1	2	9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3



c) Use the graph to find the value of y when $x = -1.5$ $y = 9$

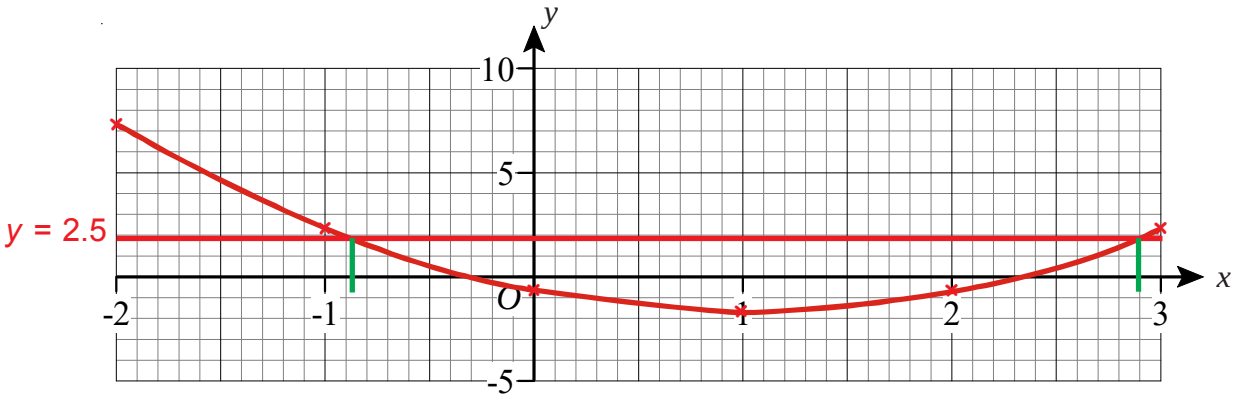
d) Use the graph to find the values of x when $y = 4$ $x = -0.85$ and $x = 2.33$

---

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8	3	0	-1	0	3

b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3

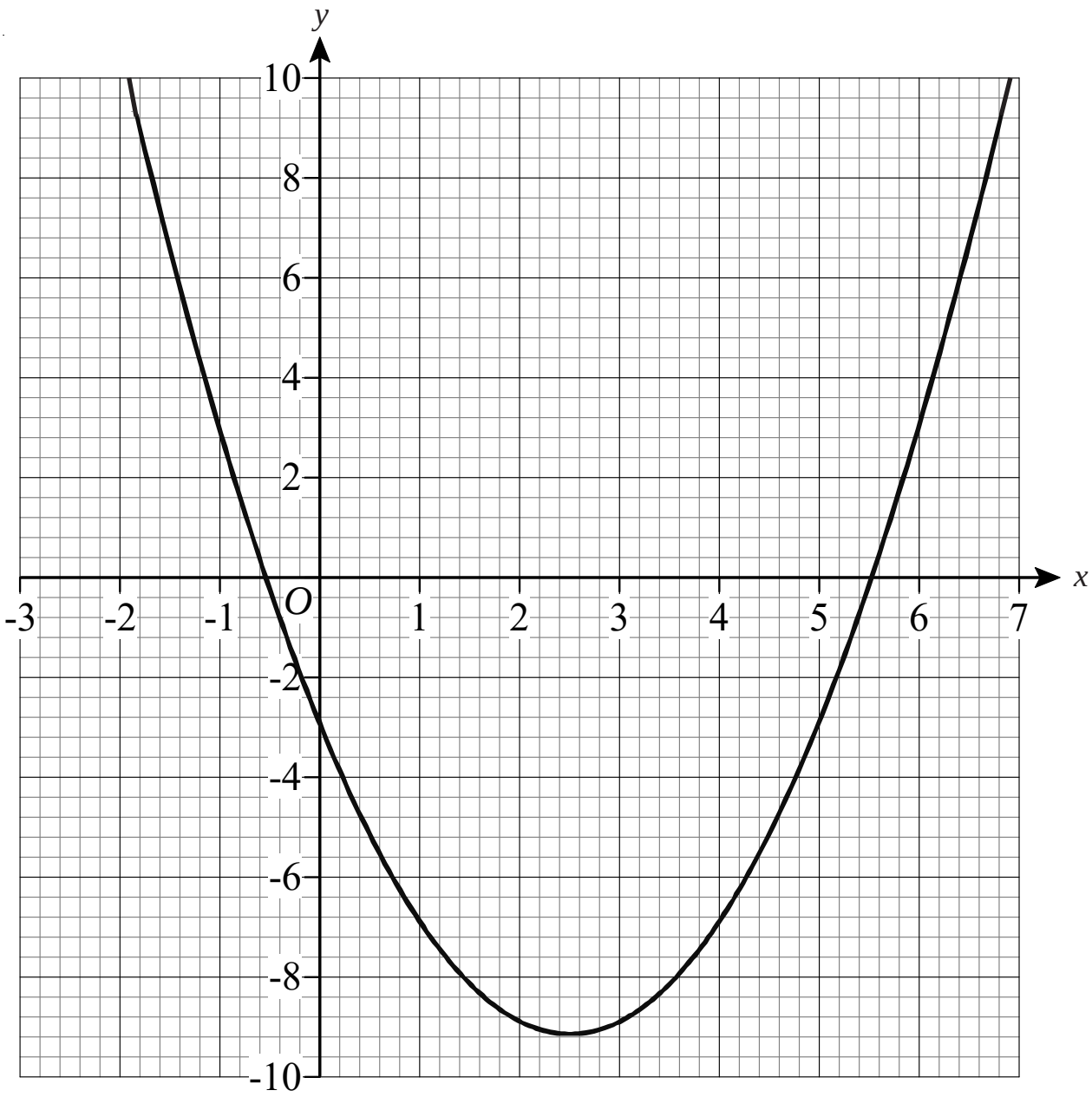


c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$ $x = -0.89$ or $x = 2.9$

Drawing Quadratic Graphs

1) The diagram shows the graph of $y = x^2 - 5x - 3$



a) Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$

(ii) $x^2 - 5x - 3 = 6$

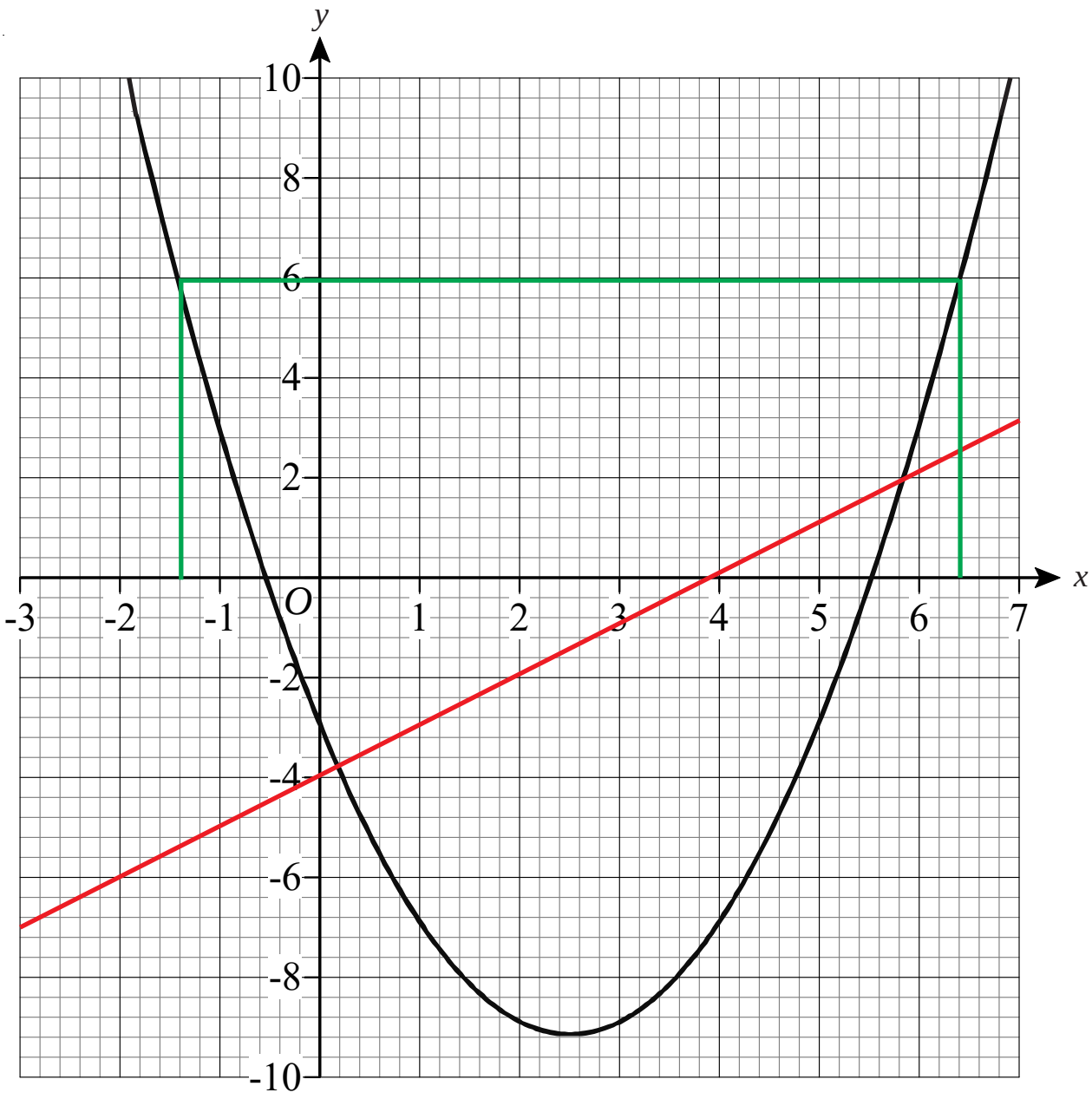
b) Use the graph to find estimates for the solutions of the simultaneous equations

$y = x^2 - 5x - 3$

$y = x - 4$

Drawing Quadratic Graphs

1) The diagram shows the graph of $y = x^2 - 5x - 3$



a) Use the graph to find estimates for the solutions of

(i) $x^2 - 5x - 3 = 0$ $x = -0.5$ and 5.5

(ii) $x^2 - 5x - 3 = 6$ $x = -1.4$ and 6.4

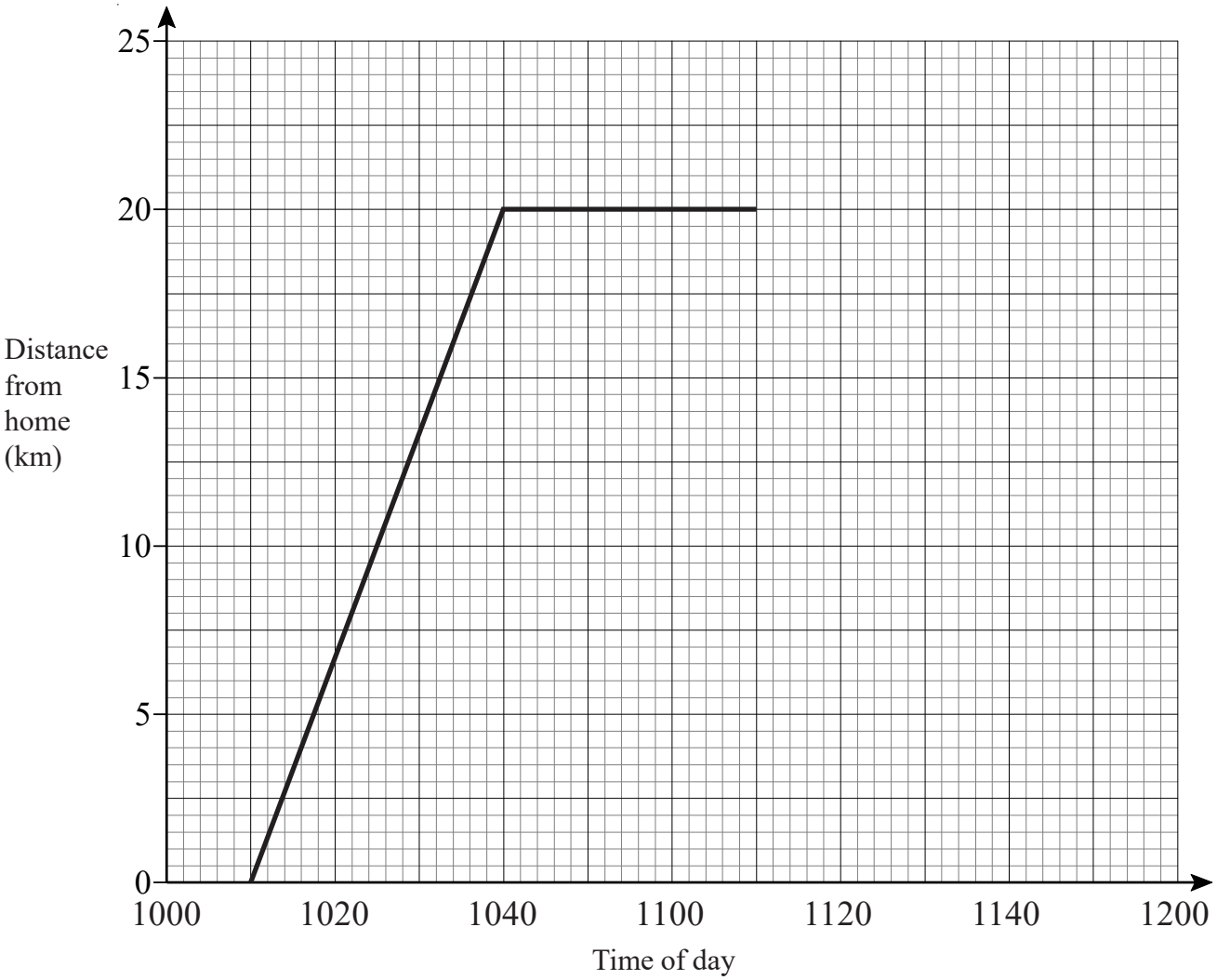
b) Use the graph to find estimates for the solutions of the simultaneous equations

$y = x^2 - 5x - 3$ $x = 0.2$ $x = 5.8$

$y = x - 4$ $y = -3.8$ $y = 1.8$

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home?

b) How far was Sarah from home at 10 30?

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed.
She arrived home at 11 50

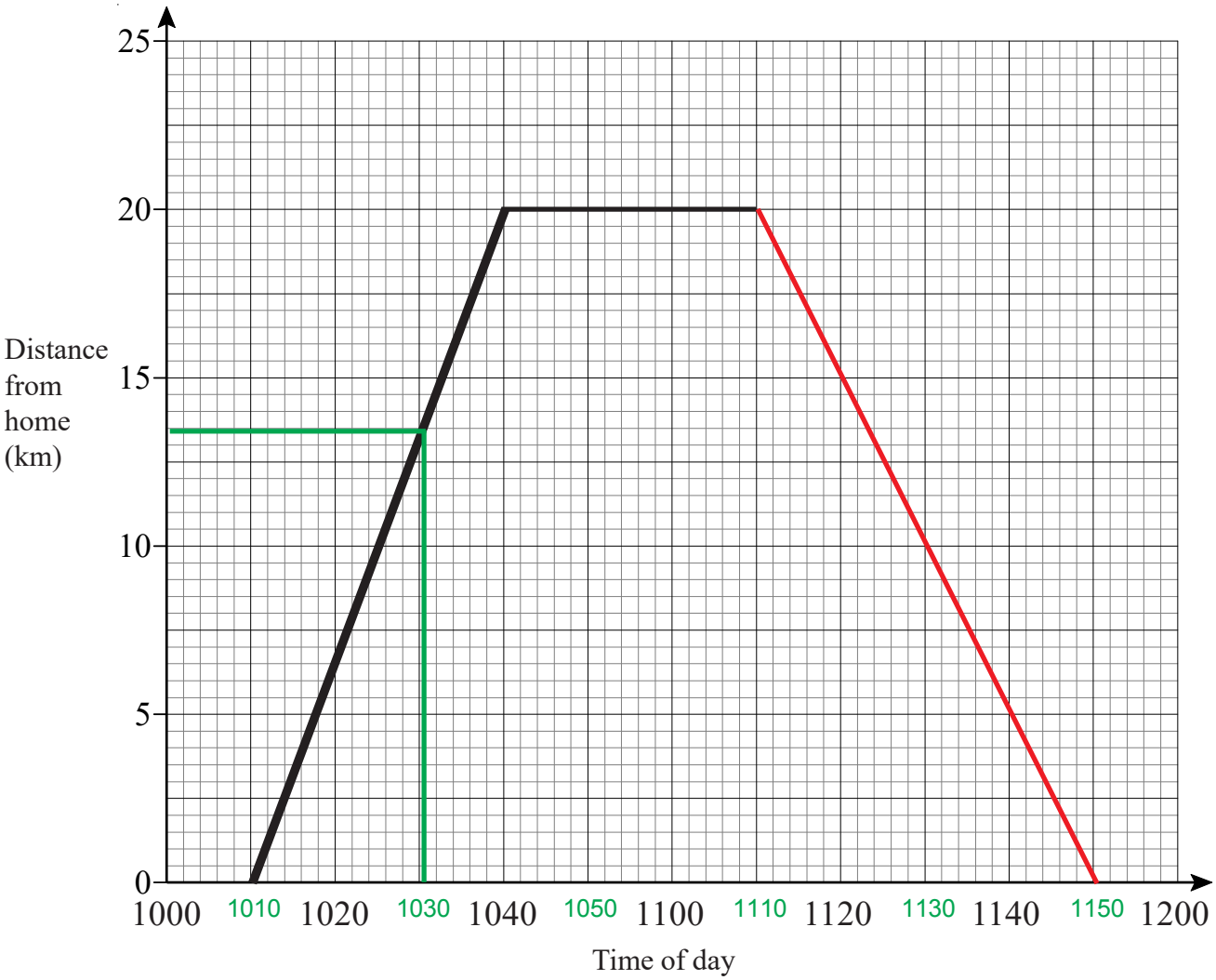
d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour.

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour.

Distance-Time Graphs

1) Sarah travelled 20 km from home to her friend's house.
She stayed at her friend's house for some time before returning home.
Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home? 10 10

b) How far was Sarah from home at 10 30? 13.5 km

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house. 30 minutes

Sarah returned home at a steady speed.
She arrived home at 11 50

d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.
Give your answer in kilometres per hour. 40 km/h

f) Work out Sarah's average speed on her journey home from her friend's house.
Give your answer in kilometres per hour. 30 km/h

Finding the *n*th Term

1) Here are the first five terms of an arithmetic sequence.

1 3 5 7 9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

2) Here are the first five terms of an arithmetic sequence.

6 10 14 18 22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

3) Here are the first five terms of an arithmetic sequence.

1 4 7 10 13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

4) Here are the first five terms of an arithmetic sequence.

7 12 17 22 27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

5) Here are the first five terms of an arithmetic sequence.

8 6 4 2 0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

Finding the *n*th Term

1) Here are the first five terms of an arithmetic sequence.

1 3 5 7 9

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$2n - 1$

2) Here are the first five terms of an arithmetic sequence.

6 10 14 18 22

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$4n + 2$

3) Here are the first five terms of an arithmetic sequence.

1 4 7 10 13

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$3n - 2$

4) Here are the first five terms of an arithmetic sequence.

7 12 17 22 27

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$5n + 2$

5) Here are the first five terms of an arithmetic sequence.

8 6 4 2 0

Find, in terms of *n*, an expression for the *n*th term of this sequence.

$-2n + 10$

The *n*th Term

1) Here are the first four terms of an arithmetic sequence.

4 7 10 13

Find an expression, in terms of n, for the nth term of the sequence.

2) The nth term of a number sequence is $n^2 + 3$
Write down the first three terms of the sequence.

3) Here are the first five terms of an arithmetic sequence.

2 7 12 17 22

a) Find, in terms of n, an expression for the nth term of this sequence.

b) An expression for the nth term of another sequence is $11 - n^2$

(i) Find the third term of this sequence.

(ii) Find the fifth term of this sequence.

4) The nth term of a sequence is $2n^2$

(i) Find the 4th term of the sequence.

(ii) Is the number 400 a term of the sequence?

Give reasons for your answer.

The *n*th Term

1) Here are the first four terms of an arithmetic sequence.

4 7 10 13

Find an expression, in terms of *n*, for the *n*th term of the sequence.

$3n + 1$

2) The *n*th term of a number sequence is $n^2 + 3$
Write down the first three terms of the sequence.

4, 7, 12

3) Here are the first five terms of an arithmetic sequence.

2 7 12 17 22

a) Find, in terms of *n*, an expression for the *n*th term of this sequence. $5n - 3$

b) An expression for the *n*th term of another sequence is $11 - n^2$

(i) Find the third term of this sequence. 2

(ii) Find the fifth term of this sequence. -14

4) The *n*th term of a sequence is $2n^2$

(i) Find the 4th term of the sequence. 32

(ii) Is the number 400 a term of the sequence?

Give reasons for your answer. No, $400 = 2 \times 200$, but 200 is not a square number.

The *n*th Term

1) The *n*th term of a number sequence is given by $4n + 1$

a) Work out the first **two** terms of the number sequence.

Here are the first four terms of another number sequence.

1 4 7 10

b) Find, in terms of *n*, an expression for the *n*th term of this number sequence.

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4			
. . .			
10			

a) Complete Line Number 4 of the pattern.

b) Complete Line Number 10 of the pattern.

c) Use the number pattern to find the answer to $999^2 + 1001^2$

The *n*th Term

1) The *n*th term of a number sequence is given by $4n + 1$

a) Work out the first **two** terms of the number sequence.

5, 9

Here are the first four terms of another number sequence.

1 4 7 10

b) Find, in terms of *n*, an expression for the *n*th term of this number sequence.

$3n - 2$

2) Here is a number pattern.

Line Number			
1	$1^2 + 3^2$	$2 \times 2^2 + 2$	10
2	$2^2 + 4^2$	$2 \times 3^2 + 2$	20
3	$3^2 + 5^2$	$2 \times 4^2 + 2$	34
4	$4^2 + 6^2$	$2 \times 5^2 + 2$	52
. . .			
10	$10^2 + 12^2$	$2 \times 11^2 + 2$	244

a) Complete Line Number 4 of the pattern.

b) Complete Line Number 10 of the pattern.

c) Use the number pattern to find the answer to $999^2 + 1001^2$ 2000002

Drawing a Triangle Using Compasses

1) The diagram shows a sketch of triangle *ABC*.

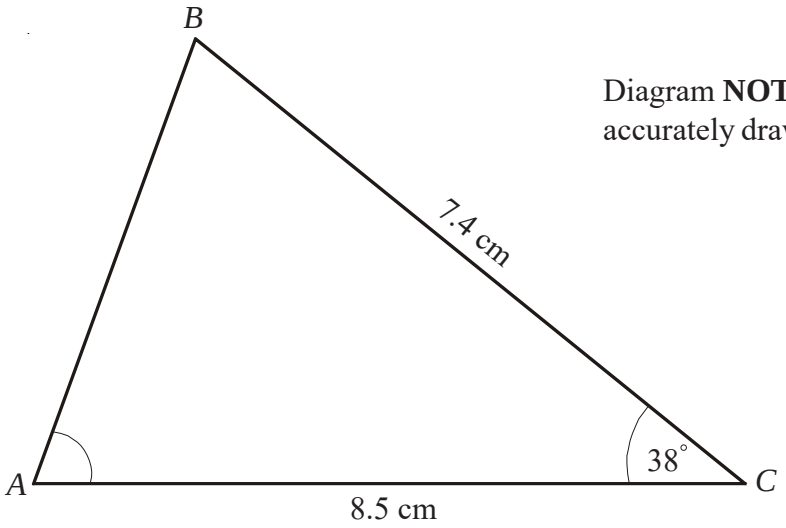


Diagram **NOT** accurately drawn

BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram.

2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

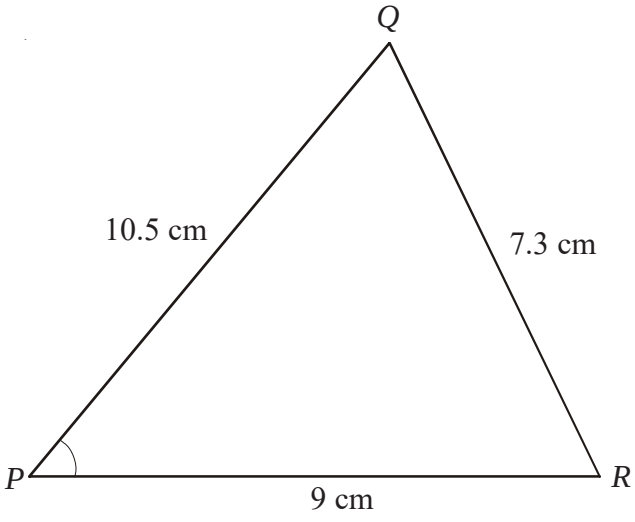


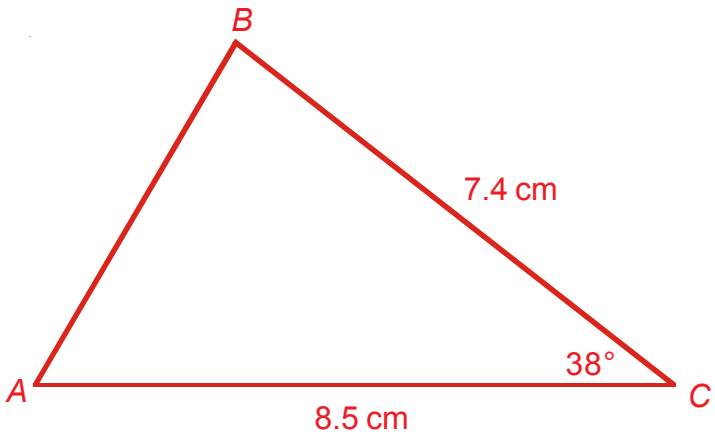
Diagram **NOT** accurately drawn

a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.

Drawing a Triangle Using Compasses

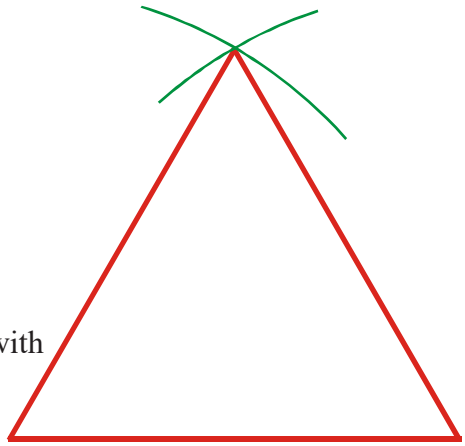
1) The diagram shows a sketch of triangle *ABC*.



BC = 7.4 cm
AC = 8.5 cm
Angle *C* = 38°

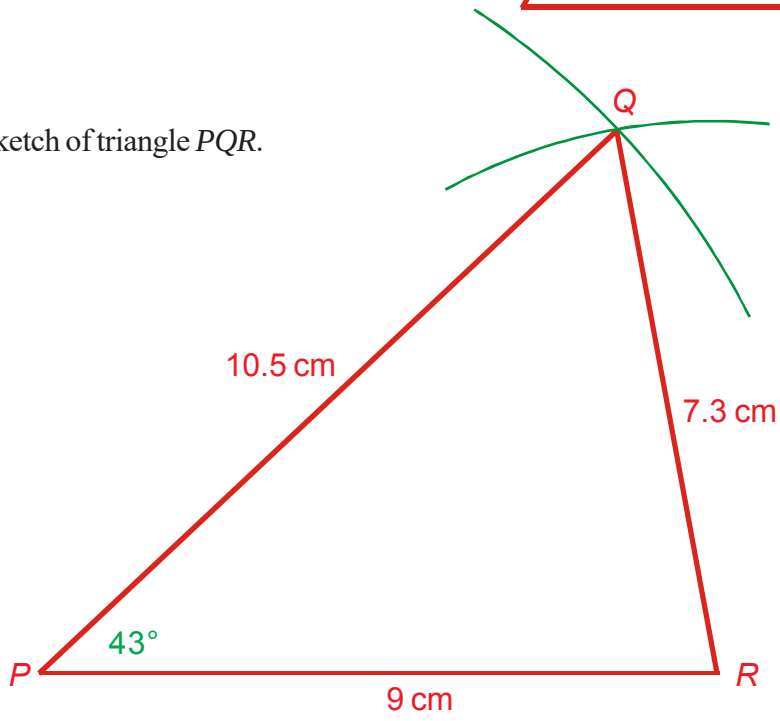
a) Make an accurate drawing of triangle *ABC*.

b) Measure the size of angle *A* on your diagram. Angle A = 59°



2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
You must show all construction lines.

3) The diagram shows a sketch of triangle *PQR*.

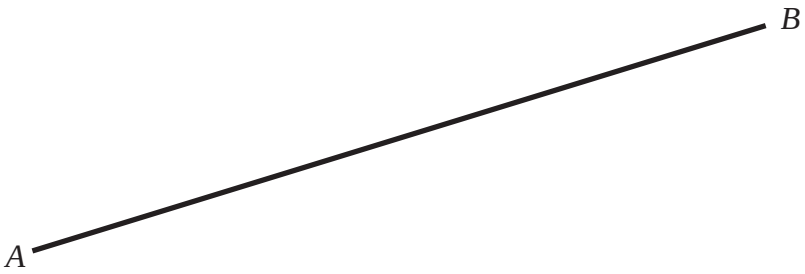


a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

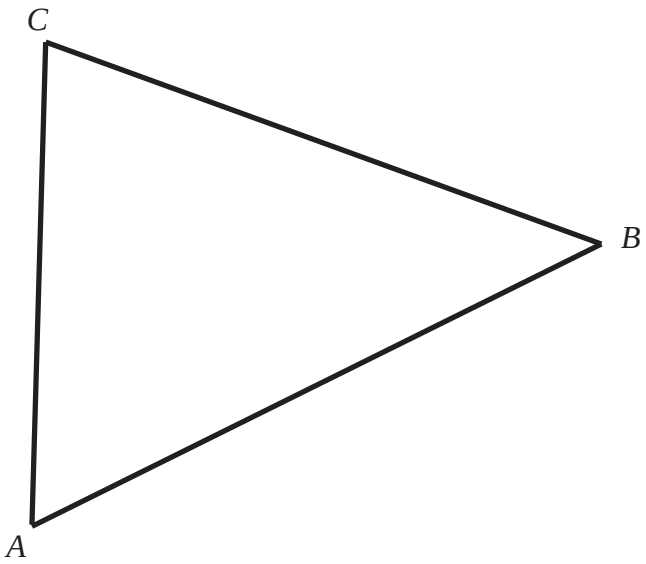
b) Measure angle *P*. Angle *P* = 43°

Bisecting a Line

1) Use ruler and compasses to bisect the line segment *AB*.
You must show all construction lines.



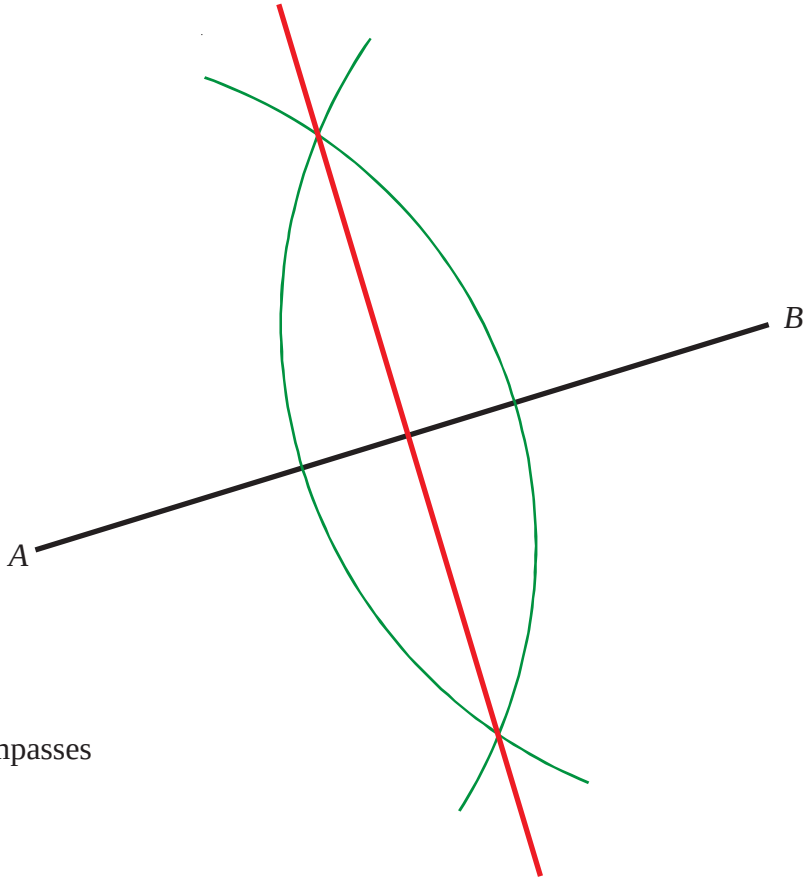
2) Using ruler and compasses
   a) Bisect line *AB*
   b) Bisect line *BC*
   c) Bisect line *AC*
   d) Place your compass point where your three lines cross*
   Now open them out until your pencil is touching vertex *A*.
   Draw a circle using this radius.



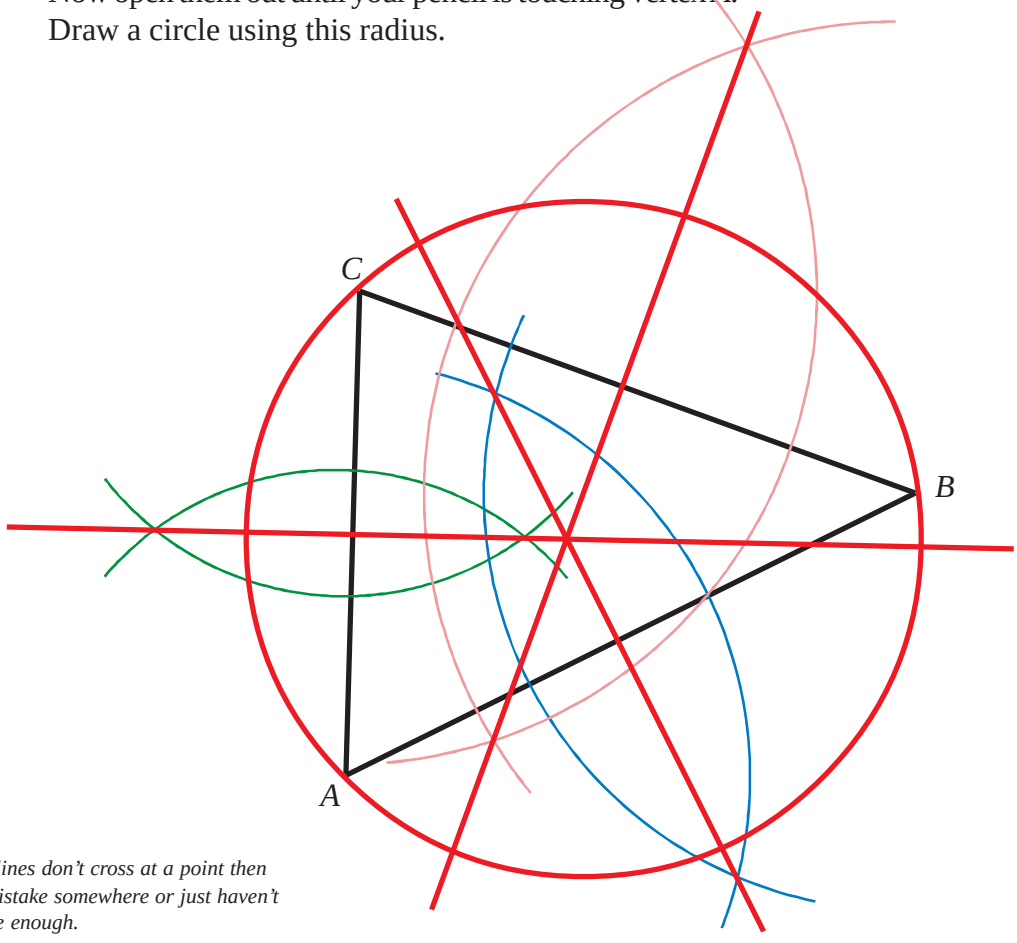
* *If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.*

Bisecting a Line

1) Use ruler and compasses to bisect the line segment *AB*.
You must show all construction lines.



2) Using ruler and compasses
   a) Bisect line *AB*
   b) Bisect line *BC*
   c) Bisect line *AC*
   d) Place your compass point where your three lines cross*
   Now open them out until your pencil is touching vertex *A*.
   Draw a circle using this radius.

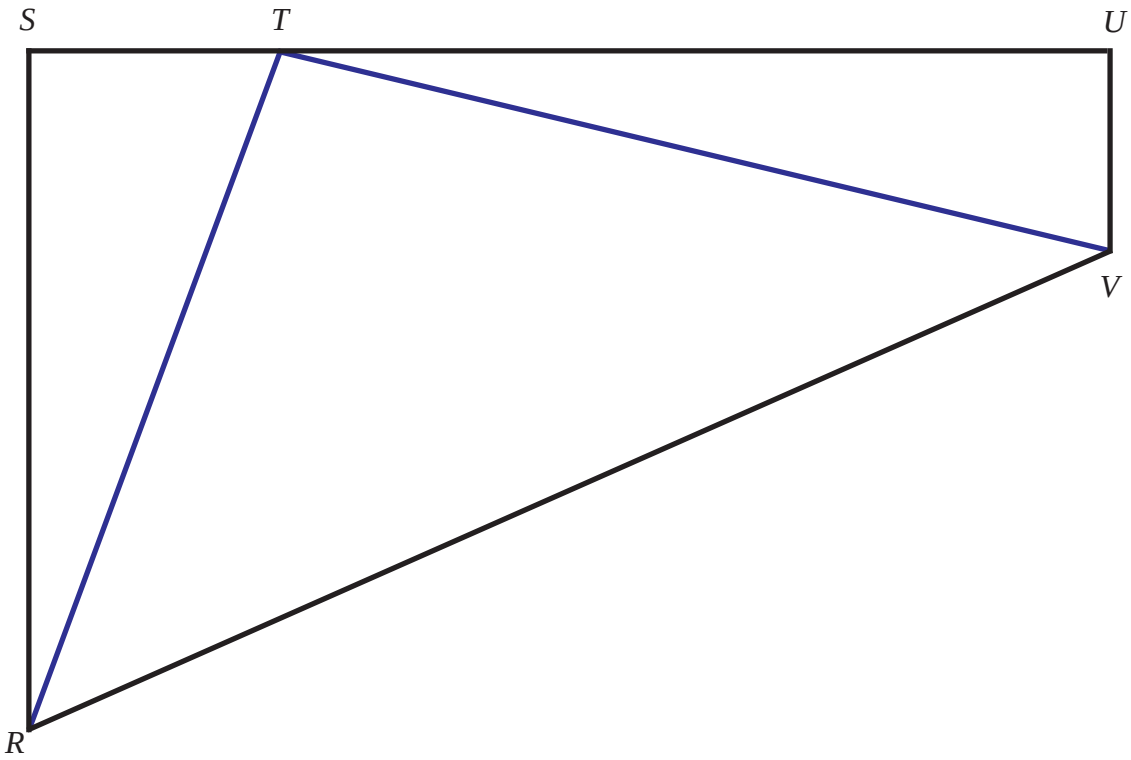


* *If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.*

Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.

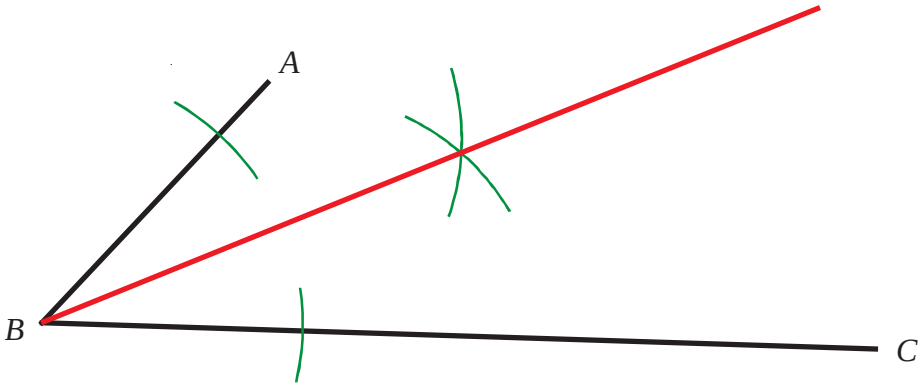
2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*



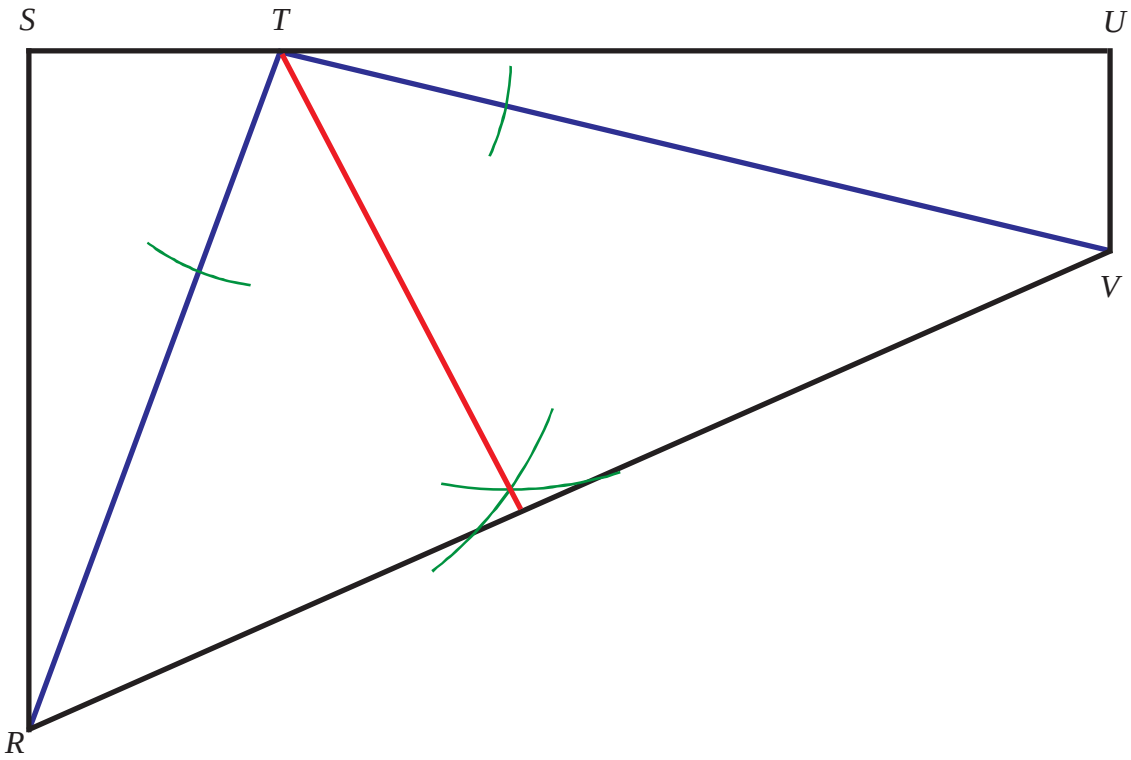
There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.



2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*

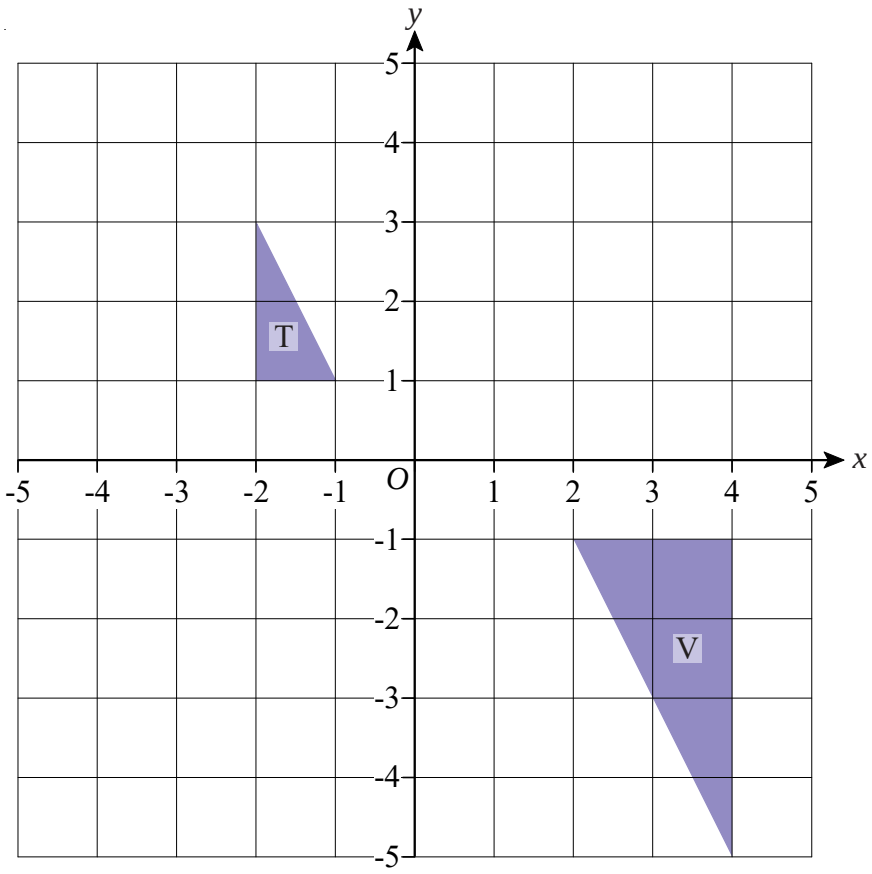


There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

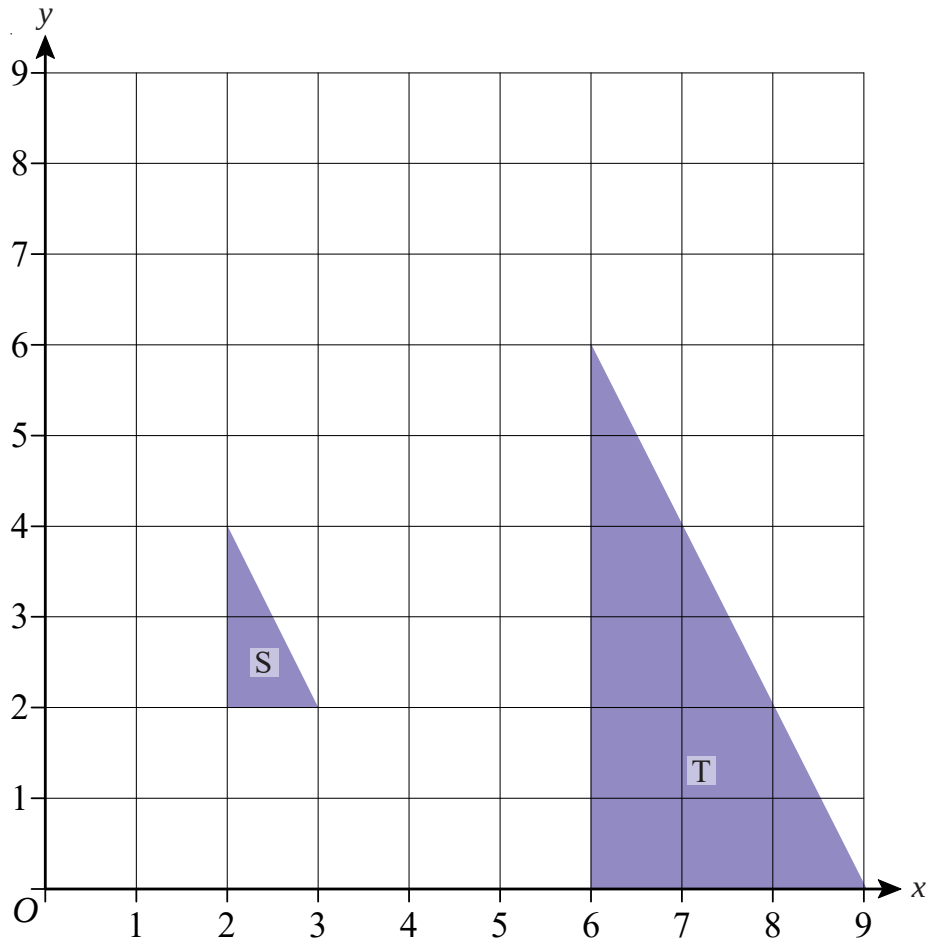
Enlargements

1) a) Enlarge triangle T by scale factor 2 using point (-5, 2) as the centre of enlargement.
Label your new triangle U.

b) Enlarge triangle V by scale factor a half using the point (-2, -3) as the centre of enlargement.
Label your new triangle W.



2) Describe fully the single transformation which maps triangle S to triangle T.



Enlargements

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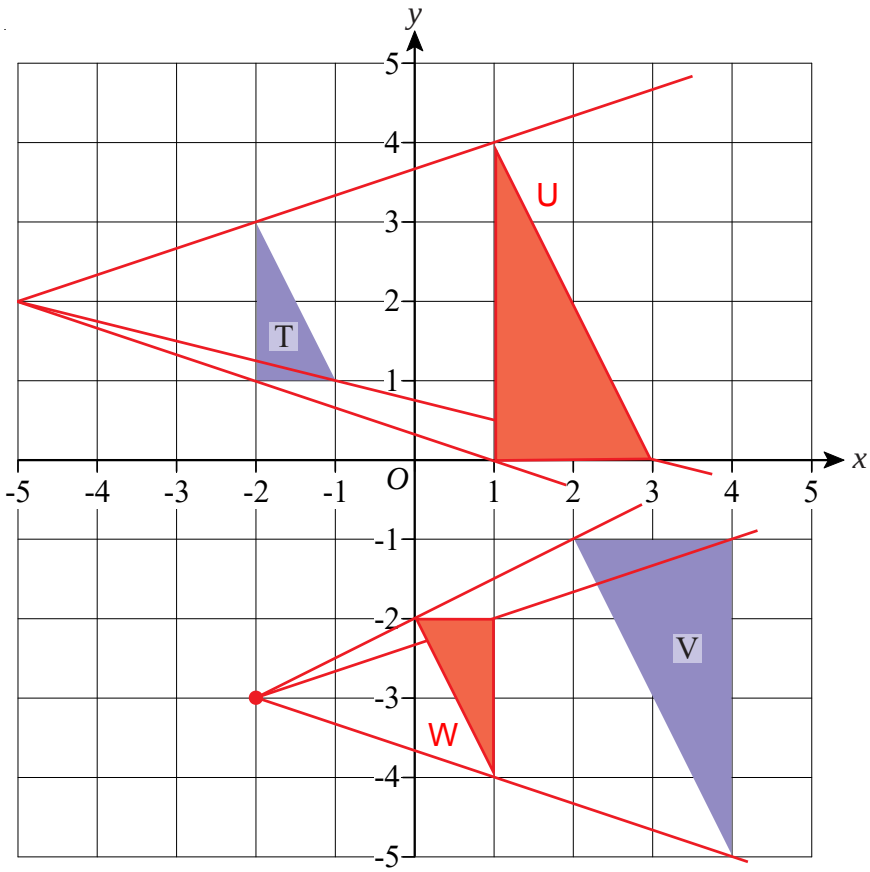
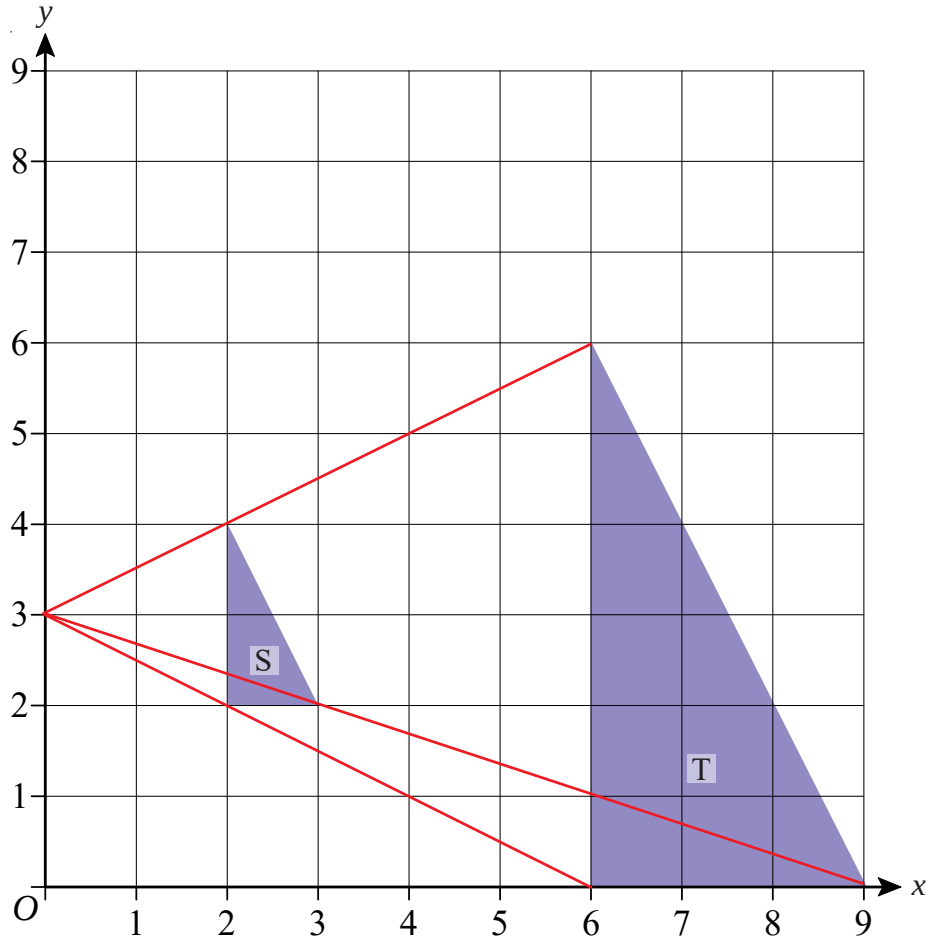


2) Describe fully the single transformation which maps triangle S to triangle T.

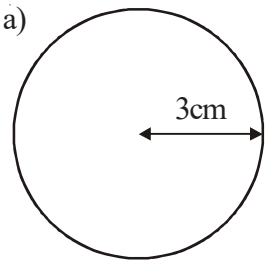
Enlargement, scale factor 3, centre of enlargement (0, 3).



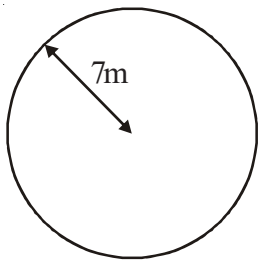
Area of a Circle

1) Find the areas of the following shapes.

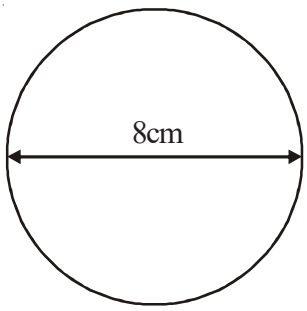
a)



b)

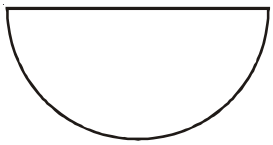


c)

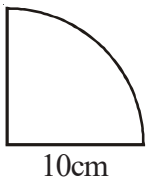


2) Work out the areas of the following shapes.

a)



b)



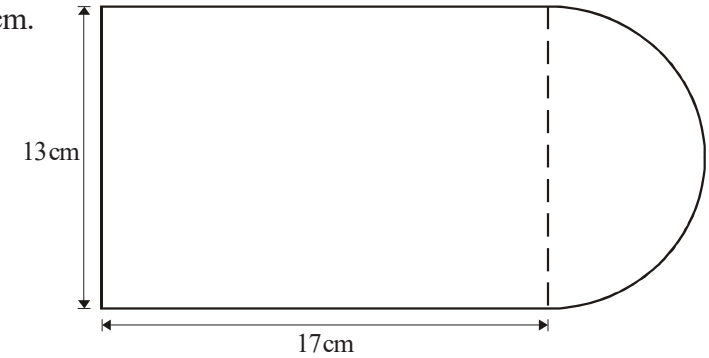
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table.

b) Work out the area of the base of the table.

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

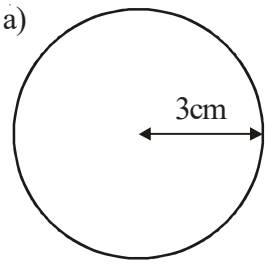
Calculate the area of the shape.
Give your answer correct to
3 significant figures.



Area of a Circle

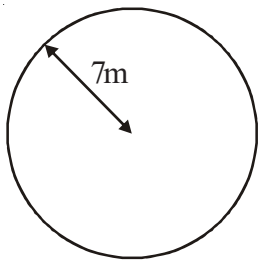
1) Find the areas of the following shapes.

a)



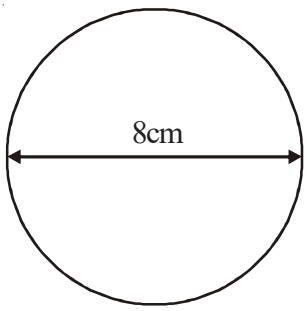
28.278 cm^2

b)



153.958 m^2

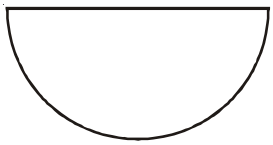
c)



50.272 cm^2

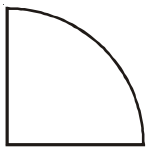
2) Work out the areas of the following shapes.

a)



56.556 mm^2

b)



78.55 cm^2

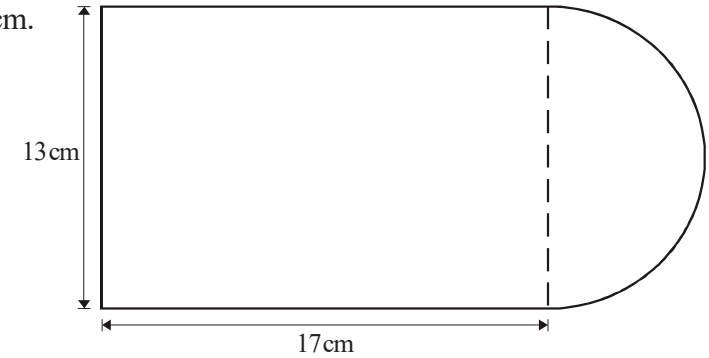
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table. 11311.2 cm^2

b) Work out the area of the base of the table. 706.95 cm^2

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 13 cm.
The length of the rectangle is 17 cm.

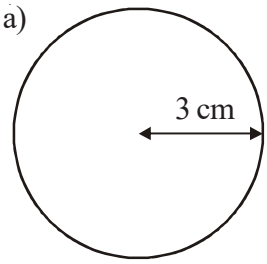
Calculate the area of the shape.
Give your answer correct to
3 significant figures. 287 cm^2



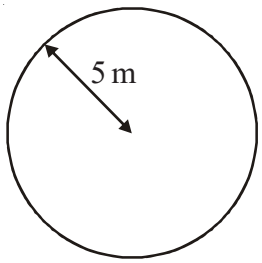
Circumference of a Circle

1) Find the circumference of the following shapes.

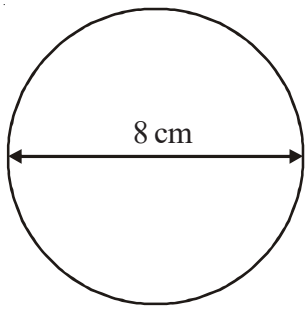
a)



b)

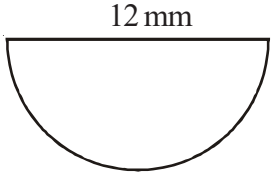


c)

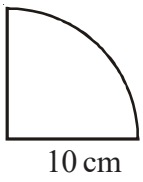


2) Work out the perimeter of the following shapes.

a)



b)



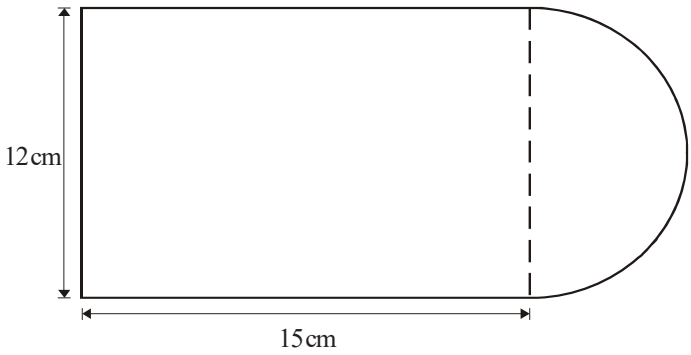
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.
Let π be 3.14

b) Work out the circumference of the base of the table.
Let π be 3.14

4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

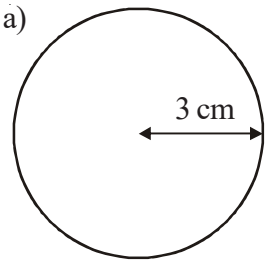
Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.



Circumference of a Circle

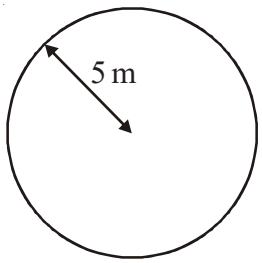
1) Find the circumference of the following shapes.

a)



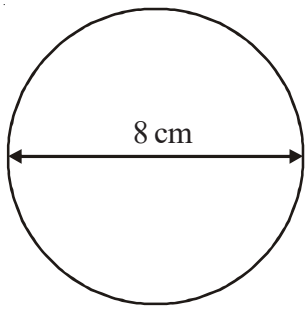
18.852 cm

b)



31.42 m

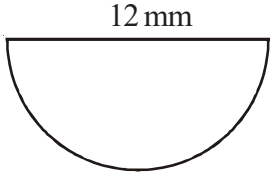
c)



25.136 cm

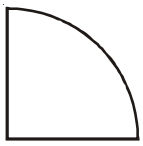
2) Work out the perimeter of the following shapes.

a)



30.852 mm

b)



35.71 cm

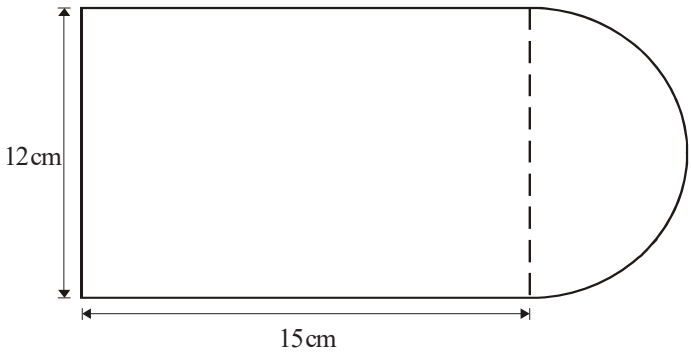
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

a) Work out the circumference of the top of the table.
Let π be 3.14 376.8 cm

b) Work out the circumference of the base of the table.
Let π be 3.14 94.2 cm

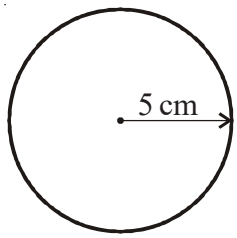
4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

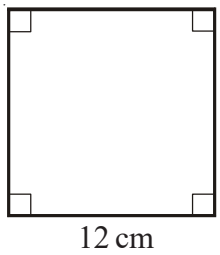
Calculate the perimeter of the shape.
Give your answer correct to 3 significant figures. 60.9 cm



Area and Circumference of a Circle

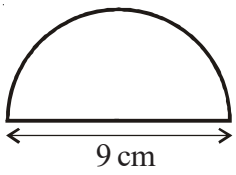
1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.





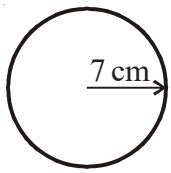
Work out the difference between the area of the circle and the area of the square if you take π to be 3.

2) Here is a tile in the shape of a semi-circle.



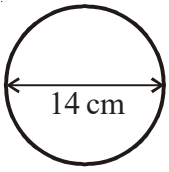
The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places.

3) A circle has a radius of 7 cm.



Work out the area of the circle.
Give your answer correct to three significant figures.

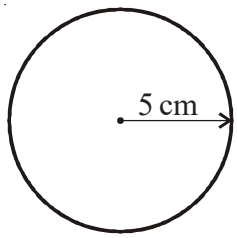
4) A circle has a diameter of 14 cm.

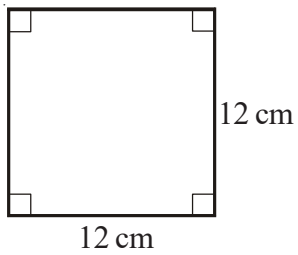


Work out the circumference of the circle.
Give your answer correct to three significant figures.

Area and Circumference of a Circle

1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.

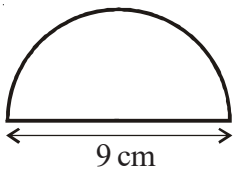




Work out the difference between the area of the circle and the area of the square if you take π to be 3.

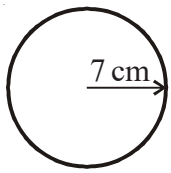
69 cm^2

2) Here is a tile in the shape of a semi-circle.



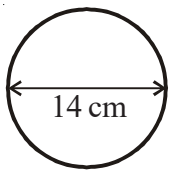
The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places. 23.14 cm

3) A circle has a radius of 7 cm.



Work out the area of the circle.
Give your answer correct to three significant figures. 154 cm^2

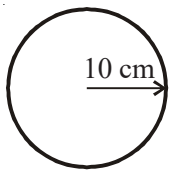
4) A circle has a diameter of 14 cm.



Work out the circumference of the circle.
Give your answer correct to three significant figures. 44.0 cm

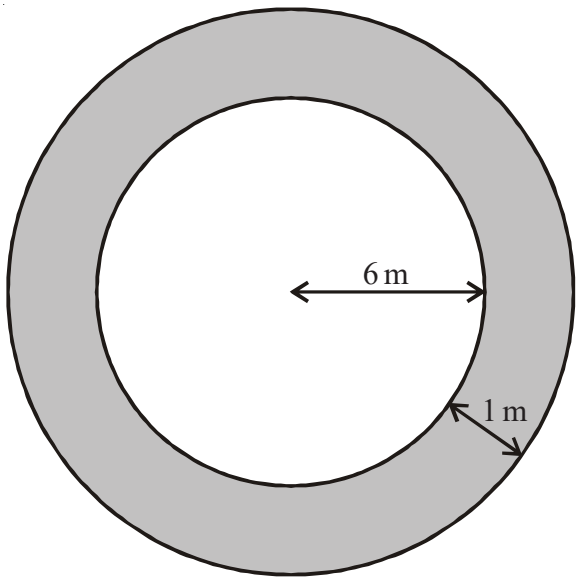
Area and Circumference of a Circle

1) The radius of a circle is 10 cm.



Work out the area of this circle.

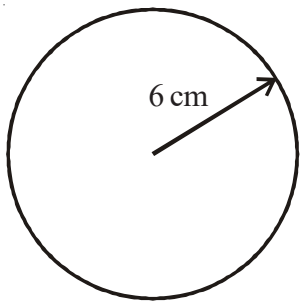
2) The diagram shows a circular pond with a path around it.



The pond has a radius of 6 m.
The path has a width of 1 m.

Work out the area of the path.
Give your answer correct to 3 significant figures.

3) The diagram shows a CD which has a radius of 6 cm.



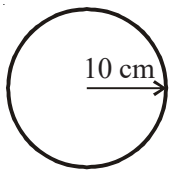
a) Work out the circumference of the CD.
Give your answer correct to 3 significant figures.

CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.

b) Work out the greatest number of CDs which can be cut from one rectangular sheet.

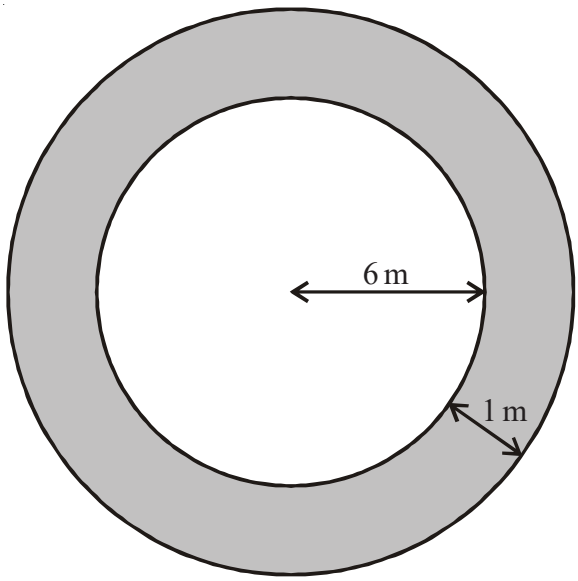
Area and Circumference of a Circle

1) The radius of a circle is 10 cm.



Work out the area of this circle. 314.2 cm^2

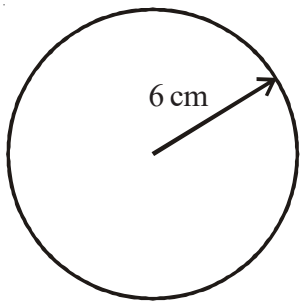
2) The diagram shows a circular pond with a path around it.



The pond has a radius of 6 m.
The path has a width of 1 m.

Work out the area of the path.
Give your answer correct to 3 significant figures. 40.8 m^2

3) The diagram shows a CD which has a radius of 6 cm.



a) Work out the circumference of the CD.
Give your answer correct to 3 significant figures.

37.7 cm

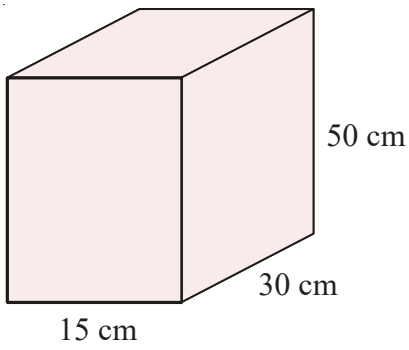
CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.

b) Work out the greatest number of CDs which can be cut from one rectangular sheet. 32

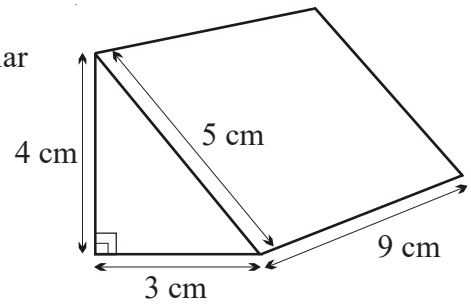
Volume of a Prism

1) The diagram shows a cuboid.

Work out the volume of the cuboid.

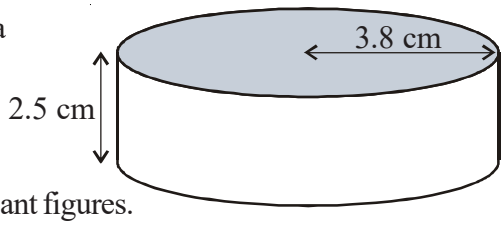


2) Calculate the volume of this triangular prism.



3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

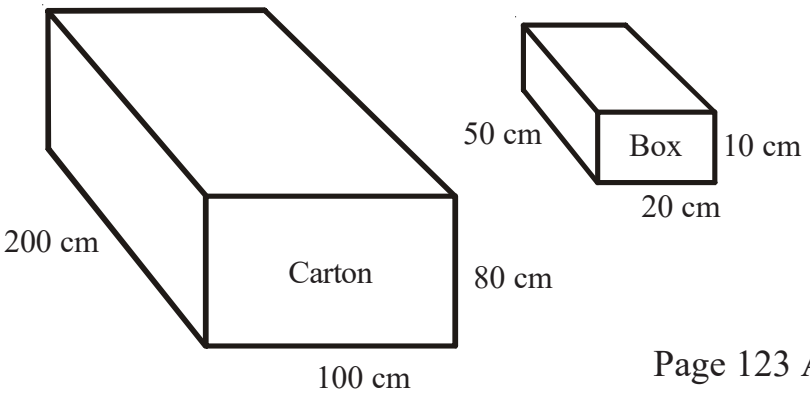
Work out the volume of the puck.
Give your answer correct to 3 significant figures.



4) A cuboid has: a volume of 80cm^3
a length of 5 cm
a width of 2 cm

Work out the height of the cuboid.

5) Work out the maximum number of boxes which can fit in the carton.

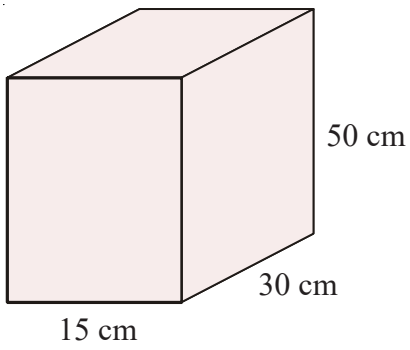


Volume of a Prism

1) The diagram shows a cuboid.

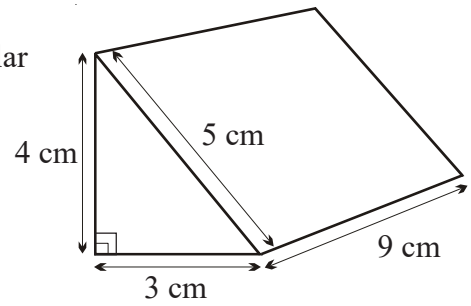
Work out the volume of the cuboid.

22500 cm^3



2) Calculate the volume of this triangular prism.

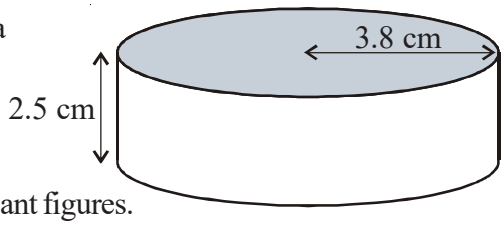
54 cm^3



3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

Work out the volume of the puck.
Give your answer correct to 3 significant figures.

113 cm^3

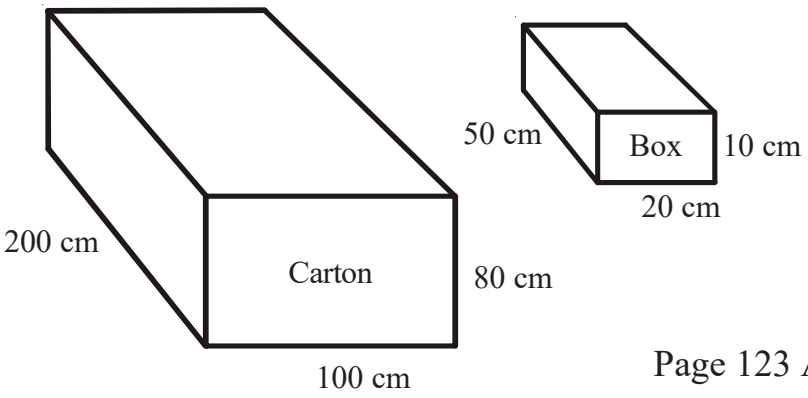


4) A cuboid has: a volume of 80cm^3
a length of 5 cm
a width of 2 cm

Work out the height of the cuboid. 8 cm

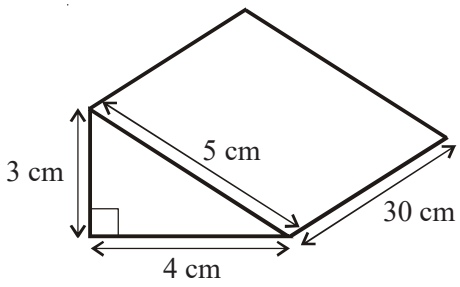
5) Work out the maximum number of boxes which can fit in the carton.

160

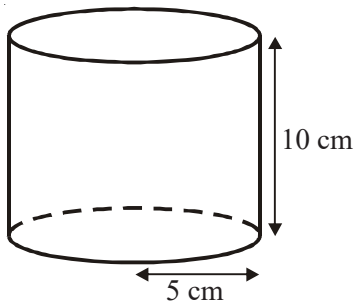


Volume of a Prism

1) Work out the volume of the prism.



2)

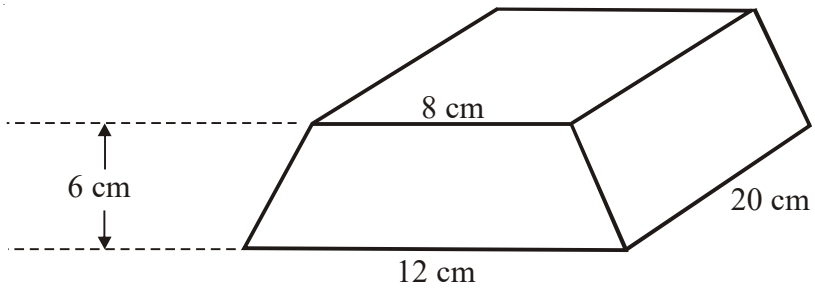


A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

3)

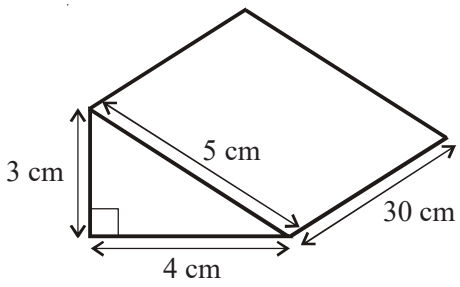


The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

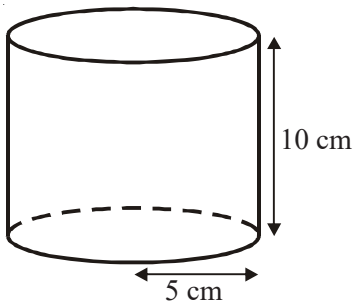
Find the volume of the prism.
You must state your units.

Volume of a Prism

1) Work out the volume of the prism. 180 cm^3



2)



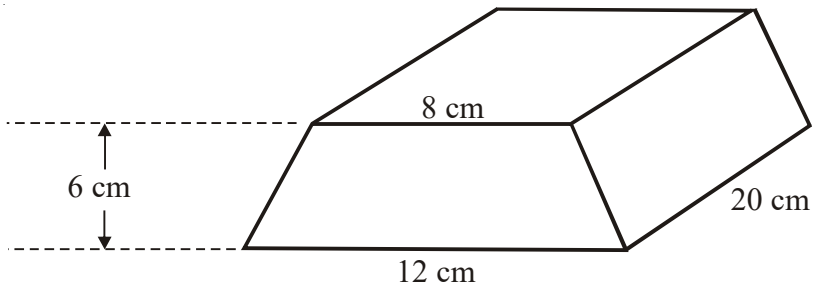
A solid cylinder has a radius of 5 cm and a height of 10 cm.

Work out the volume of the cylinder.

Give your answer correct to 3 significant figures.

786 cm^3

3)



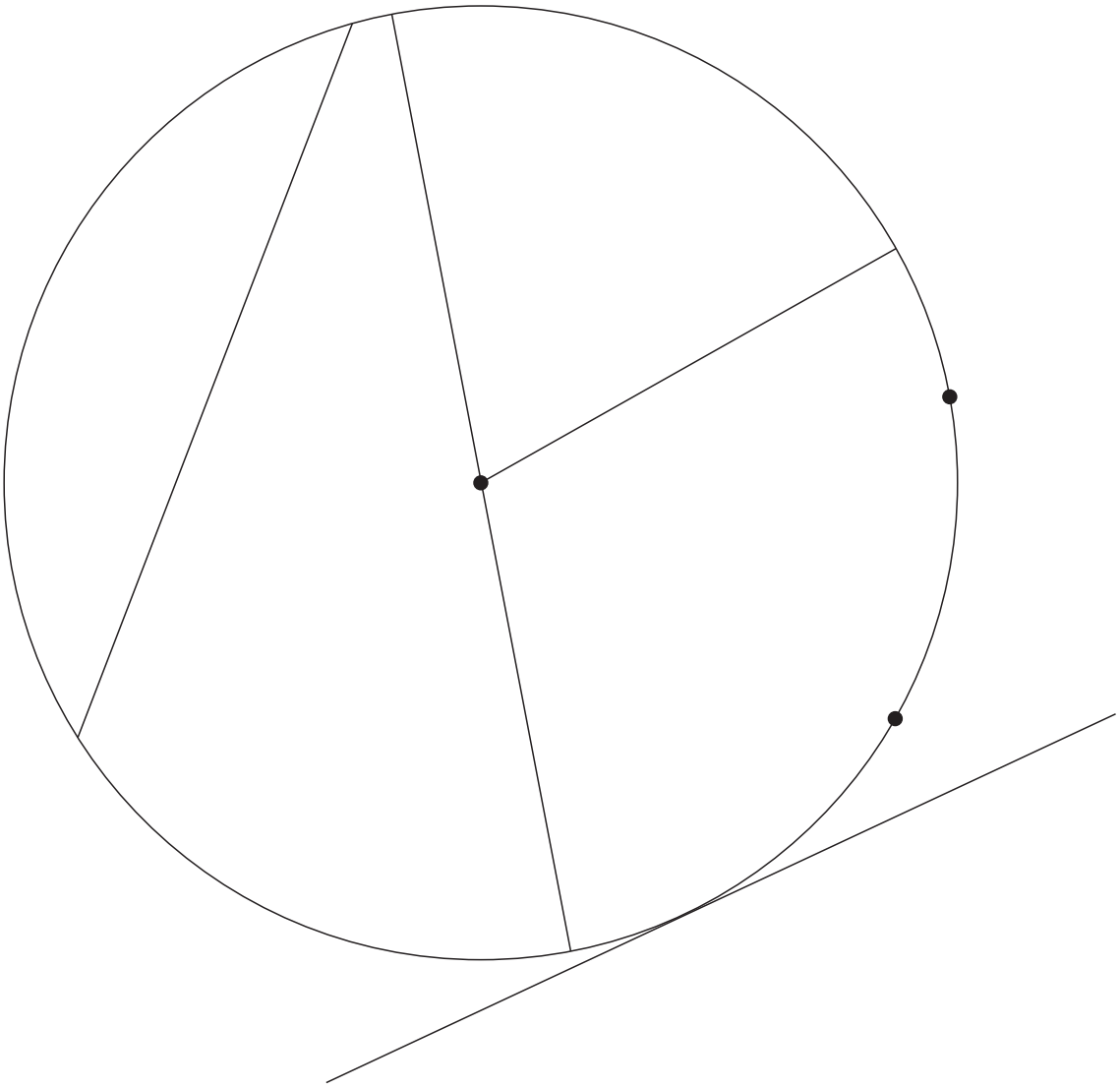
The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

Find the volume of the prism.
You must state your units. 1200 cm^3

Tangents, Arcs, Sectors and Segments

Tangent
Radius
Minor sector
Minor segment
Arc
Diameter
Chord
Circumference

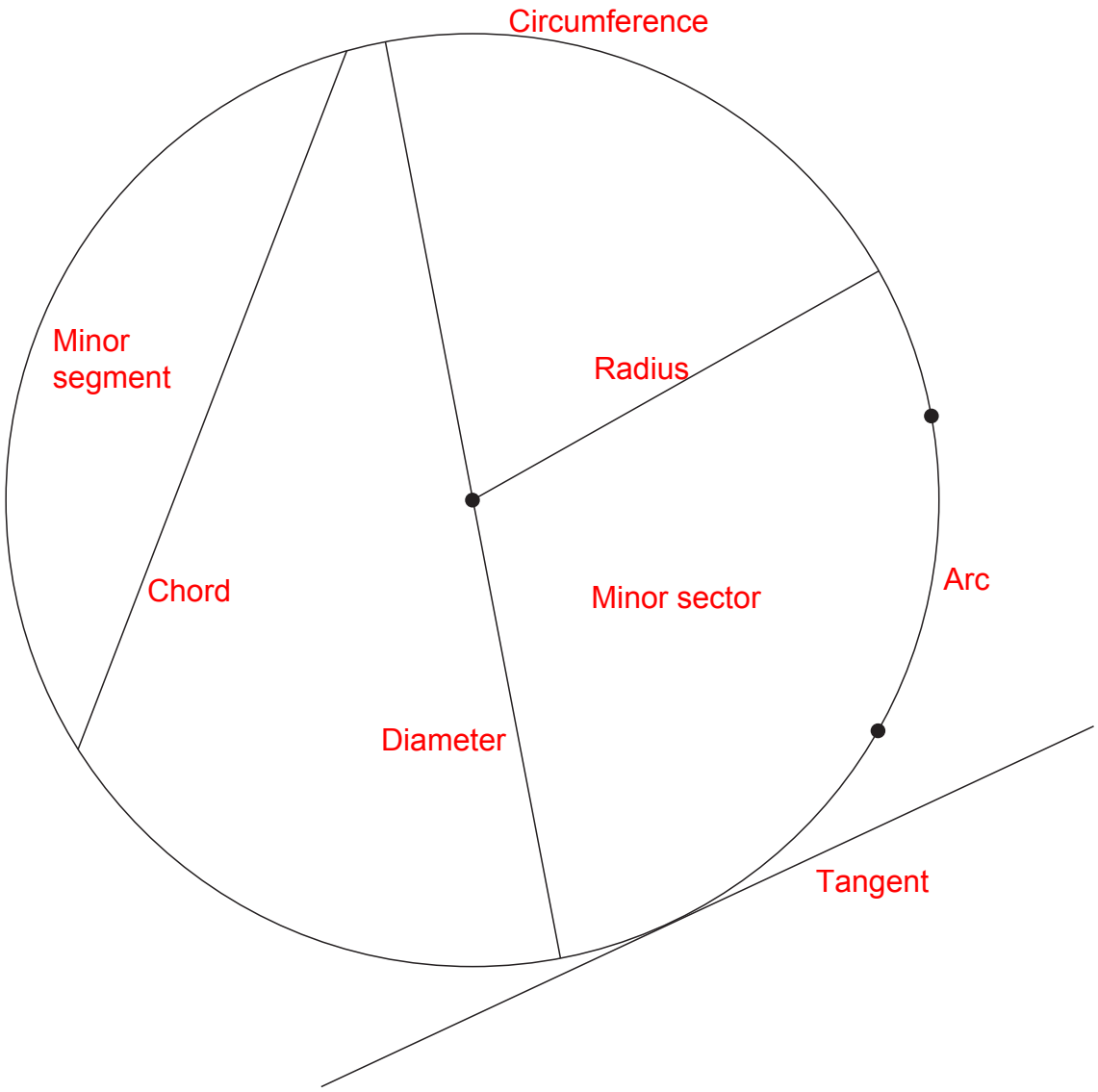
On the diagram, mark on all of the words from the box in an appropriate place.



Tangents, Arcs, Sectors and Segments

Tangent
Radius
Minor sector
Minor segment
Arc
Diameter
Chord
Circumference

On the diagram, mark on all of the words from the box in an appropriate place.



Compound Units

1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

7) Tony went on holiday to Miami.
He travelled from London by plane.

The distance from London to Miami is 7120 km.
The plane journey took 8 hours.

Calculate the average speed of the plane.

Compound Units

1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

S = 9.3 m/s

2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

S = 62 mph

3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

T = 6 hours

4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

D = 26.6 miles

5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

S = 96 mph

6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

S = 14.4 mph

7) Tony went on holiday to Miami.
He travelled from London by plane.

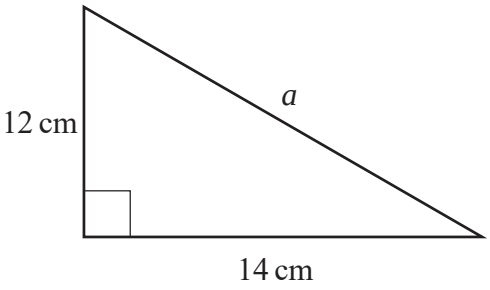
The distance from London to Miami is 7120 km.
The plane journey took 8 hours.

Calculate the average speed of the plane.

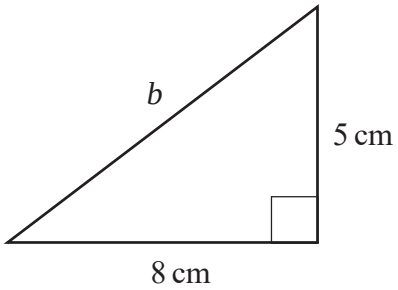
890 km/h

Pythagoras' Theorem

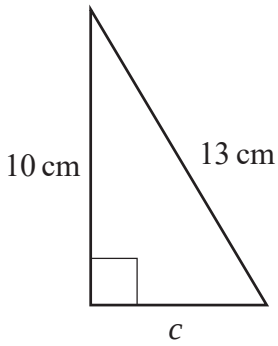
1) Find the length of side *a*.
Give your answer to 1 decimal place.



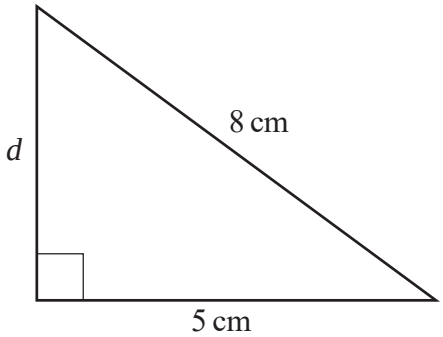
2) Find the length of side *b*.
Give your answer to 1 decimal place.



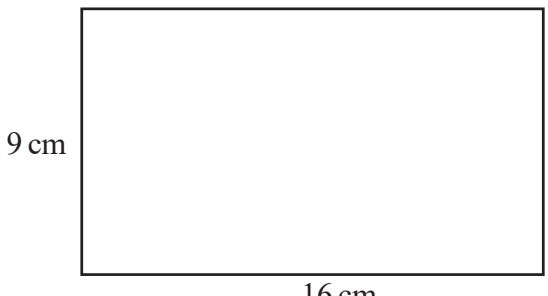
3) Find the length of side *c*.
Give your answer to 1 decimal place.



4) Find the length of side *d*.
Give your answer to 1 decimal place.



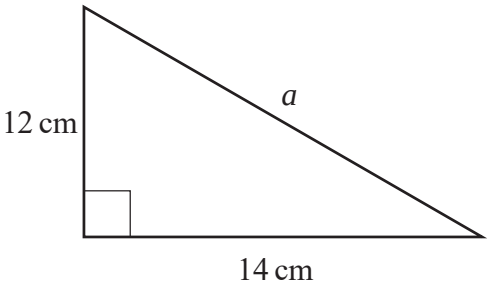
5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place.



Pythagoras' Theorem

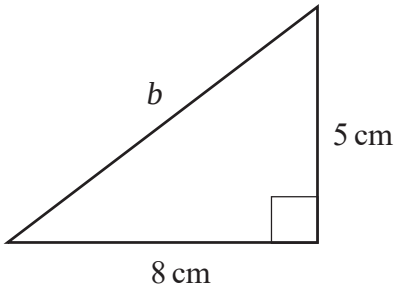
1) Find the length of side *a*.
Give your answer to 1 decimal place.

18.4 cm



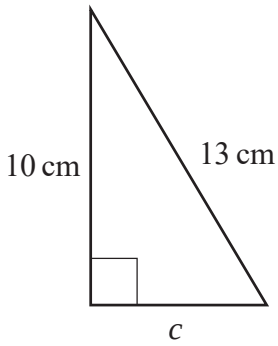
2) Find the length of side *b*.
Give your answer to 1 decimal place.

9.4 cm



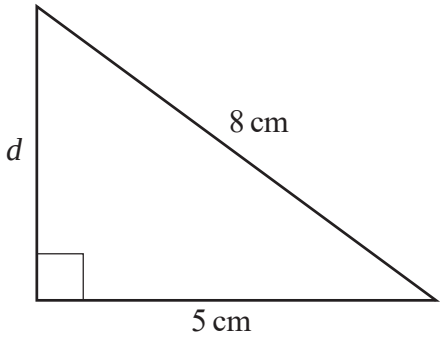
3) Find the length of side *c*.
Give your answer to 1 decimal place.

8.3 cm



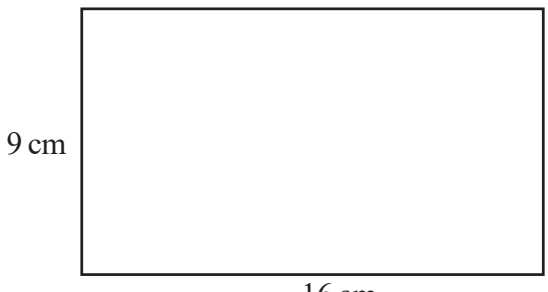
4) Find the length of side *d*.
Give your answer to 1 decimal place.

6.2 cm



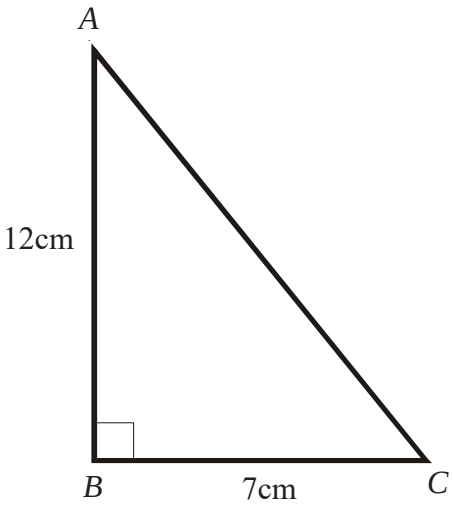
5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place.

18.4 cm

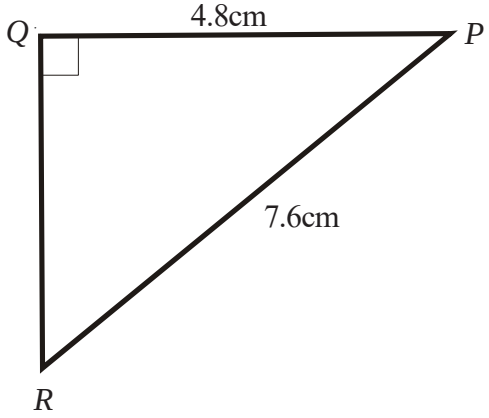


Pythagoras' Theorem

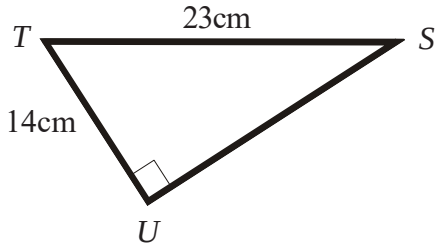
1) Find the length of side *AC*.
Give your answer to 1 decimal place.



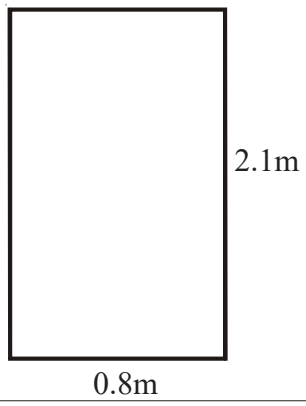
2) Find the length of side *QR*
Give your answer to 1 decimal place.



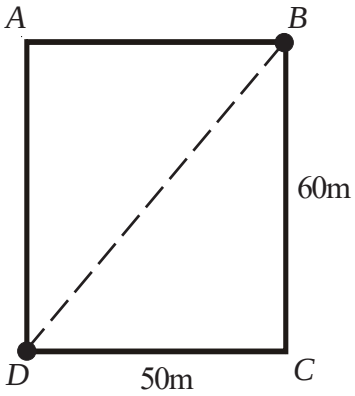
3) Find the length of side *SU*
Give your answer to 1 decimal place.



4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

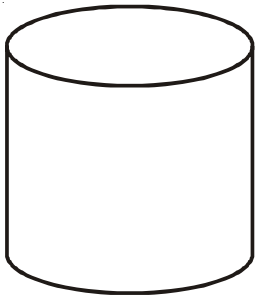


5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.



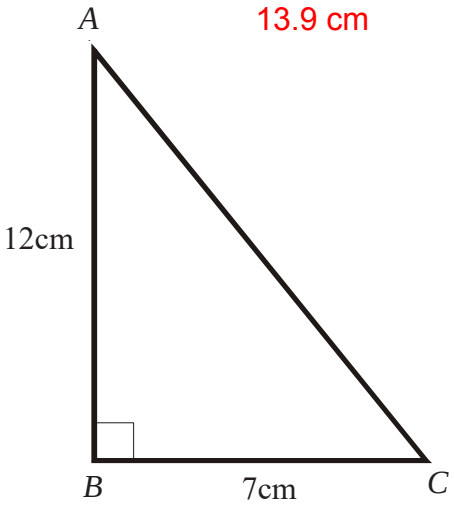
Which of the following routes is shorter and by how much?
From *B* to *C* to *D* or straight across the field from *B* to *D*.
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top?
All workings must be shown.

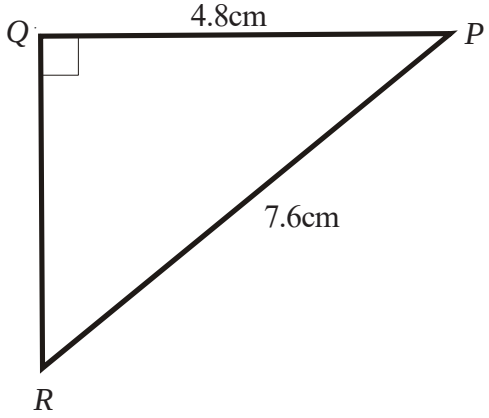


Pythagoras' Theorem

1) Find the length of side *AC*.
Give your answer to 1 decimal place.

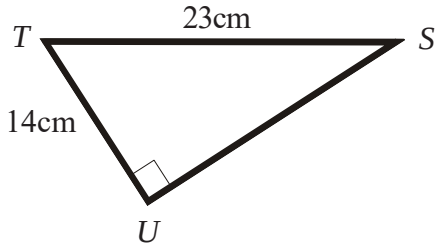


2) Find the length of side *QR* 5.9 cm
Give your answer to 1 decimal place.

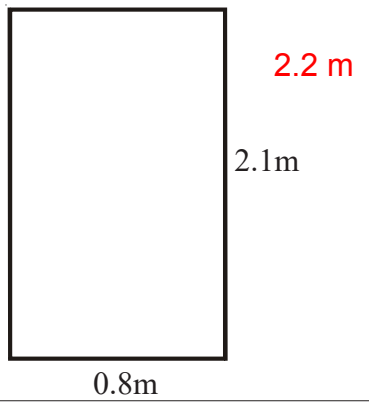


3) Find the length of side *SU*
Give your answer to 1 decimal place.

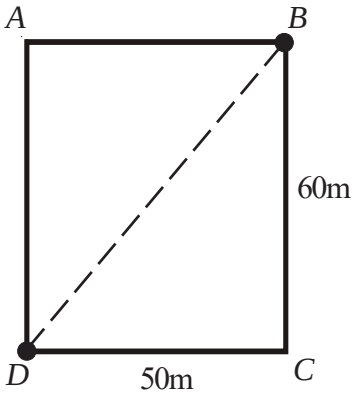
18.2 cm



4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.



5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.



Which of the following routes is shorter and by how much?
From *B* to *C* to *D* or straight across the field from *B* to *D*. *B* to *D* is shorter, by 32 m
Give your answer to the nearest metre.

6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top? No. The diagonal is only 18.8cm.
All workings must be shown.

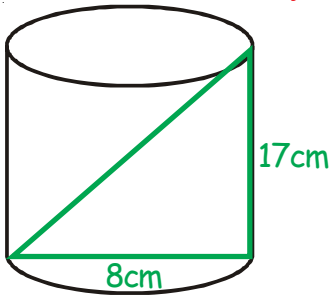
Longest side

$17^2 = 289$

$8^2 = 64$

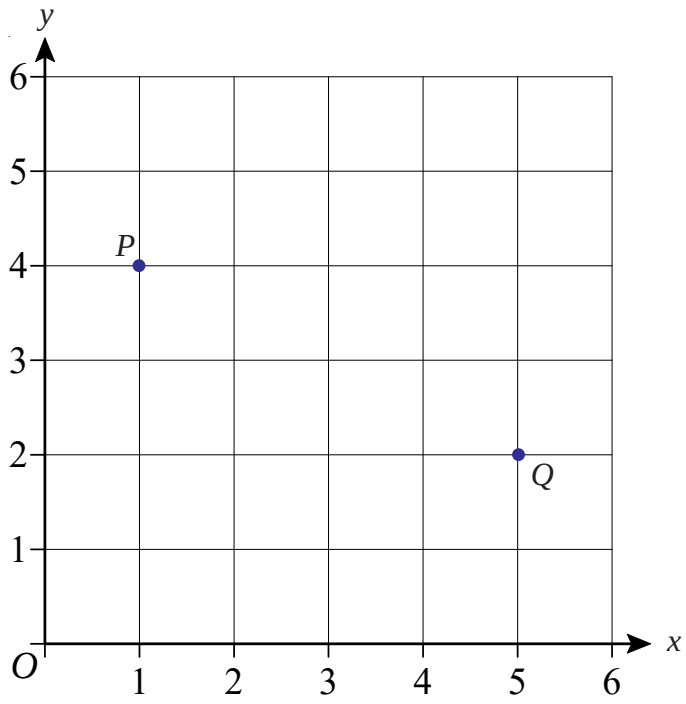
353

$\sqrt{353} = 18.79$

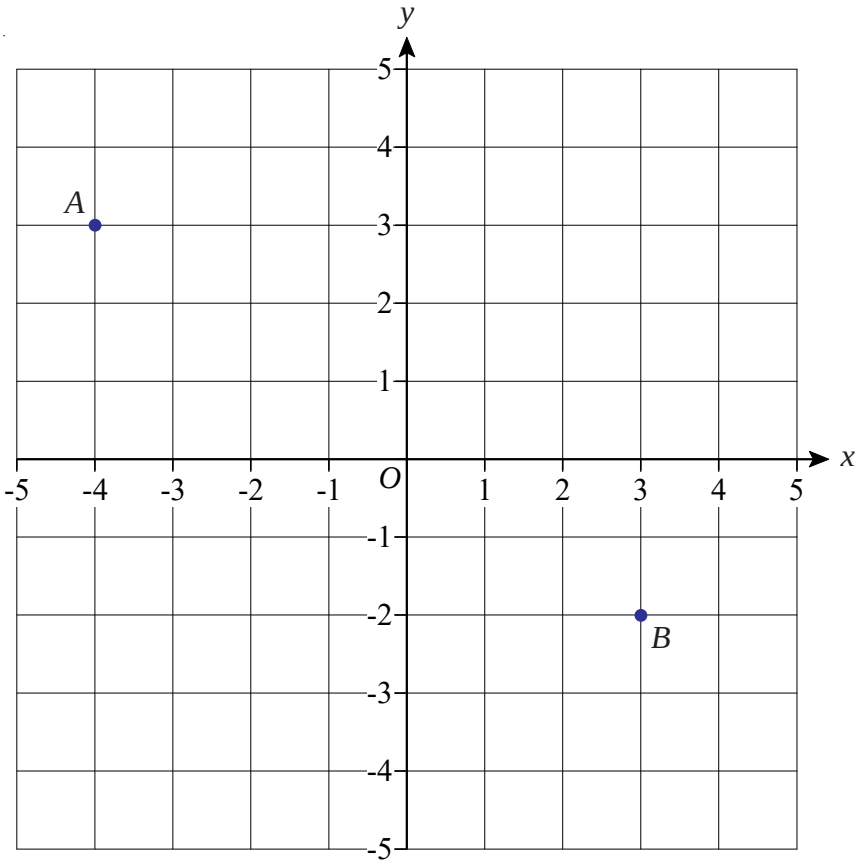


Pythagoras' Theorem

1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place.

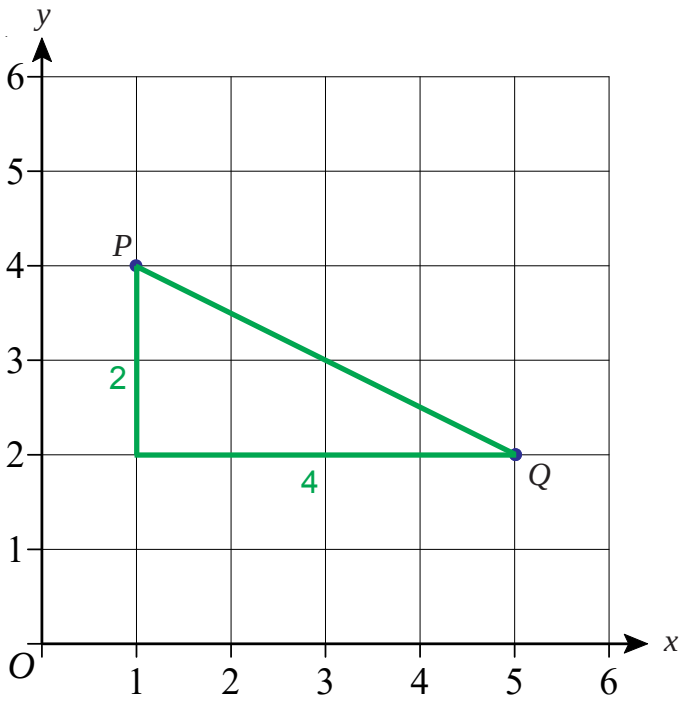


2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.

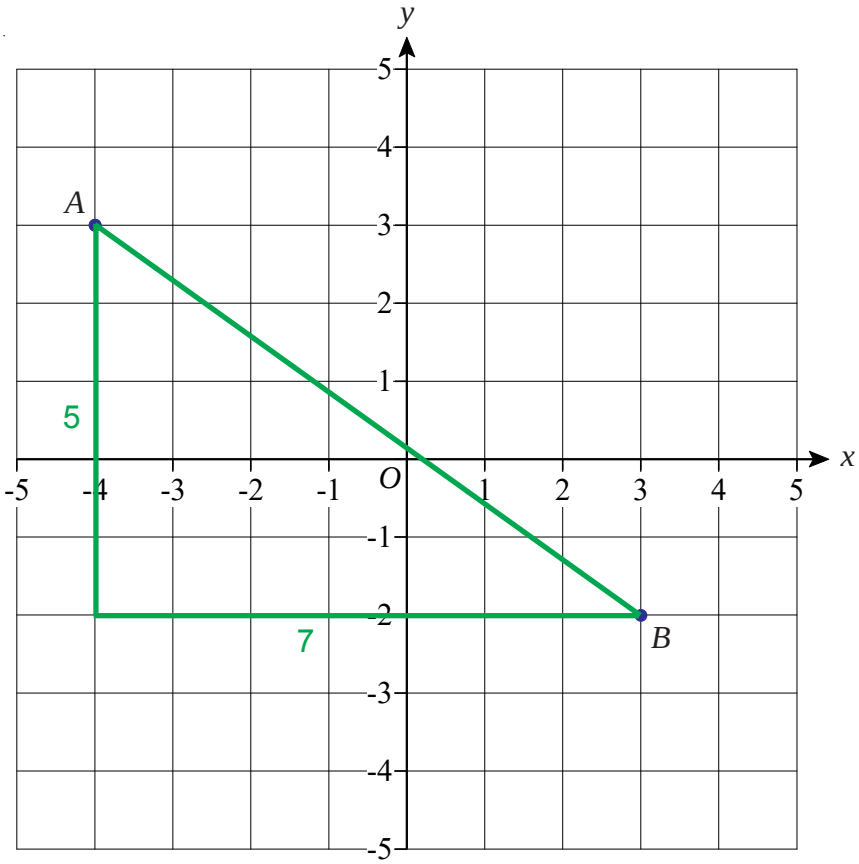


Pythagoras' Theorem

1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place. 4.5

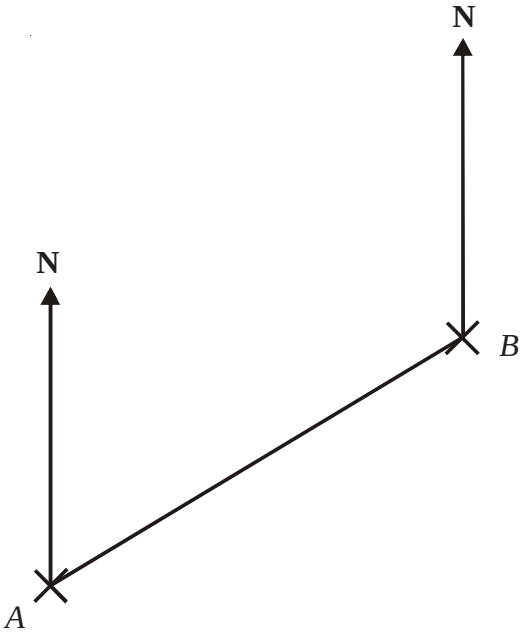


2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place. 8.6



Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.



a) Measure the bearing of *B* from *A*.

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

b) Mark the position of *C* with a cross and label it *C*.

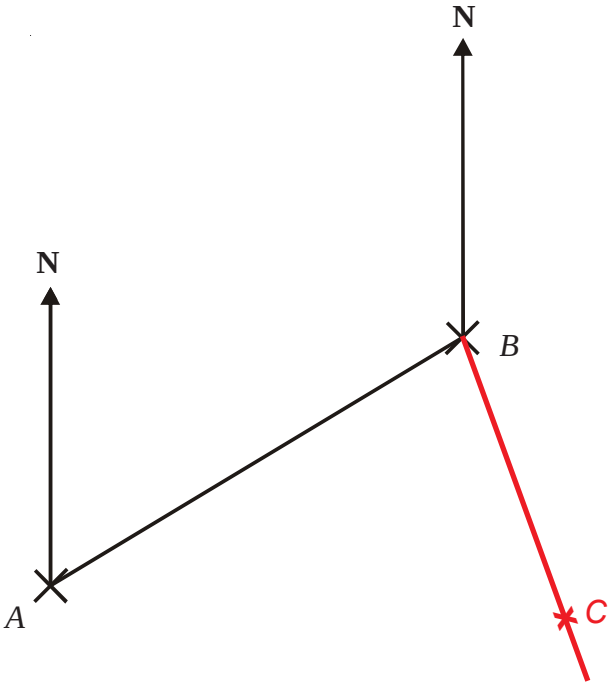
2) The diagram shows the positions of two boats, *P* and *Q*.

The bearing of a boat *R* from boat *P* is 050°
The bearing of boat *R* from boat *Q* is 320°

In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

Bearings

1) The diagram shows the position of two telephone masts, *A* and *B*, on a map.

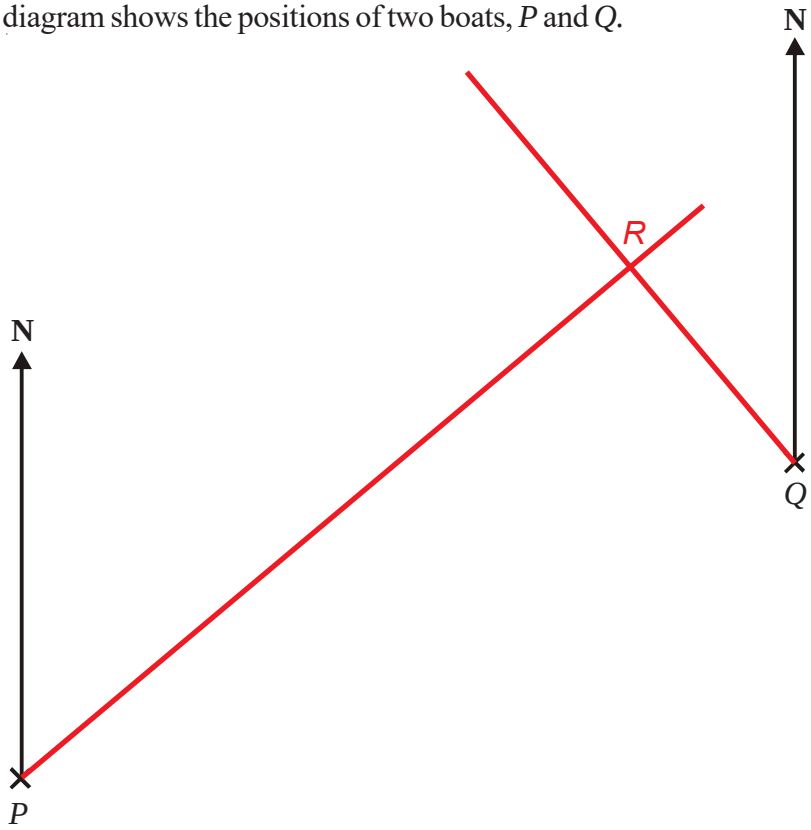


a) Measure the bearing of *B* from *A*. 059°

Another mast *C* is on a bearing of 160° from *B*.
On the map, *C* is 4 cm from *B*.

b) Mark the position of *C* with a cross and label it *C*.

2) The diagram shows the positions of two boats, *P* and *Q*.



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In the space above, draw an accurate diagram to show the position of boat *R*.
Mark the position of boat *R* with a cross (×). Label it *R*.

Bearings

1) School *B* is due east of school *A*.
C is another school.
The bearing of *C* from *A* is 065°.
The bearing of *C* from *B* is 313°.

Complete the scale drawing below.
Mark with a cross the position of *C*.

2) In the diagram, point *A* marks the position of Middlewitch.
The position of Middlemarch is to be marked on the diagram as point *B*
On the diagram, mark with a cross the position of *B* given that:
B is on a bearing of 320° from *A* and
B is 5 cm from *A*

3) **Work out** the bearing of
a) *B* from *P*
b) *P* from *A*

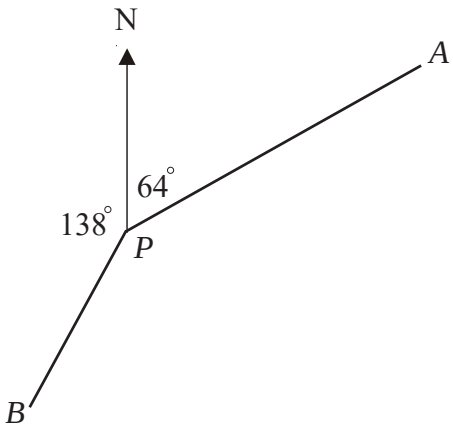

*Diagram **NOT** accurately drawn.*

Bearings

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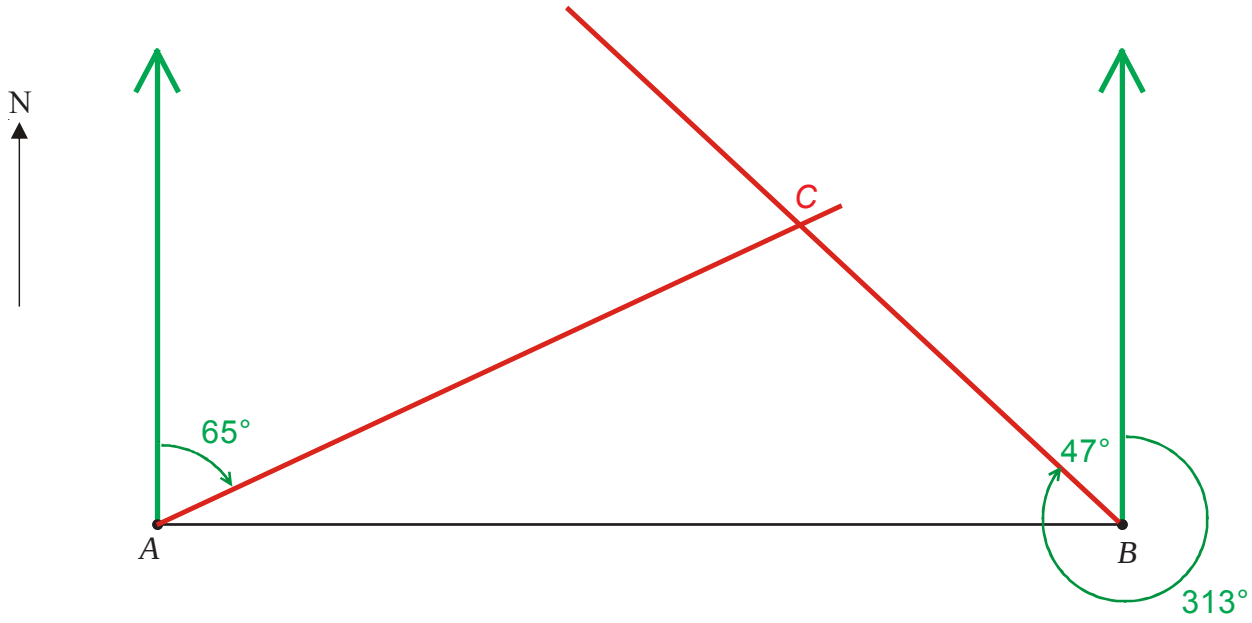

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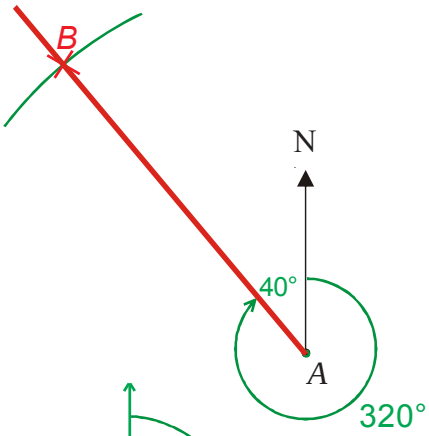
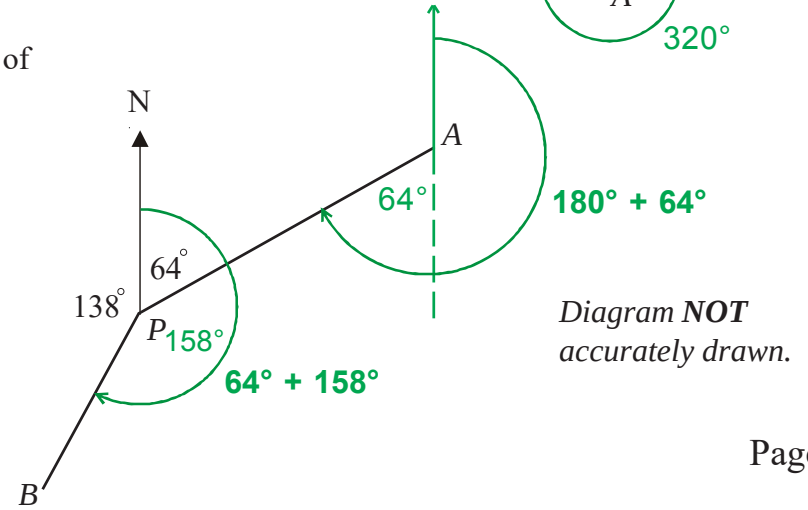
B is 5 cm from *A*

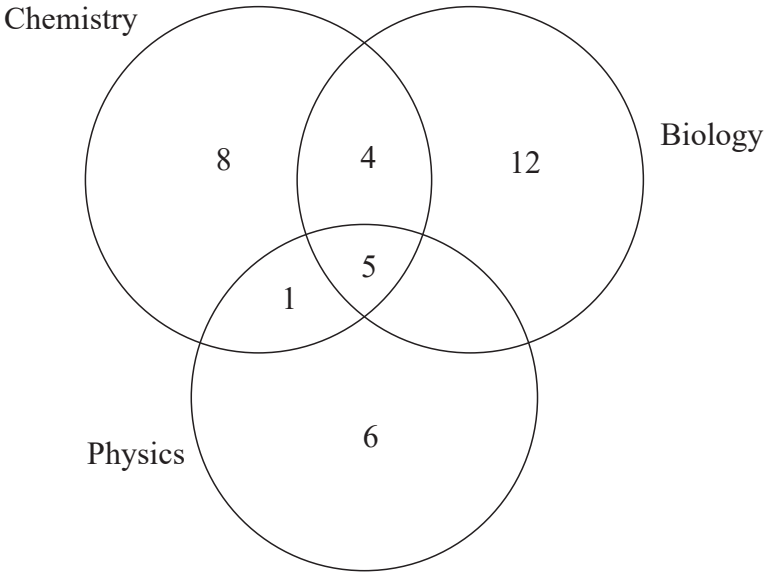


3) **Work out** the bearing of
a) *B* from *P* 222°
b) *P* from *A* 244°



Venn Diagrams

1) The Venn diagram shows the number of students studying one or more of the sciences Chemistry, Biology and Physics.

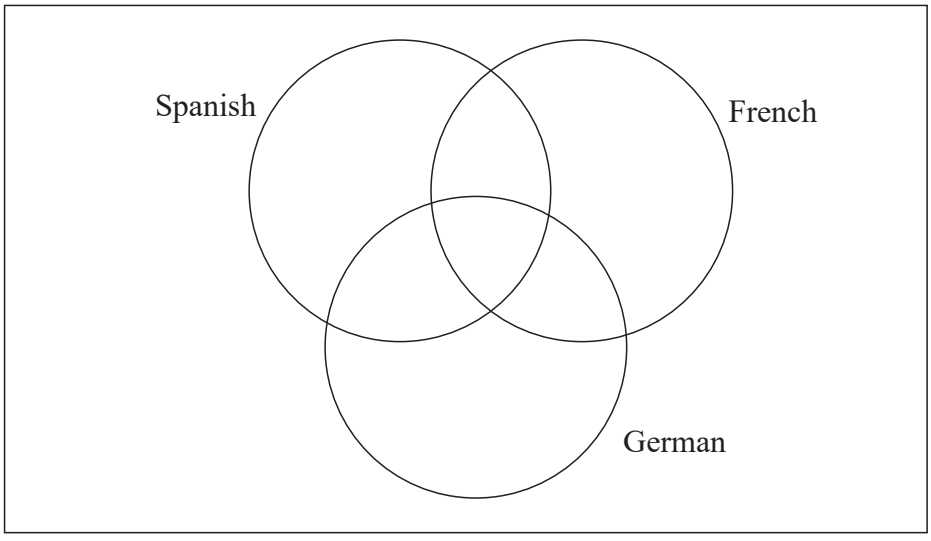


a) How many students are represented in this Venn diagram?

b) How many students are studying exactly two sciences?

c) What is the probability that a student chosen at random is not studying Physics?

2) There are 31 student who study languages.
All 31 study at least one of Spanish, French or German.
4 study all three languages.
9 study Spanish and French.
7 study French and German.
6 study Spanish and German.
7 study only French and 5 study only German.
Complete the Venn diagram to show this information.



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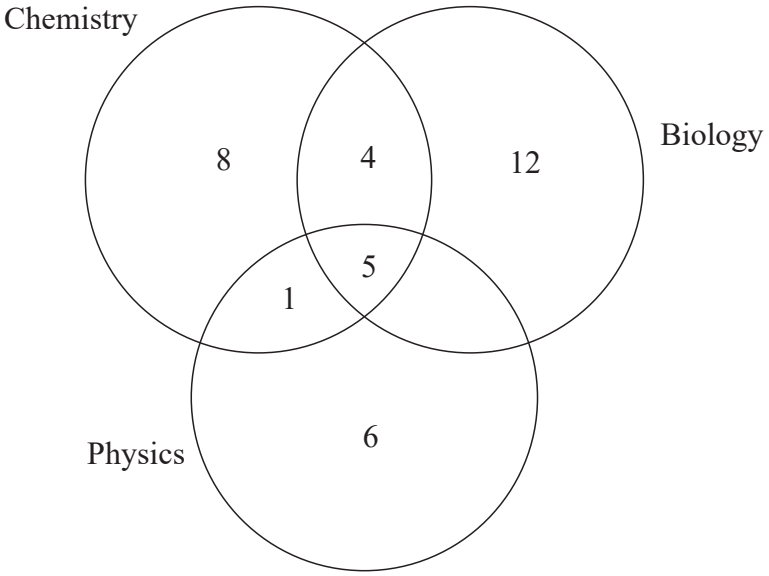

a) How many students are represented in this Venn diagram? 36

b) How many students are studying exactly two sciences? 5

c) What is the probability that a student chosen at random is not studying Physics? $\frac{24}{36}$

2) There are 31 student who study languages.
All 31 study at least one of Spanish, French or German.
4 study all three languages.
9 study Spanish and French.
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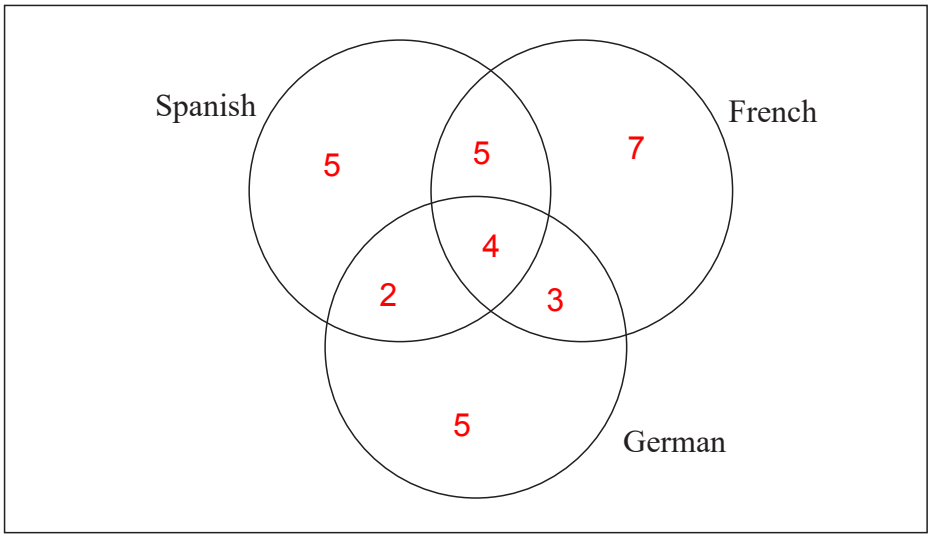
7 study only French and 5 study only German.
Complete the Venn diagram to show this information.

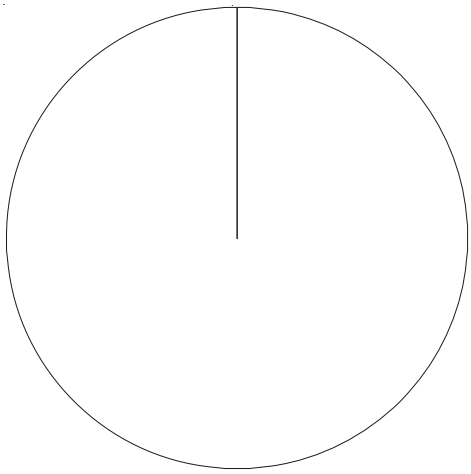


Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency
Alicante	8
Paris	7
Ibiza	15
St Lucia	1
Biarritz	9

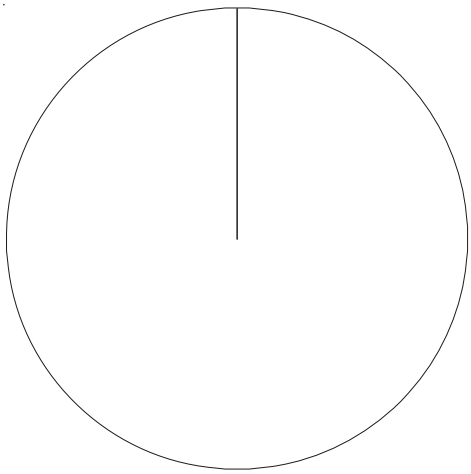
Draw a pie chart to illustrate the information.



2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

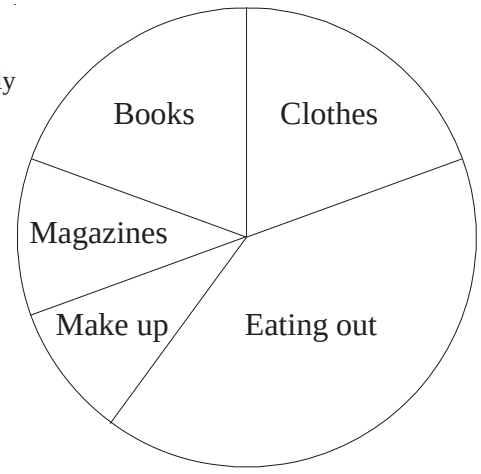
Region	Frequency
Southern England	9
London	23
Midlands	16
Northern England	12
Total	60

Draw a pie chart to illustrate the information.



3) Sophie represents her monthly expenses using a pie char

Diagram accurately drawn



Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

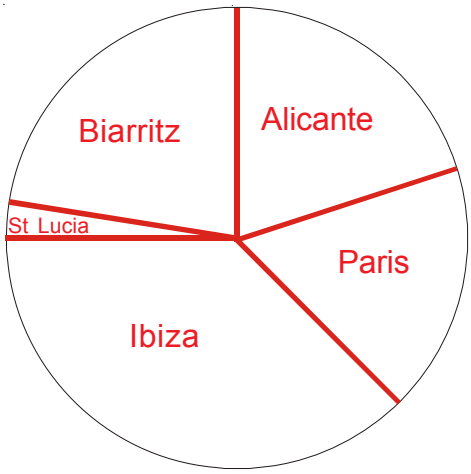
		Angle
Clothes	£35	
Eating out		
Make up	£17	34°
Magazines		
Books		
Total	£180	

Pie Charts

1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency	Angle
Alicante	8	72°
Paris	7	63°
Ibiza	15	135°
St Lucia	1	9°
Biarritz	9	81°

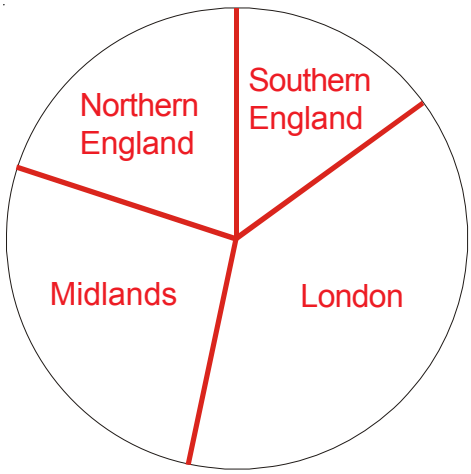
Draw a pie chart to illustrate the information.



2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

Region	Frequency	Angle
Southern England	9	54°
London	23	138°
Midlands	16	96°
Northern England	12	72°
Total	60	

Draw a pie chart to illustrate the information.



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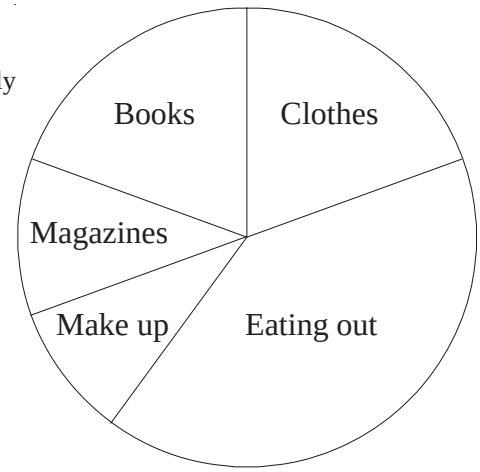


Numbers from her table have been rubbed out by mistake.
Use the pie chart to complete the table.

		Angle
Clothes	£35	70°
Eating out	£73	146°
Make up	£17	34°
Magazines	£20	40°
Books	£35	70°
Total	£180	360°

Averages From a Table

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	**Frequency**	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners.
Give your answer to 1 decimal place.

2) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

a) Work out the total number of pens in the classroom.

b) Write down the modal number of pens in a pencil case.

c) Work out the mean number of pens in a pencil case.

d) Work out the range of the number of pens in a pencil case.

3) Thomas is analysing the local football team.
He records the number of goals scored in each football match in the past twelve months.

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

Thomas said that the mode is 7
Thomas is wrong.

a) Explain why.

b) Calculate the mean number of goals scored.

Averages From a Table

1) Tom carried out a survey of the number of school dinners 34 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	7	
2	14	
3	7	
4	4	
5	2	

Calculate the mean number of school dinners. 2.4
Give your answer to 1 decimal place.

2) The number of pens in each pupil's pencil case in a classroom has been counted.
The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

a) Work out the total number of pens in the classroom. 52

b) Write down the modal number of pens in a pencil case. 2

c) Work out the mean number of pens in a pencil case. 2

d) Work out the range of the number of pens in a pencil case. 5

3) Thomas is analysing the local football team.
He records the number of goals scored in each football match in the past twelve months.

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

Thomas said that the mode is 7
Thomas is wrong.

a) Explain why. Thomas gave the highest frequency instead of giving the number of 'goals scored' associated with it.

b) Calculate the mean number of goals scored.
1.92

Negative Indices

1) Find the value of:

a) 2^{-3}

b) 3^{-2}

c) 5^{-1}

d) 10^{-4}

2) Find the value of:

a) $2^{-3} \times 4^{-1}$

b) $10^{-2} \times 2^{-4}$

c) 5×5^{-3}

d) 8×2^{-3}

3) Write these numbers in order of size.

Start with the smallest.

3^2 3^{-1} 0.3 3^0 3^{-2} -3

4) If $2^x = \frac{1}{64}$, find the value of x.

Negative Indices

1) Find the value of:

a) 2^{-3} $\frac{1}{8}$

b) 3^{-2} $\frac{1}{9}$

c) 5^{-1} $\frac{1}{5}$

d) 10^{-4} $\frac{1}{10000}$

2) Find the value of:

a) $2^{-3} \times 4^{-1}$ $\frac{1}{32}$

b) $10^{-2} \times 2^{-4}$ $\frac{1}{1600}$

c) 5×5^{-3} $\frac{1}{25}$

d) 8×2^{-3} 1

3) Write these numbers in order of size.

Start with the smallest.

3^2 3^{-1} 0.3 3^0 3^{-2} -3

$-3, 3^{-2}, 0.3, 3^{-1}, 3^0, 3^2$

4) If $2^x = \frac{1}{64}$, find the value of x.

$x = -6$

Percentage Change

1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold.

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College.

3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction?

4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate.

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures.

6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20

b) DVD recorder bought for £42, sold for £60.90

c) Gold necklace bought for £90, sold for £78.30

d) A DVD collection bought for £120, sold for £81.60

Percentage Change

1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold. 12%

2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College. 25%

3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction? 10%

4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate. 6%

5) Keith buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures. 11%

6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20 33.3% profit

b) DVD recorder bought for £42, sold for £60.90 45% profit

c) Gold necklace bought for £90, sold for £78.30 13% loss

d) A DVD collection bought for £120, sold for £81.60 32% loss

Reverse Percentage Problems

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt.

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car.

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder.

4) A salesman gets a basic wage of £160 per week plus a commision of 30% of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week.

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account.

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why

b) Work out Jonathan's weekly pay last year.

7) The price of all rail season tickets to London increased by 4%.

a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase.

b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase.

Reverse Percentage Problems

1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26

Calculate the normal price of the shirt. £32.50

2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.

Calculate the normal price of the car. £7200

3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75

Calculate the normal price of the DVD recorder. £125

4) A salesman gets a basic wage of £160 per week plus a commision of 30% of the sales he makes that week.
In one week his total wage was £640

Work out the value of the sales he made that week. £1600

5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976

Work out the amount with which Jason opened his account. £1900

6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.

Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.

a) Explain why Tess has calculated 20% of £960, and subtracted it.

b) Work out Jonathan's weekly pay last year. £800

7) The price of all rail season tickets to London increased by 4%.

a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase. £3060

b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase. £2820

Compound Interest and Depreciation

1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years.

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years.

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years?

4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years?

5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether?

---

6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years?

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years?

8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it?

---

9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.69 in the bank?

10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66?

Compound Interest and Depreciation

1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years. £6564.70

2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years. £9983.62

3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years? £13131.66

4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years? £582.56

5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether? £7779.19

---

6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years? £6665.38

7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years? £79.63

8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it? £1167.68

---

9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.69 in the bank? 3 years

10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66? 6 years

Ratio Questions

1) A forest has 1260 trees.
The trees are maple, beech or oak.

A fifth of the trees are maple and the number of maple trees is 3 times the number of beech trees.
The rest of the trees are oak.

number of oak : number of beech = n : 1

Work out the value of n.
You must show how you get your answer.

2) a : b is 2 : 5 and b : c is 3 : 8

Work out a : c

Give your answer in its simplest form.

3) Given that $\frac{x}{y} = \frac{1}{3}$ and $\frac{y}{z} = \frac{4}{5}$

find x : z

4) p : q = 1 : 5

Circle the correct equation.

$q = \frac{p}{5}$ $q = p + 4$ $q = p - 4$ $q = 5p$

5) a : b = 7 : 2

Form an equation.

6) $x : y = \frac{1}{3} : \frac{2}{5}$

What is x as a fraction of y?

Circle your answer.

$\frac{1}{5}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{6}{5}$

Ratio Questions

1) A forest has 1260 trees.
The trees are maple, beech or oak.

A fifth of the trees are maple and the number of maple trees is 3 times the number of beech trees.
The rest of the trees are oak.

number of oak : number of beech = n : 1

Work out the value of n.
You must show how you get your answer.

1260 ÷ 5 = 252 maple trees
252 ÷ 3 = 84 beech trees
1260 – 252 – 84 = 924 oak trees

O : B = 924 : 84
O : B = 11 : 1 hence n = 11

2) a : b is 2 : 5 and b : c is 3 : 8

Work out a : c

Give your answer in its simplest form. $a : c = 3 : 20$

3) Given that $\frac{x}{y} = \frac{1}{3}$ and $\frac{y}{z} = \frac{4}{5}$

find x : z $x : z = 4 : 15$

4) $p : q = 1 : 5$

Circle the correct equation.

$q = \frac{p}{5}$ $q = p + 4$ $q = p - 4$ (circled) $q = 5p$

5) $a : b = 7 : 2$

Form an equation. $2a = 7b$ *or equivalent*

6) $x : y = \frac{1}{3} : \frac{2}{5}$

What is x as a fraction of y?

Circle your answer.

$\frac{1}{5}$ (circled) $\frac{5}{6}$ $\frac{3}{8}$ $\frac{6}{5}$

Mathematical Reasoning

1) Meg says,

"The sum of three prime numbers is always odd."

Write an example to show that Meg is incorrect.

2) Mike says.

"If you cube a prime number, the result will always be odd."

Give an example to show that Mike is wrong.

3) Explain why an odd number plus another odd number plus an even number is always even.

4) P is an odd number.

Q is an even number.

Explain why $2P + 2Q - 1$ is always odd.

5) P is an odd number.

Q is an even number.

Tim says that $P + Q$ is always a prime number.

Explain why Tim is wrong.

Mathematical Reasoning

1) Meg says,

"The sum of three prime numbers is always odd."

Write an example to show that Meg is incorrect.

2 + 3 + 5 = 10

Other examples are possible, but one of the chosen prime numbers should be 2.

2) Mike says.

"If you cube a prime number, the result will always be odd."

Give an example to show that Mike is wrong.

$2^3 = 8$

3) Explain why an odd number plus another odd number plus an even number is always even.

odd + odd = even
even + even = even

4) P is an odd number.

Q is an even number.

Explain why $2P + 2Q - 1$ is always odd.

$2P$ = even
$2Q$ = even

$2P + 2Q$ = even
$2P + 2Q - 1$ = odd

5) P is an odd number.

Q is an even number.

Tim says that $P + Q$ is always a prime number.

Explain why Tim is wrong.

$P + Q$ will be odd, but not all odd numbers are prime numbers. For example, if $P = 5$ and $Q = 4$, then $P + Q = 9$, but 9 is not a prime number as it is divisible by 3.

Factorising and Solving Quadratics

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$

b) $x^2 + 9x + 20 = 0$

c) $x^2 + x - 6 = 0$

d) $x^2 + 5x - 24 = 0$

e) $x^2 - 6x + 8 = 0$

f) $x^2 - 3x - 28 = 0$

g) $2x^2 + 7x + 3 = 0$

h) $6x^2 + 11x + 3 = 0$

i) $3x^2 + 13x - 10 = 0$

j) $3x^2 - 34x + 63 = 0$

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

Was Lucy correct?
Show working to justify your answer

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct?
Show working to justify your answer

Factorising and Solving Quadratics

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$ $(x + 2)(x + 3) = 0$ $x = -2$ or -3

b) $x^2 + 9x + 20 = 0$ $(x + 4)(x + 5) = 0$ $x = -4$ or -5

c) $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3$ or 2

d) $x^2 + 5x - 24 = 0$ $(x + 8)(x - 3) = 0$ $x = -8$ or 3

e) $x^2 - 6x + 8 = 0$ $(x - 2)(x - 4) = 0$ $x = 2$ or 4

f) $x^2 - 3x - 28 = 0$ $(x - 7)(x + 4) = 0$ $x = 7$ or -4

g) $2x^2 + 7x + 3 = 0$ $(x + 3)(2x + 1) = 0$ $x = -3$ or $-\frac{1}{2}$

h) $6x^2 + 11x + 3 = 0$ $(2x + 3)(3x + 1) = 0$ $x = -\frac{3}{2}$ or $-\frac{1}{3}$

i) $3x^2 + 13x - 10 = 0$ $(x + 5)(3x - 2) = 0$ $x = -5$ or $\frac{2}{3}$

j) $3x^2 - 34x + 63 = 0$ $(3x - 7)(x - 9) = 0$ $x = \frac{7}{3}$ or 9

2) Lucy said that -1 is the only solution of x that satisfies the equation
$x^2 + 2x + 1 = 0$

Was Lucy correct? Yes

Show working to justify your answer

$x^2 + 2x + 1 = 0$

$(x + 1)(x + 1) = 0$

so $x = -1$

3) Ben said that -5 is the only solution of x that satisfies the equation
$x^2 + 10x + 25 = 0$

Was Ben correct? Yes

Show working to justify your answer

$x^2 + 10x + 25 = 0$

$(x + 5)(x + 5) = 0$

so $x = -5$

The Difference of Two Squares

1) Factorise

a) $x^2 - 16$

b) $a^2 - b^2$

c) $y^2 - 9$

d) $x^2 - 1$

e) $x^2 - \frac{1}{4}$

f) $x^2 - \frac{1}{9}$

2) Factorise

a) $x^2 - 4y^2$

b) $9a^2 - b^2$

c) $9x^2 - 16y^2$

d) $\frac{1}{4}x^2 - y^2$

e) $4x^2 - 25y^2$

f) $x^2 - \frac{1}{9}y^2$

3) Simplify

a) $\frac{y^2-4}{y+2} \times \frac{5}{y+5}$

b) $\frac{3}{2x+1} \times \frac{4x^2-1}{x-2}$

c) $\frac{12x^2+8x}{9x^2-4}$

d) $\frac{25a^2-16b^2}{10ab-8b^2}$

4) Solve

a) $4x^2 - 16 = 0$

b) $25x^2 = 1$

c) $49x^2 = 121$

d) $9x^2 - 9 = 7$

The Difference of Two Squares

1) Factorise

a) $x^2 - 16$

$(x - 4)(x + 4)$

b) $a^2 - b^2$

$(a - b)(a + b)$

c) $y^2 - 9$

$(y - 3)(y + 3)$

d) $x^2 - 1$

$(x - 1)(x + 1)$

e) $x^2 - \frac{1}{4}$

$(x - \frac{1}{2})(x + \frac{1}{2})$

f) $x^2 - \frac{1}{9}$

$(x - \frac{1}{3})(x + \frac{1}{3})$

2) Factorise

a) $x^2 - 4y^2$

$(x - 2y)(x + 2y)$

b) $9a^2 - b^2$

$(3a - b)(3a + b)$

c) $9x^2 - 16y^2$

$(3x - 4y)(3x + 4y)$

d) $\frac{1}{4}x^2 - y^2$

$(\frac{1}{2}x - y)(\frac{1}{2}x + y)$

e) $4x^2 - 25y^2$

$(2x - 5y)(2x + 5y)$

f) $x^2 - \frac{1}{9}y^2$

$(x - \frac{1}{3}y)(x + \frac{1}{3}y)$

3) Simplify

a) $\frac{y^2-4}{y+2} \times \frac{5}{y+5}$

$\frac{5(y - 2)}{y + 5}$

b) $\frac{3}{2x+1} \times \frac{4x^2-1}{x-2}$

$\frac{3(2x - 1)}{x - 2}$

c) $\frac{12x^2+8x}{9x^2-4}$

$\frac{4x}{3x - 2}$

d) $\frac{25a^2-16b^2}{10ab-8b^2}$

$\frac{5a + 4b}{2b}$

4) Solve

a) $4x^2 - 16 = 0$

$x = 2$, $x = -2$

b) $25x^2 = 1$

$x = \frac{1}{5}$, $x = -\frac{1}{5}$

c) $49x^2 = 121$

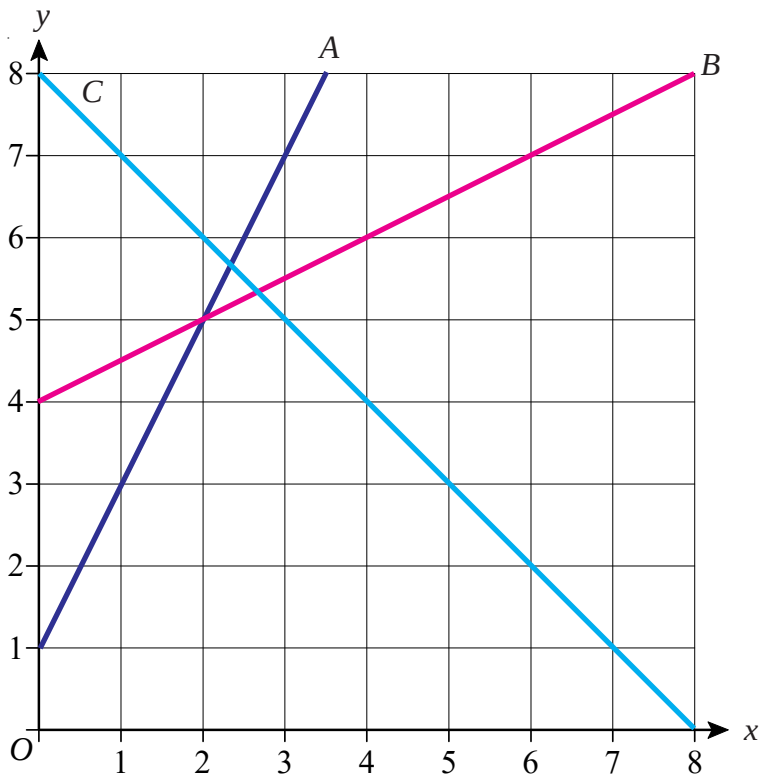
$x = 1\frac{4}{7}$, $x = -1\frac{4}{7}$

d) $9x^2 - 9 = 7$

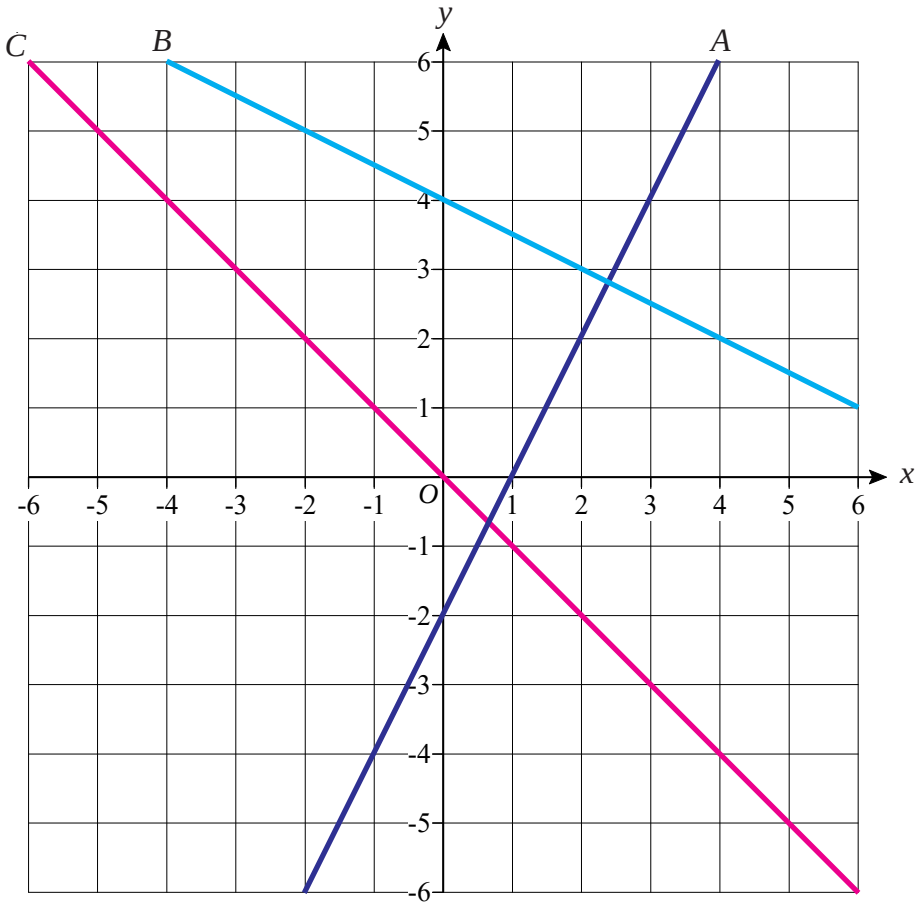
$x = 1\frac{1}{3}$, $x = -1\frac{1}{3}$

Finding the Equation of a Straight Line

1) Find the equations of lines *A*, *B* and *C* on the axes below



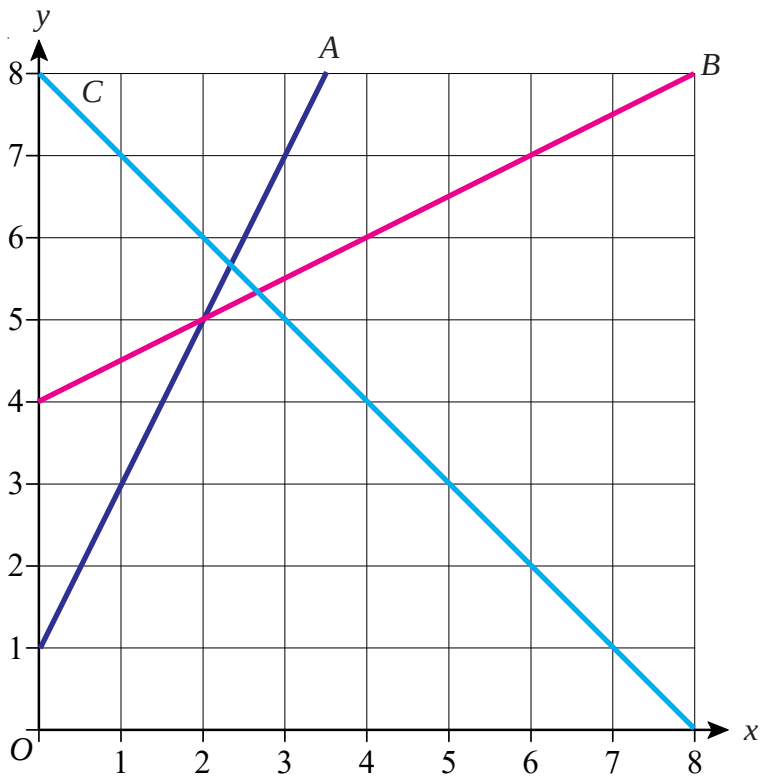
2) Find the equations of lines *A*, *B* and *C* on the axes below



Finding the Equation of a Straight Line

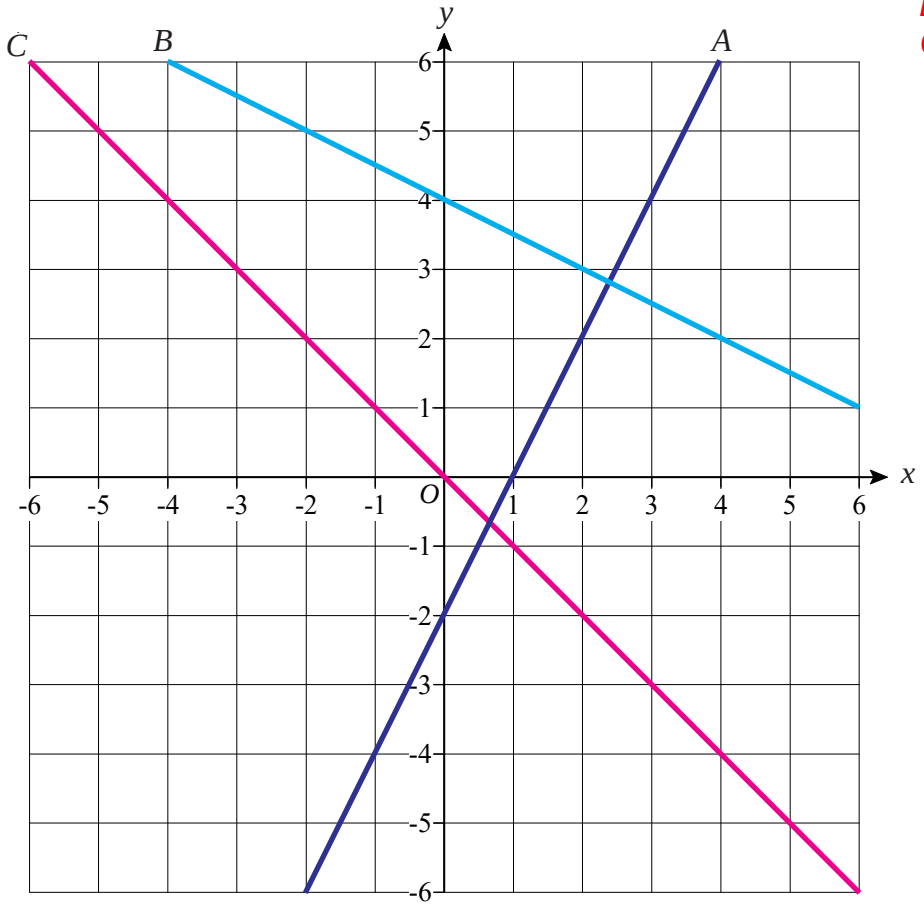
1) Find the equations of lines *A*, *B* and *C* on the axes below

A: $y = 2x + 1$
B: $y = 0.5x + 4$
C: $y = -x + 8$



2) Find the equations of lines *A*, *B* and *C* on the axes below

A: $y = 2x - 2$
B: $y = -0.5x + 4$
C: $y = -x$



Roots and Turning Points of Quadratics

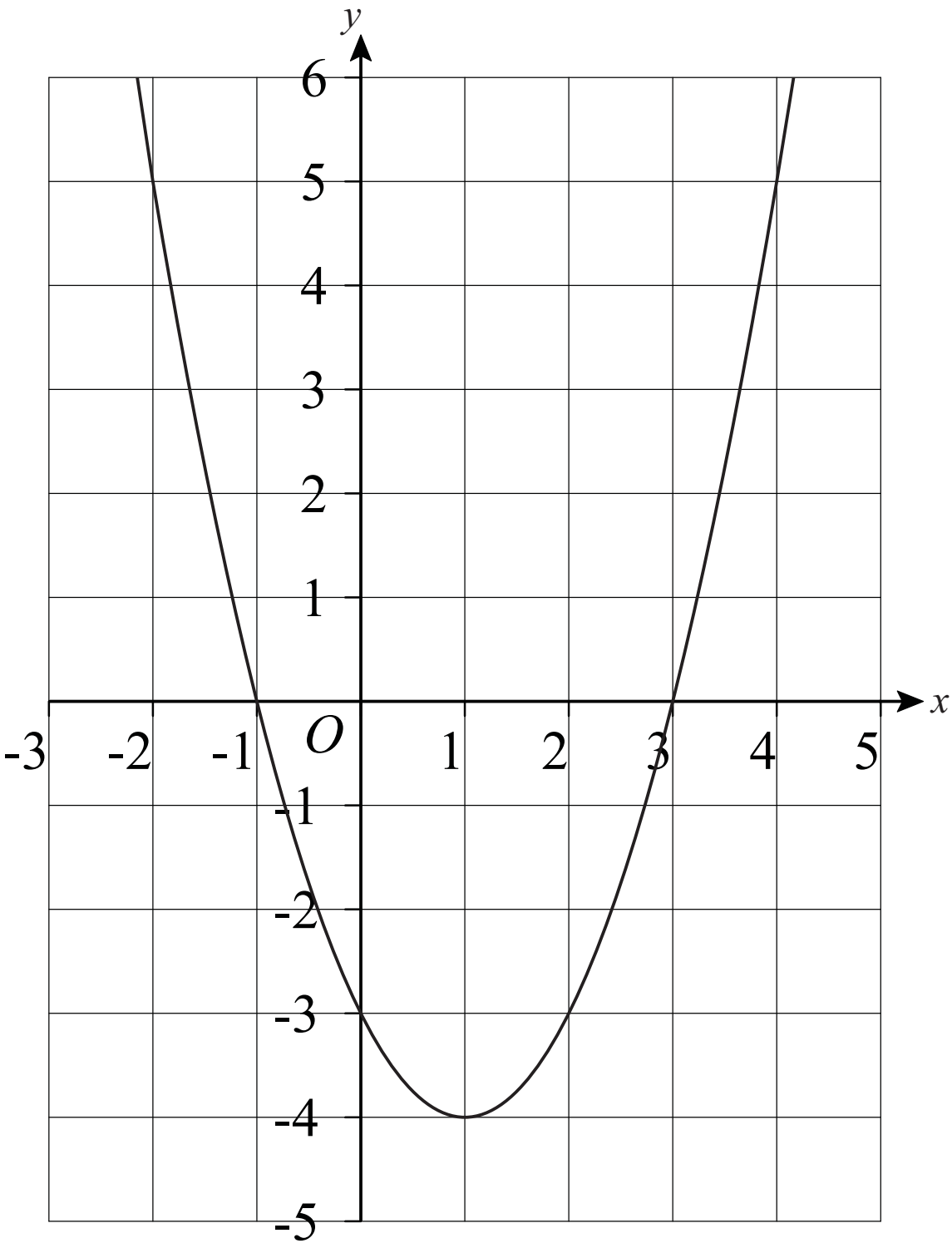
1) The graph of $y = x^2 - 2x - 3$ is shown.

Write down the coordinates of:

a) The turning point of the curve.

b) The roots of the equation $x^2 - 2x - 3 = 0$

c) The intersection of the curve with the y-axis.



Roots and Turning Points of Quadratics

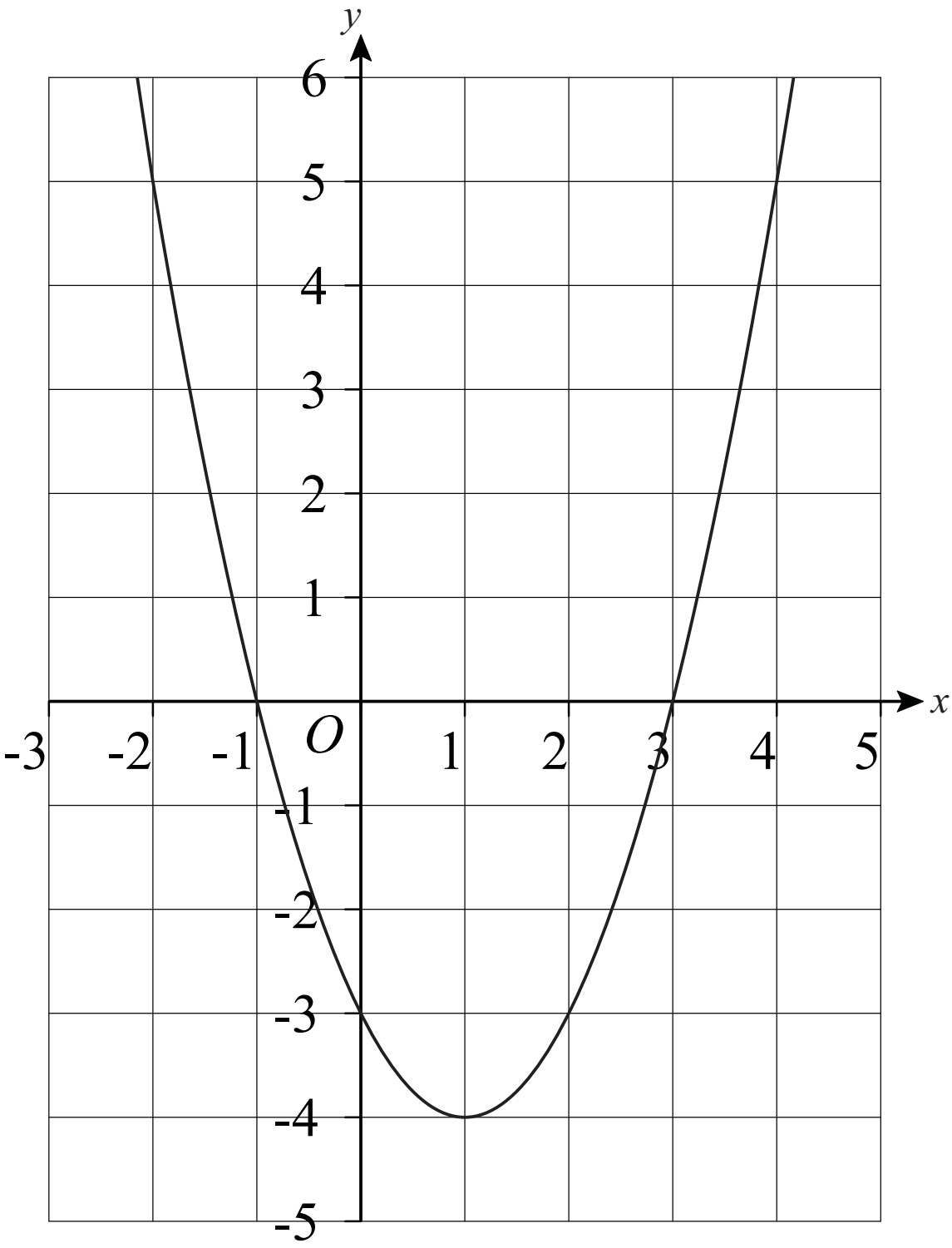
1) The graph of $y = x^2 - 2x - 3$ is shown.

Write down the coordinates of:

a) The turning point of the curve. (1, -4)

b) The roots of the equation $x^2 - 2x - 3 = 0$ (-1, 0), (3, 0)

c) The intersection of the curve with the y-axis. (0, -3)



Simultaneous Equations Algebraically

1) Solve

$4x + 3y = 6$
$5x - 3y = 21$

2) Solve

$4x + 3y = 19$
$3x - 5y = 7$

3) Solve

$3x + 5y = 13$
$2x + 3y = 8$

4) Solve

$x + 4y = 5$
$4x - 2y = 11$

5) Solve

$2a + b = 3$
$4a - 5b = 20$

6) Solve

$5x + 3y = 4$
$3x + 4y = 9$

7) Solve

$6x - 2y = 13$
$2x + 3y = -3$

8) Solve

$3a - 2b = 14$
$4a + 3b = 13$

9) Solve

$5x + 4y = 5$
$2x + 7y = 29$

10) Solve

$6x - 4y = 39$
$2x + y = 6$

Simultaneous Equations Algebraically

1) Solve

$4x + 3y = 6$
$5x - 3y = 21$

$x = 3$ and $y = -2$

2) Solve

$4x + 3y = 19$
$3x - 5y = 7$

$x = 4$ and $y = 1$

3) Solve

$3x + 5y = 13$
$2x + 3y = 8$

$x = 1$ and $y = 2$

4) Solve

$x + 4y = 5$
$4x - 2y = 11$

$x = 3$ and $y = 0.5$

5) Solve

$2a + b = 3$
$4a - 5b = 20$

$a = 2.5$ and $b = -2$

6) Solve

$5x + 3y = 4$
$3x + 4y = 9$

$x = -1$ and $y = 3$

7) Solve

$6x - 2y = 13$
$2x + 3y = -3$

$x = 1.5$ and $y = -2$

8) Solve

$3a - 2b = 14$
$4a + 3b = 13$

$a = 4$ and $b = -1$

9) Solve

$5x + 4y = 5$
$2x + 7y = 29$

$x = -3$ and $y = 5$

10) Solve

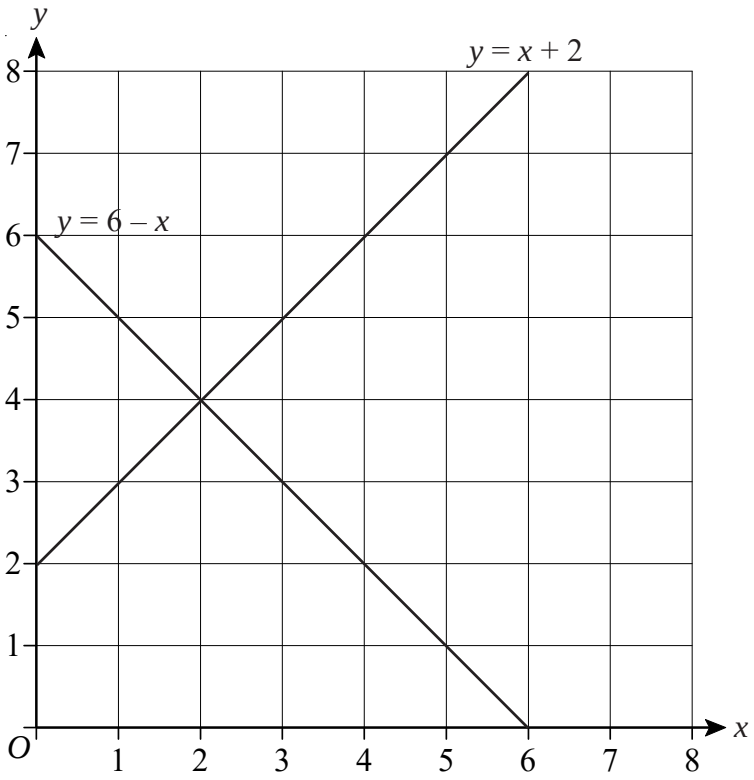
$6x - 4y = 39$
$2x + y = 6$

$x = 4.5$ and $y = -3$

Simultaneous Equations Graphically

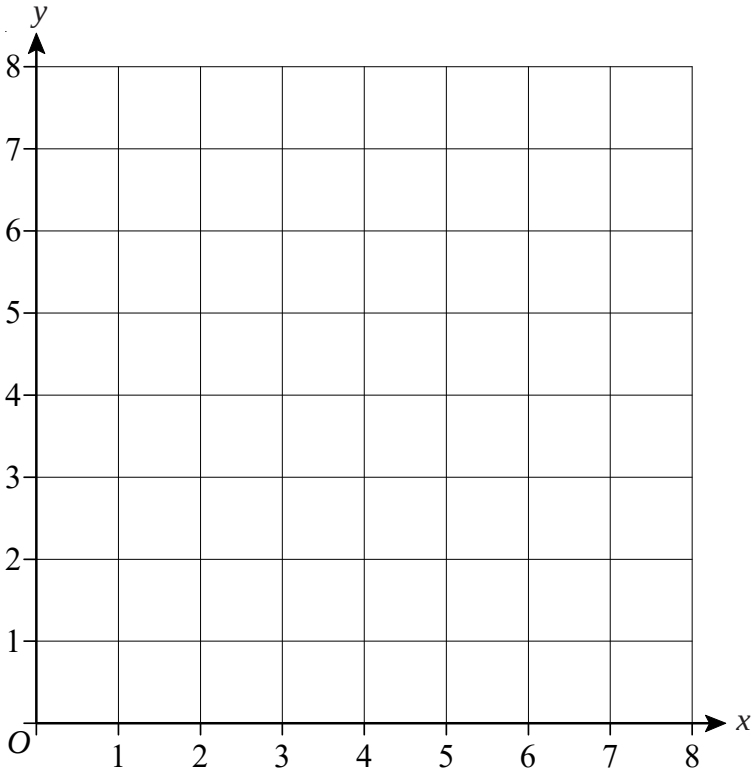
1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$



2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

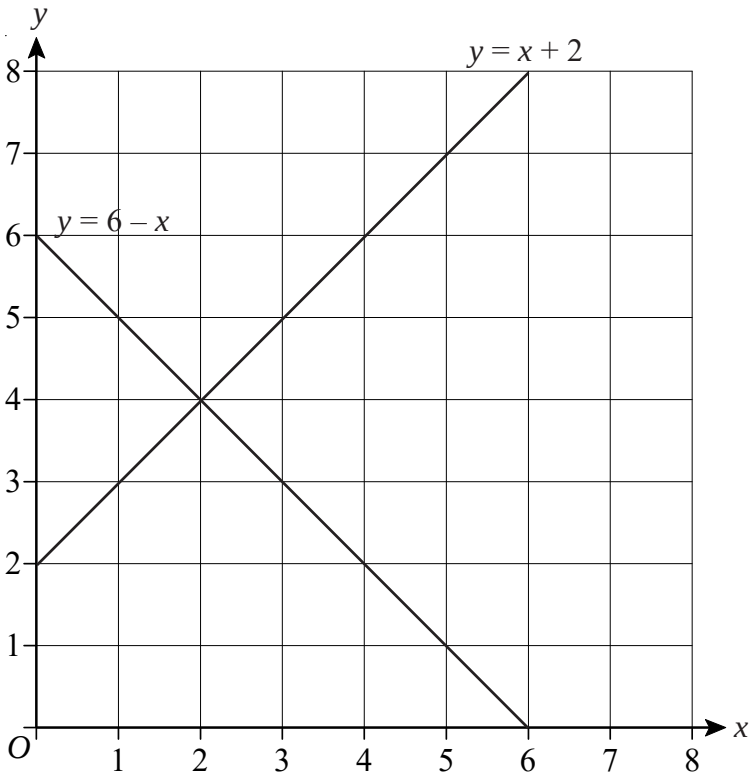


Simultaneous Equations Graphically

1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$

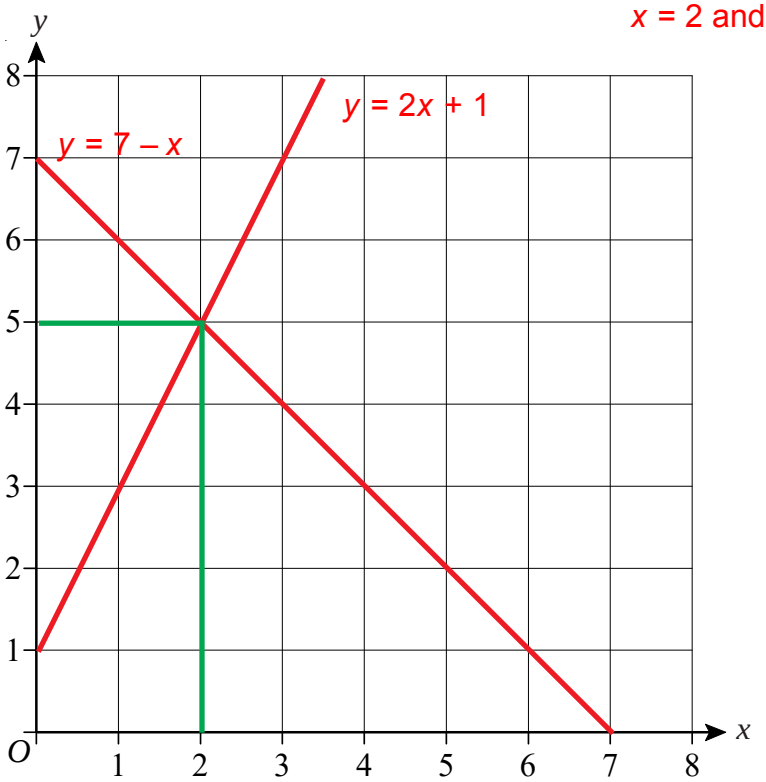
$x = 2$
$y = 4$



2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$

Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

$x = 2$ and $y = 5$



Solving Linear Inequalities

1) Solve

a) $3x - 1 > 5$

b) $7y + 2 \leq 30$

c) $\frac{x}{2} - 3 \geq 2$

d) $5 + 2x > 7$

e) $8 < 5p - 2$

f) $\frac{y}{3} + 5 \geq 3$

g) $\frac{2x}{3} - 5 \geq -3$

h) $6x - 5 > 2x + 3$

i) $3p - 9 < 6 - 2p$

j) $5 - 3y < 2y - 10$

2) a) Solve the inequality

$2z + 2 \geq 7$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z + 2 \geq 7$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

$x =$ ....., $y =$ .....

and

$x =$ ....., $y =$ .....

Solving Linear Inequalities

1) Solve

a) $3x - 1 > 5$

$x > 2$

b) $7y + 2 \leq 30$

$y \leq 4$

c) $\frac{x}{2} - 3 \geq 2$

$x \geq 10$

d) $5 + 2x > 7$

$x > 1$

e) $8 < 5p - 2$

$2 < p$

f) $\frac{y}{3} + 5 \geq 3$

$y \geq -6$

g) $\frac{2x}{3} - 5 \geq -3$

$x \geq 3$

h) $6x - 5 > 2x + 3$

$x > 2$

i) $3p - 9 < 6 - 2p$

$p < 3$

j) $5 - 3y < 2y - 10$

$3 < y$

2) a) Solve the inequality

$2z + 2 \geq 7$

$z \geq 2.5$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z + 2 \geq 7$

$z = 3$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

$x =$ ....1...., $y =$ ....1....

and

$x =$ ....1...., $y =$ ....2....

other pairs of values are possible.

Solving Equations and Linear Inequalities

1) Solve the inequality $6x - 3 < 9$

2) Solve $4x + 1 = 2x + 12$

3) a) Solve the inequality $3t + 1 < t + 13$

b) If $2t^2 = 72$ find a value of t

4) Solve $3(x + 2) = 8$

5) Solve the inequality $6y \geqslant y + 10$

6) Solve $4(2x - 3) = 5x + 7$

7) $h = 5t^2 + 3$
Work out the value of t when $h = 48$

8) Solve $3(2p - 4) = 2p + 12$

9) Solve the equation $4x + 1 = 19$

10) Solve $\dfrac{29 - x}{3} = x + 5$

11) Solve $3x - 10 = x + 30$

12) Solve the inequality $3x - 2 > x + 7$

13) Solve the inequality $\dfrac{2x}{3} < 10$

Solving Equations and Linear Inequalities

1) Solve the inequality $6x - 3 < 9$

$x < 2$

2) Solve $4x + 1 = 2x + 12$

$x = 5.5$

3) a) Solve the inequality $3t + 1 < t + 13$

$t < 6$

b) If $2t^2 = 72$ find a value of t

$t = 6$ (or -6)

4) Solve $3(x + 2) = 8$ $x = \frac{2}{3}$

5) Solve the inequality $6y \geqslant y + 10$

$y \geqslant 2$

6) Solve $4(2x - 3) = 5x + 7$ $x = 6\frac{1}{3}$

7) $h = 5t^2 + 3$

Work out the value of t when $h = 48$ $t = 3$ or -3

8) Solve $3(2p - 4) = 2p + 12$

$p = 6$

9) Solve the equation $4x + 1 = 19$

$x = 4.5$

10) Solve $\frac{29 - x}{3} = x + 5$ $x = 3.5$

11) Solve $3x - 10 = x + 30$ $x = 20$

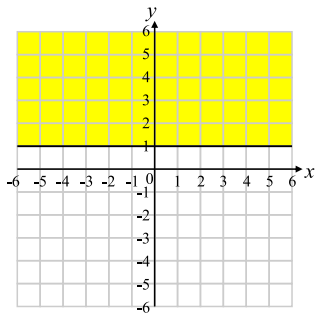
12) Solve the inequality $3x - 2 > x + 7$ $x > 4.5$

13) Solve the inequality $\frac{2x}{3} < 10$ $x < 15$

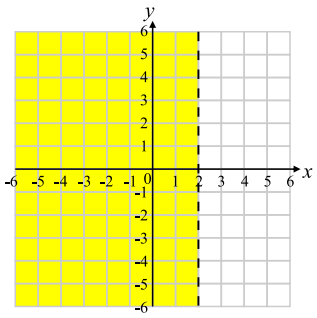
Inequalities on a Graph

1) For each question below, find the inequality that is represented by the shaded region.

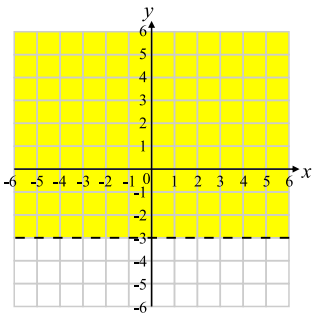
a)



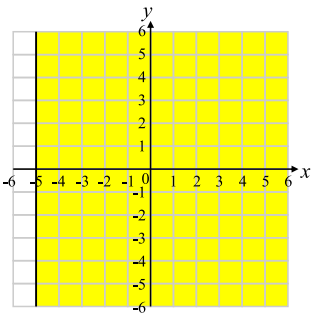
b)



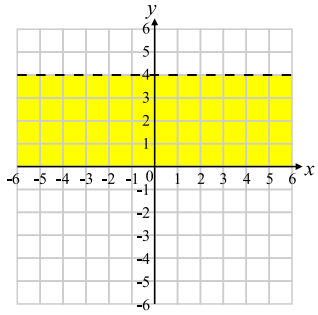
c)



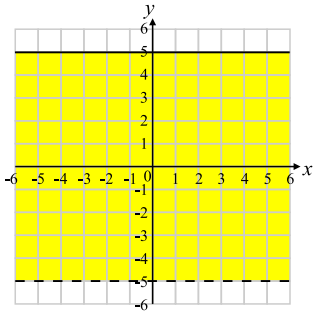
d)



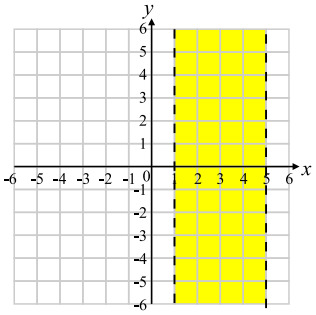
e)



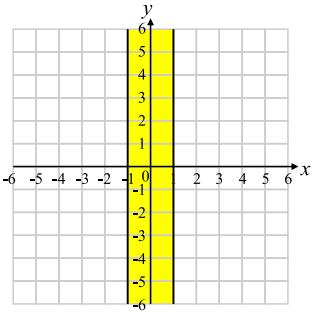
f)



g)

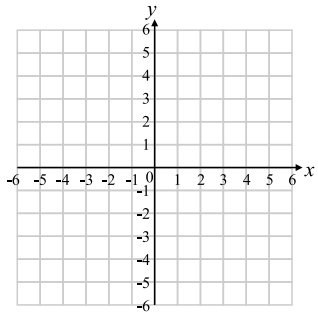


h)

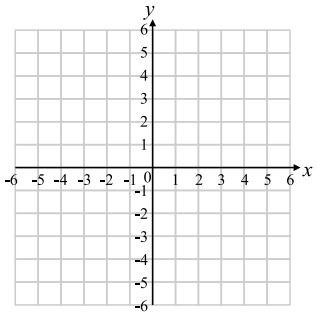


2) For each question below, shade the region represented by the inequality given.

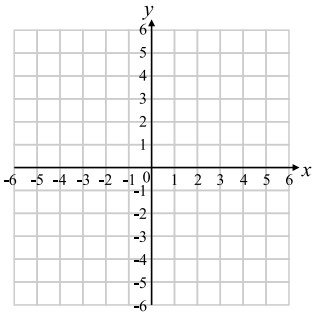
a) $x \geq 3$



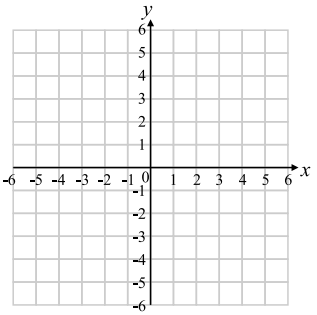
b) $y < 1$



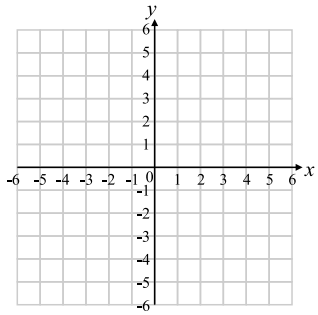
c) $x < -4$



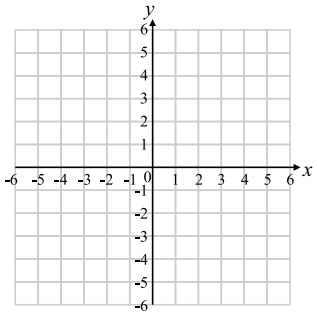
d) $y \geq 2$



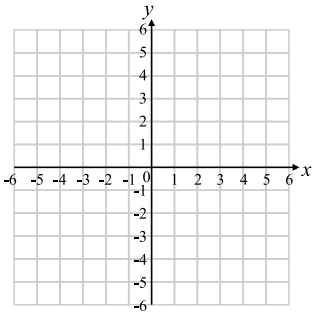
e) $-1 \leq x \leq 4$



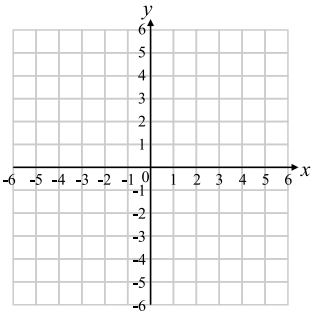
f) $-3 < y < 4$



g) $-2 \leq y < 2$



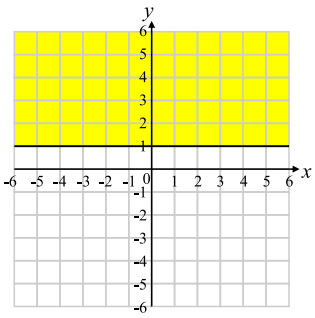
h) $-5 < x \leq -1$



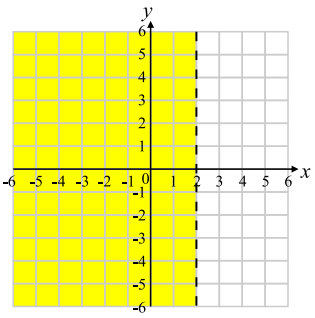
Inequalities on a Graph

1) For each question below, find the inequality that is represented by the shaded region.

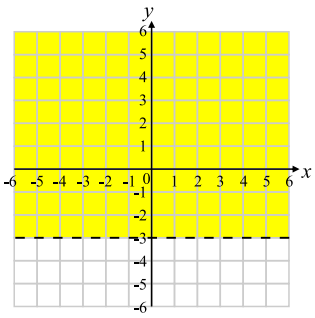
a) $y \geq 1$



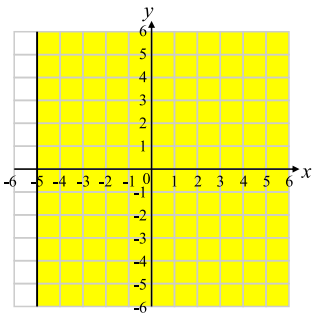
b) $x < 2$



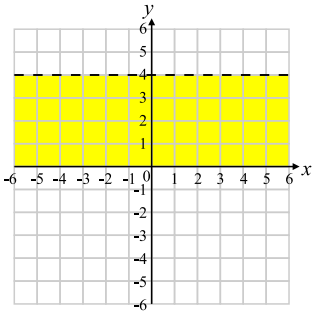
c) $y > -3$



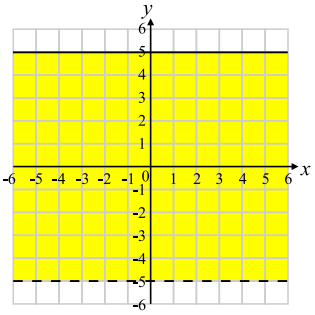
d) $x \geq -5$



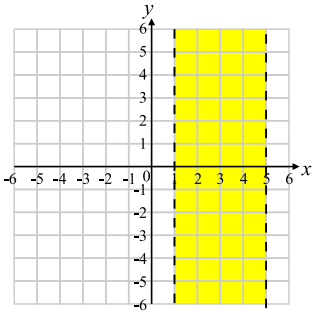
e) $0 \leq y < 4$



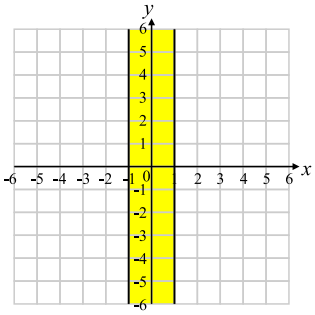
f) $-5 < y \leq 5$



g) $1 < x < 5$

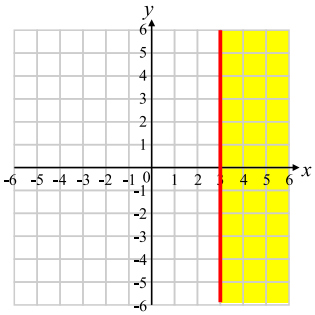


h) $-1 \leq x \leq 1$

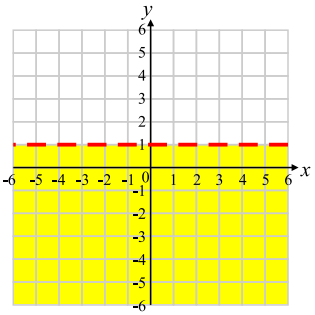


2) For each question below, shade the region represented by the inequality given.

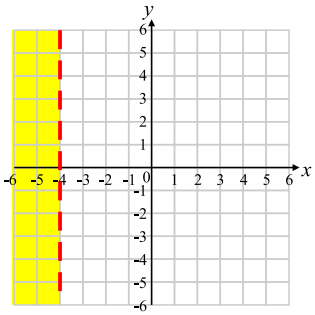
a) $x \geq 3$



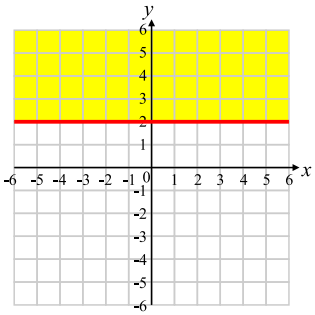
b) $y < 1$



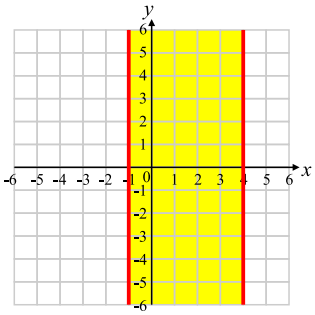
c) $x < -4$



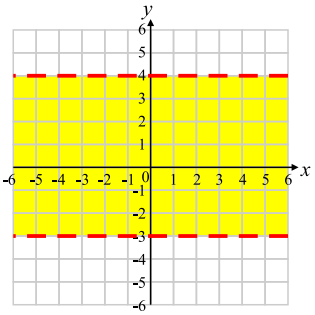
d) $y \geq 2$



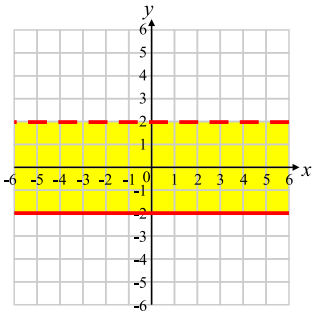
e) $-1 \leq x \leq 4$



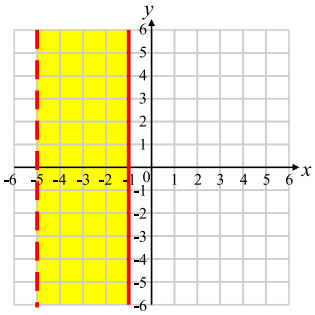
f) $-3 < y < 4$



g) $-2 \leq y < 2$



h) $-5 < x \leq -1$



Compound Units

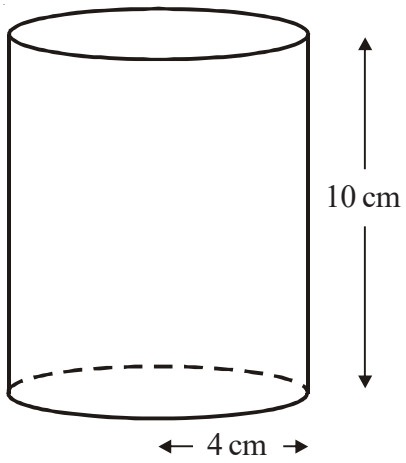
1) An ice hockey puck has a volume of 113 cm^3.
It is made out of rubber with a density of 1.5 grams per cm^3.
Work out the mass of the ice hockey puck.

2) An apple has a mass of 160 g and a volume of 100 cm^3.
Find its density in g/cm^3.

3) A steel ball has a volume of 1500 cm^3.
The density of the ball is 95 g/cm^3.
Find the mass of the ball **in kg**.

4) The mass of a bar of chocolate is 1800 g.
The density of the chocolate is 9 g/cm^3.
What is the volume of the bar of chocolate?

5) A solid cylinder has a radius of 4 cm and a height of 10 cm.



a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

The cylinder is made of wood.
The density of the wood is 0.7 grams per cm^3

b) Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

Compound Units

1) An ice hockey puck has a volume of 113 cm^3.
It is made out of rubber with a density of 1.5 grams per cm^3.
Work out the mass of the ice hockey puck.

M = 169.5 g

2) An apple has a mass of 160 g and a volume of 100 cm^3.
Find its density in g/cm^3.

D = 1.6 g/cm^3

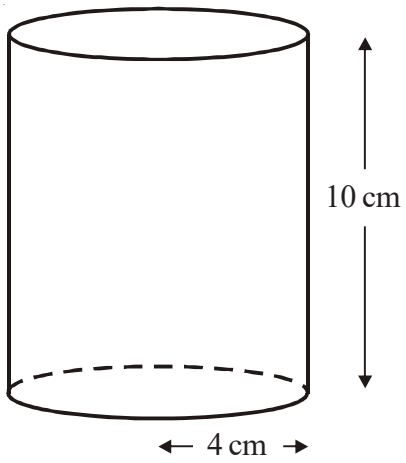
3) A steel ball has a volume of 1500 cm^3.
The density of the ball is 95 g/cm^3.
Find the mass of the ball **in kg**.

M = 142.5 kg

4) The mass of a bar of chocolate is 1800 g.
The density of the chocolate is 9 g/cm^3.
What is the volume of the bar of chocolate?

V = 200 cm^3

5) A solid cylinder has a radius of 4 cm and a height of 10 cm.



a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

503 cm^3

The cylinder is made of wood.
The density of the wood is 0.7 grams per cm^3

b) Work out the mass of the cylinder.
Give your answer correct to 3 significant figures.

352 g

Compound Units

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

1) Work out the **pressure** when the force is 150 newtons and the area is 30cm^2.
Circle your answer.

A. 120N/cm^2 B. 180N/cm^2 C. 50N/cm^2 D. 5N/cm^2

2) Work out the **force** when the pressure is 30N/m^2 and the area is 5m^2.
Circle your answer.

A. 150N B. 35N C. 25N D. 6N

3) A solid block exerts a force of 220 newtons on a surface area of 100cm^2.

Work out the pressure, giving the units of your answer.

4) A box exerts a force of 100 newtons on a table.
The pressure on the table as a result of the force applied by the box is 5N/cm^2.

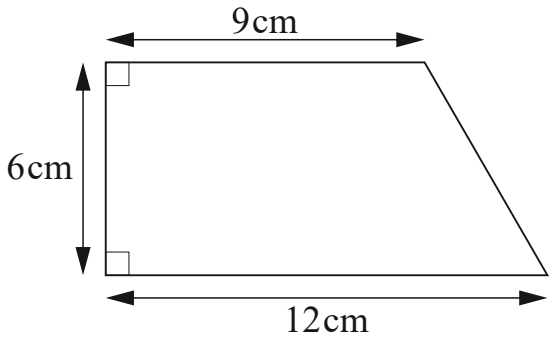
Work out the surface area of the box that is in contact with the table.

5) A tank exerts a force of 600 newtons on the ground.
The base of the tank in contact with the ground is a 2.5m by 1.2m rectangle.

Work out the pressure applied to the ground by the tank.

6) A force is applied to the surface of this trapezium.
The resulting pressure on the trapezium is 5N/cm^2.

Work out the force applied in newtons.



Compound Units

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

1) Work out the **pressure** when the force is 150 newtons and the area is 30cm^2.
Circle your answer.

A. 120N/cm^2 B. 180N/cm^2 C. 50N/cm^2 D. 5N/cm^2

2) Work out the **force** when the pressure is 30N/m^2 and the area is 5m^2.
Circle your answer.

A. 150N B. 35N C. 25N D. 6N

3) A solid block exerts a force of 220 newtons on a surface area of 100cm^2.

Work out the pressure, giving the units of your answer. 2.2N/cm^2

4) A box exerts a force of 100 newtons on a table.
The pressure on the table as a result of the force applied by the box is 5N/cm^2.

Work out the surface area of the box that is in contact with the table. 20cm^2

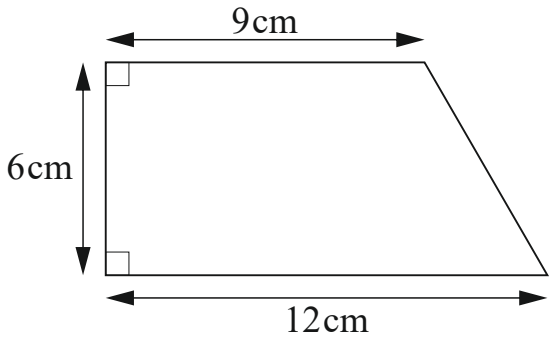
5) A tank exerts a force of 600 newtons on the ground.
The base of the tank in contact with the ground is a 2.5m by 1.2m rectangle.

Work out the pressure applied to the ground by the tank. 200N/m^2

6) A force is applied to the surface of this trapezium.
The resulting pressure on the trapezium is 5N/cm^2.

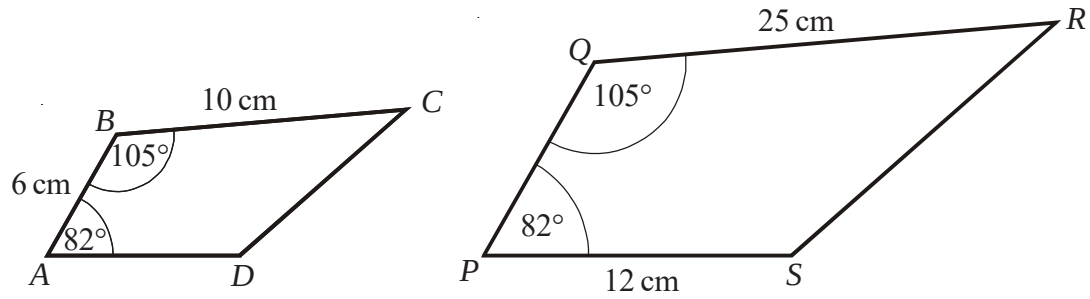
Work out the force applied in newtons.

315N



Similar Shapes

1)

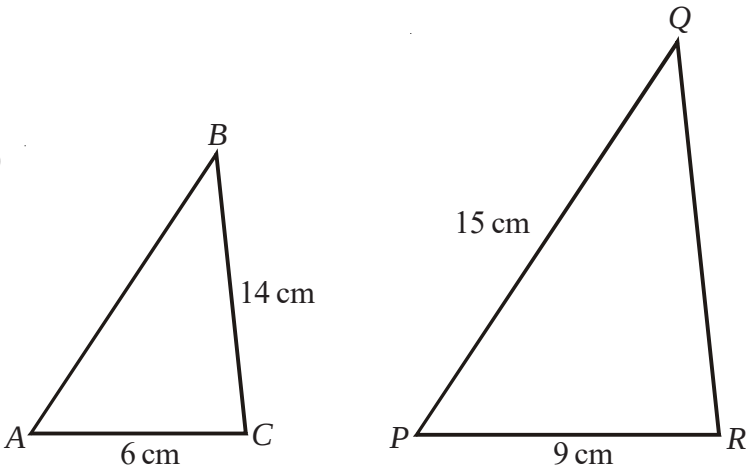


ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*.

b) Find the length of *AD*.

2)



Triangles *ABC* and *PQR* are mathematically similar.

Angle *A* = angle *P*.

Angle *B* = angle *Q*.

Angle *C* = angle *R*.

AC = 6 cm.

BC = 14 cm.

PR = 9 cm.

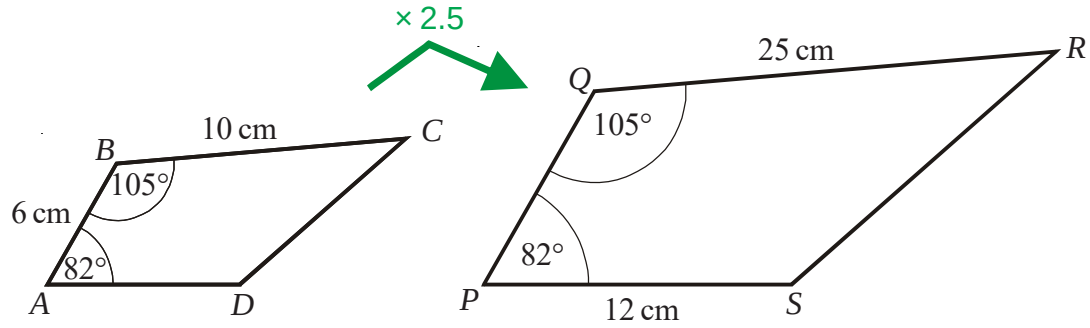
PQ = 15 cm

a) Work out the length of *QR*.

b) Work out the length of *AB*.

Similar Shapes

1)

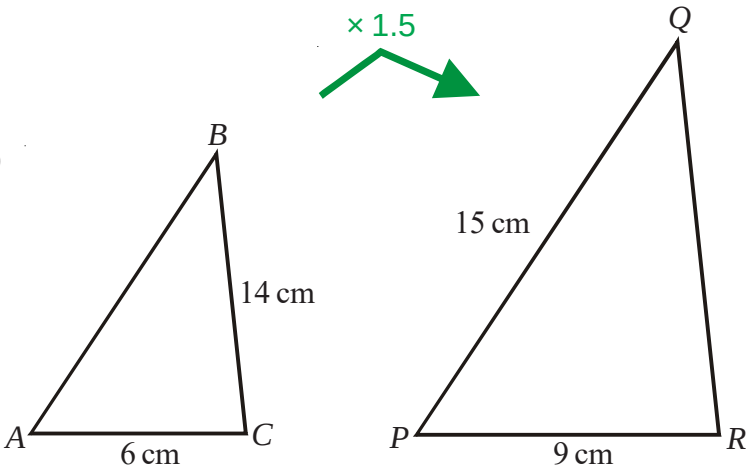


ABCD and *PQRS* are mathematically similar.

a) Find the length of *PQ*. 15 cm

b) Find the length of *AD*. 4.8 cm

2)



Triangles *ABC* and *PQR* are mathematically similar.

Angle *A* = angle *P*.

Angle *B* = angle *Q*.

Angle *C* = angle *R*.

AC = 6 cm.

BC = 14 cm.

PR = 9 cm.

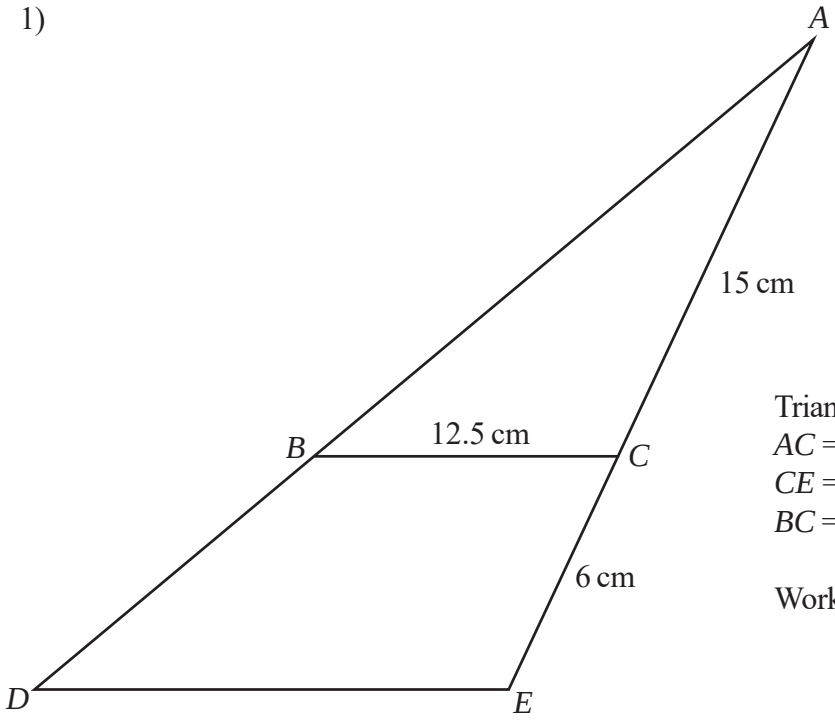
PQ = 15 cm

a) Work out the length of *QR*. 21 cm

b) Work out the length of *AB*. 10 cm

Similar Shapes

1)



Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*.

2) *ABC* and *AED* are straight lines.

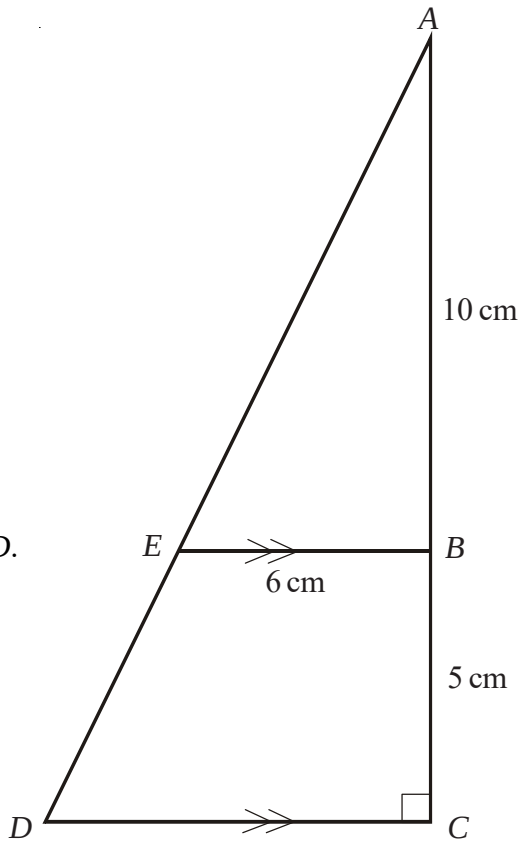
EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

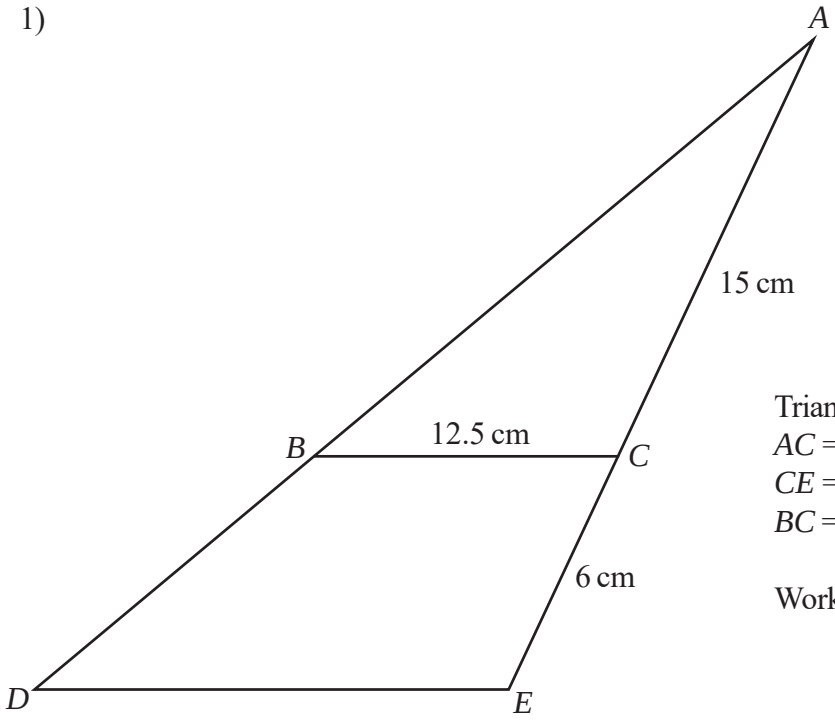
a) Work out the length of *DC*.

b) Work out the area of the trapezium *EBCD*.



Similar Shapes

1)



Triangle *ABC* is similar to triangle *ADE*.
AC = 15 cm.
CE = 6 cm.
BC = 12.5 cm.

Work out the length of *DE*. 17.5 cm

2) *ABC* and *AED* are straight lines.

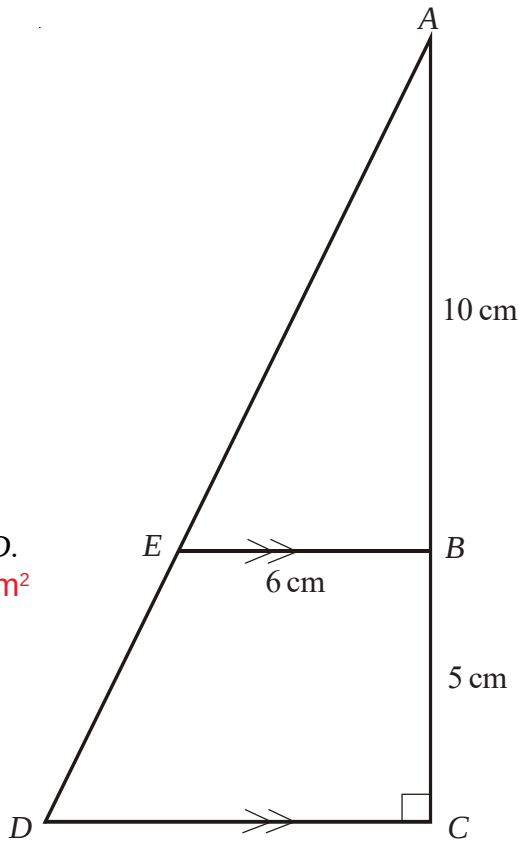
EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

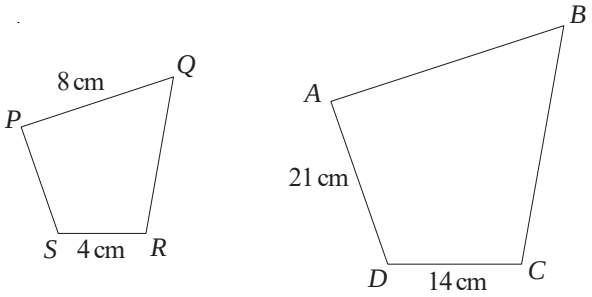
a) Work out the length of *DC*. 9 cm

b) Work out the area of the trapezium *EBCD*. 37.5 cm^2



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.

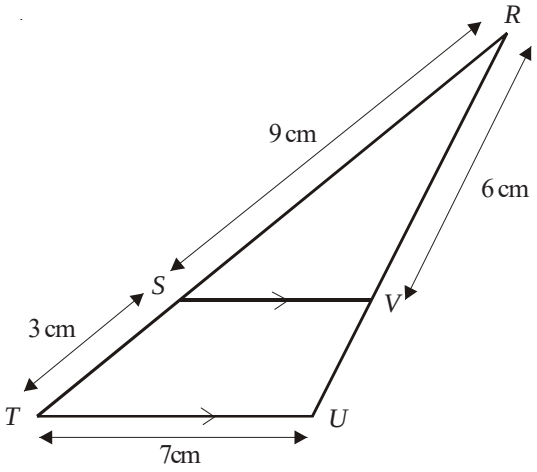


a) Calculate the length of *AB*

b) Calculate the length of *PS*

2) *SV* is parallel to *TU*.
RST and *RVU* are straight lines.
RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

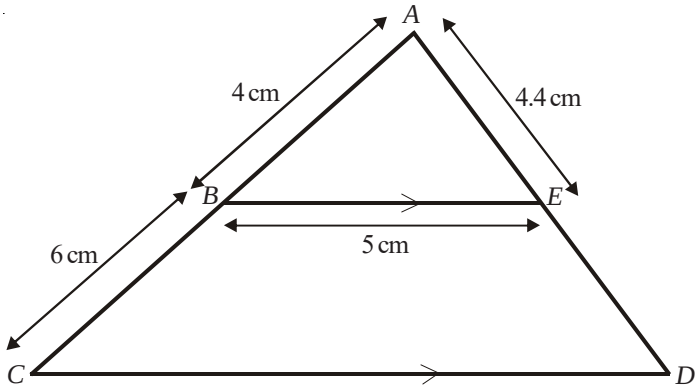
Calculate the length of *VU*.



3) *BE* is parallel to *CD*.
ABC and *AED* are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

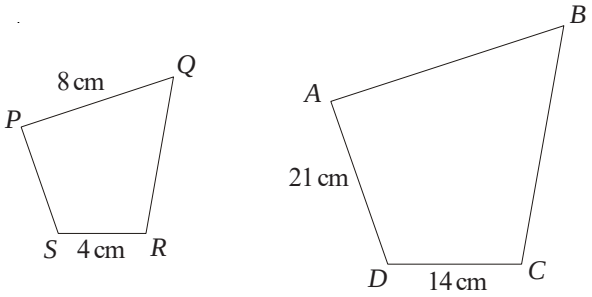
a) Calculate the length of *CD*.

b) Calculate the length of *ED*.



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.

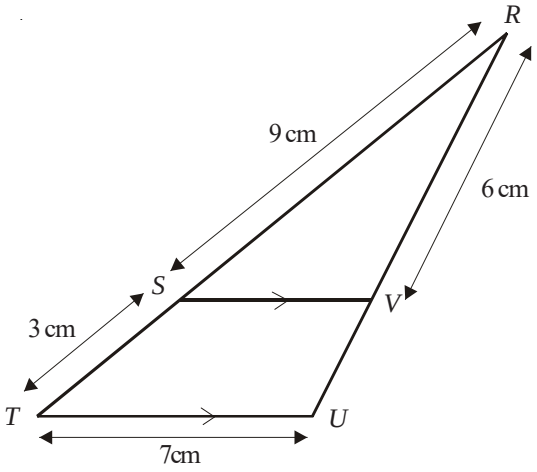


a) Calculate the length of *AB* 28 cm

b) Calculate the length of *PS* 6 cm

2) *SV* is parallel to *TU*.
RST and *RVU* are straight lines.
RS = 9 cm, *ST* = 3 cm, *TU* = 7 cm, *RV* = 6 cm

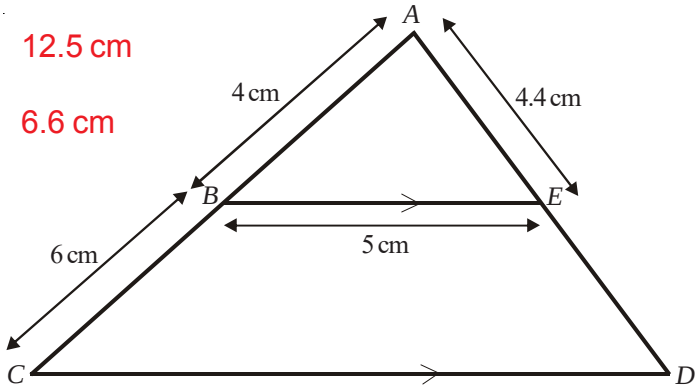
Calculate the length of *VU*. 2 cm



3) *BE* is parallel to *CD*.
ABC and *AED* are straight lines.
AB = 4 cm, *BC* = 6 cm, *BE* = 5 cm, *AE* = 4.4 cm

a) Calculate the length of *CD*. 12.5 cm

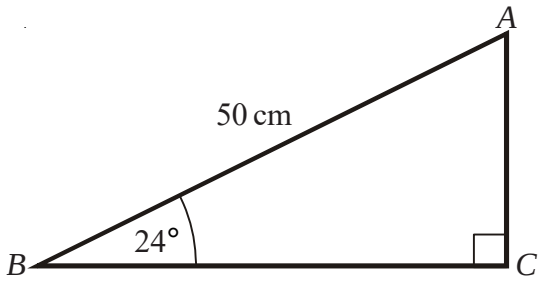
b) Calculate the length of *ED*. 6.6 cm



Trigonometry

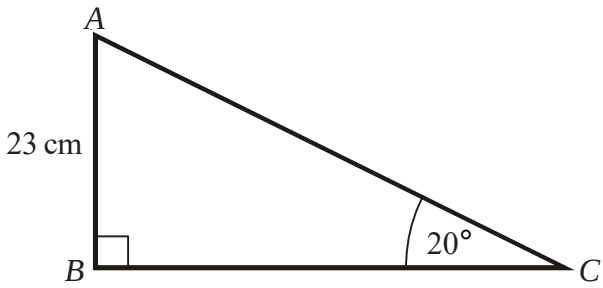
1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



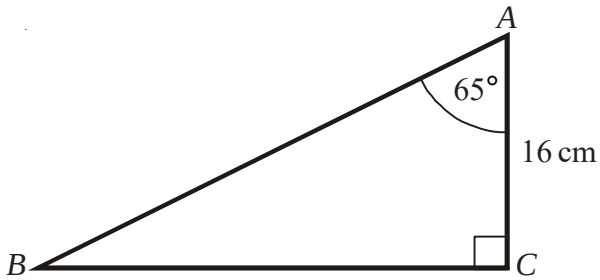
2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

Work out the length of *AC*.
Give your answer correct to 1 decimal place.



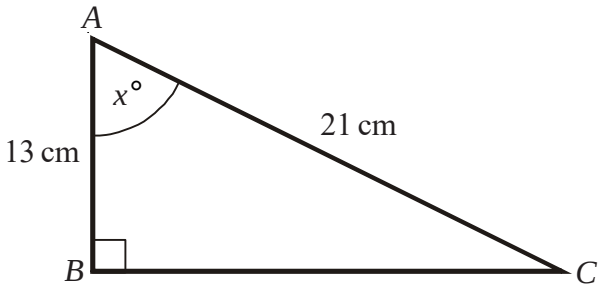
3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



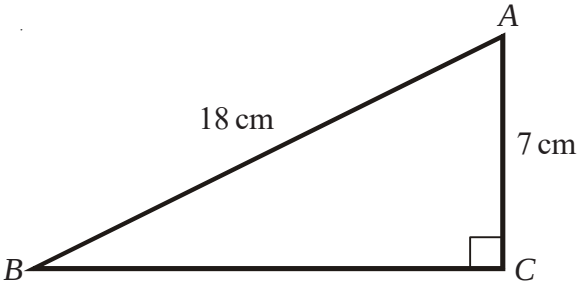
4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

Work out the size of angle *x*.
Give your answer correct to 1 decimal place.



5) *ABC* is a right-angled triangle.
AB = 18 cm.
AC = 7 cm.

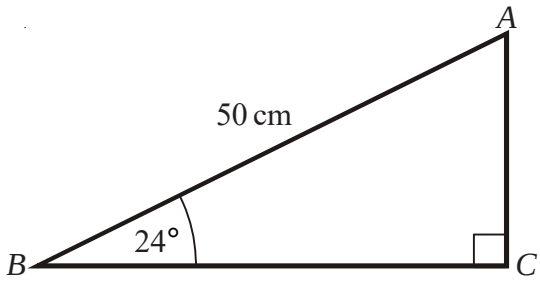
Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.



Trigonometry

1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

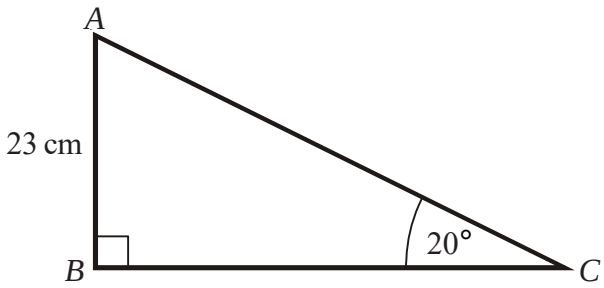
Work out the length of *BC*.
Give your answer correct to 1 decimal place.



45.7 cm

2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

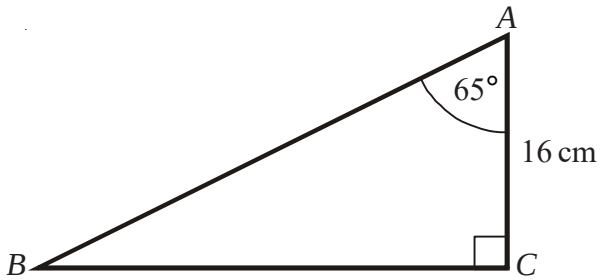
Work out the length of *AC*.
Give your answer correct to 1 decimal place.



67.2 cm

3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

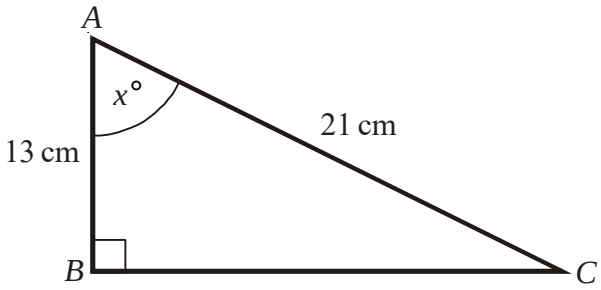
Work out the length of *BC*.
Give your answer correct to 1 decimal place.



34.3 cm

4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

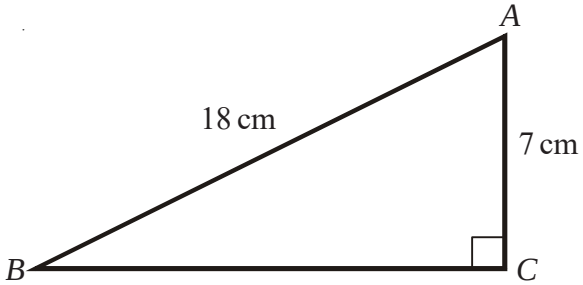
Work out the size of angle *x*.
Give your answer correct to 1 decimal place.



51.8°

5) *ABC* is a right-angled triangle.
AB = 18 cm.
AC = 7 cm.

Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.

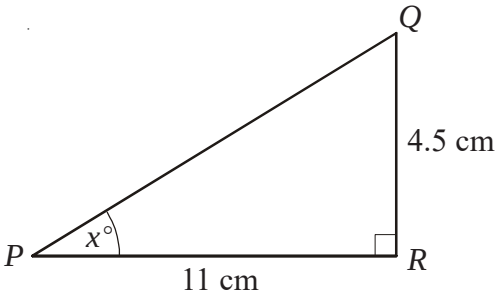


22.9°

Trigonometry

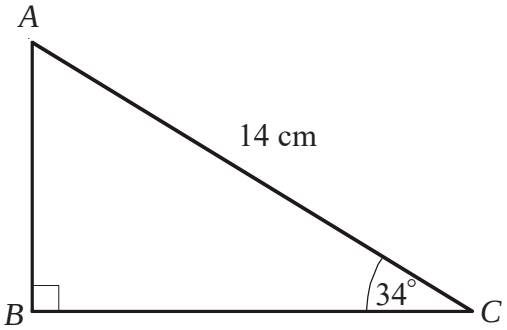
1) PQR is a right-angled triangle.
$PR = 11$ cm.
$QR = 4.5$ cm
Angle $PRQ = 90^\circ$

Work out the value of x.
Give your answer correct to 1 decimal place.



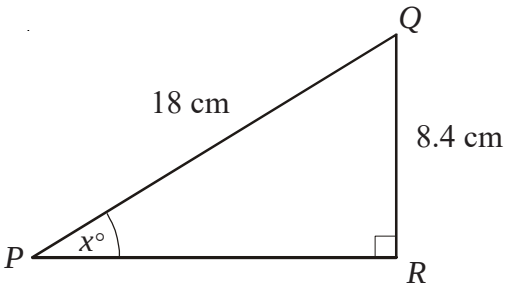
2) $AC = 14$ cm.
Angle $ABC = 90^\circ$
Angle $ACB = 34^\circ$

Calculate the length of BC.
Give your answer correct to
3 significant figures.



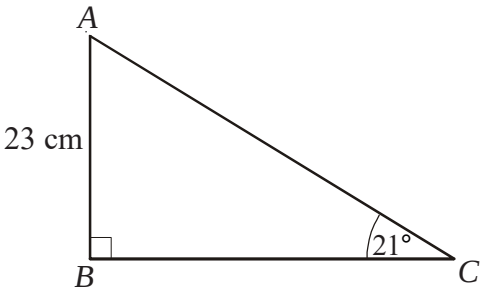
3) PQR is a right-angled triangle.
$PQ = 18$ cm.
$QR = 8.4$ cm
Angle $PRQ = 90^\circ$

Work out the value of x.
Give your answer correct to 1 decimal place.



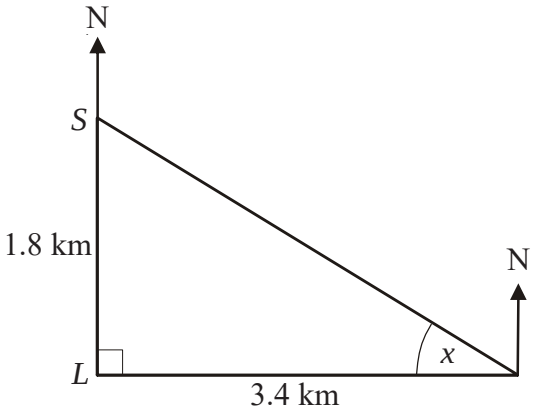
4) $AB = 23$ cm.
Angle $ABC = 90^\circ$
Angle $ACB = 21^\circ$

Calculate the length of AC.
Give your answer correct to
3 significant figures.



5) A lighthouse, L, is 3.4 km due West of a port, P.
A ship, S, is 1.8 km due North of the lighthouse, L.

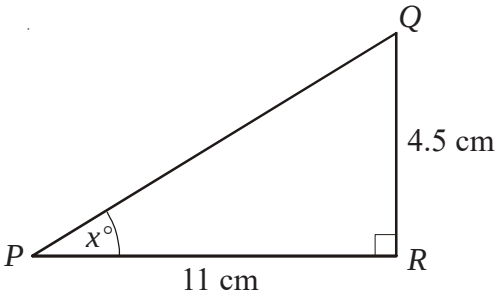
Calculate the size of the angle marked x.
Give your answer correct to 3 significant figures.



Trigonometry

1) PQR is a right-angled triangle.
$PR = 11$ cm.
$QR = 4.5$ cm
Angle $PRQ = 90^\circ$

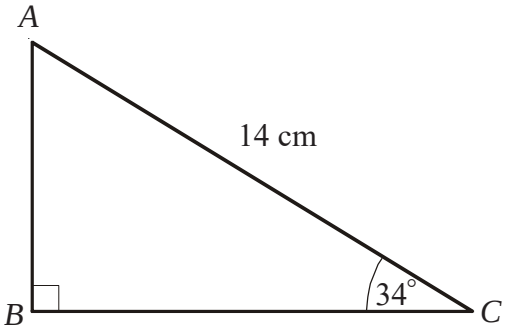
Work out the value of x.
Give your answer correct to 1 decimal place.



22.2°

2) $AC = 14$ cm.
Angle $ABC = 90^\circ$
Angle $ACB = 34^\circ$

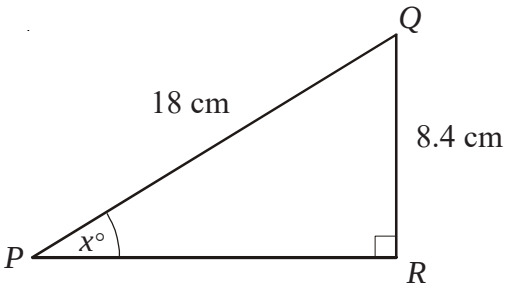
Calculate the length of BC.
Give your answer correct to
3 significant figures.



11.6 cm

3) PQR is a right-angled triangle.
$PQ = 18$ cm.
$QR = 8.4$ cm
Angle $PRQ = 90^\circ$

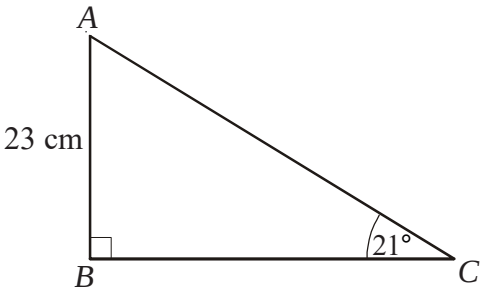
Work out the value of x.
Give your answer correct to 1 decimal place.



27.8°

4) $AB = 23$ cm.
Angle $ABC = 90^\circ$
Angle $ACB = 21^\circ$

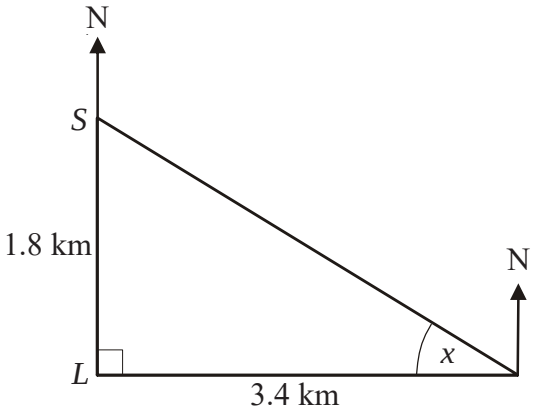
Calculate the length of AC.
Give your answer correct to
3 significant figures.



64.2 cm

5) A lighthouse, L, is 3.4 km due West of a port, P.
A ship, S, is 1.8 km due North of the lighthouse, L.

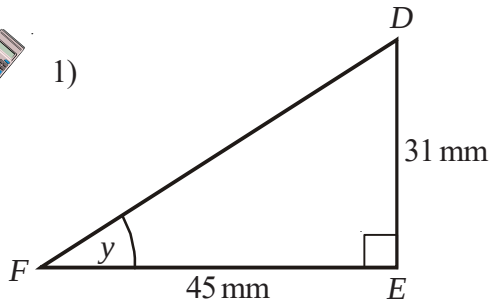
Calculate the size of the angle marked x.
Give your answer correct to 3 significant figures.



27.9°

Trigonometry

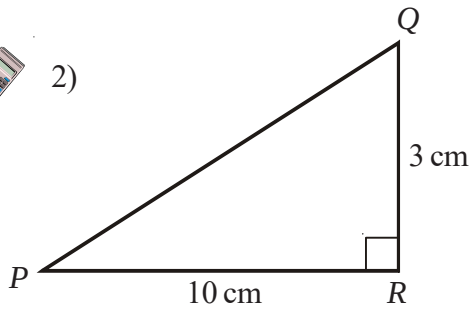
1)



DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*.
Give your answer correct to one decimal place.

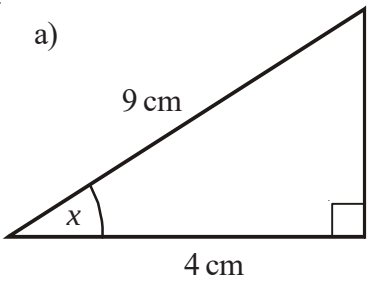
2)



PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

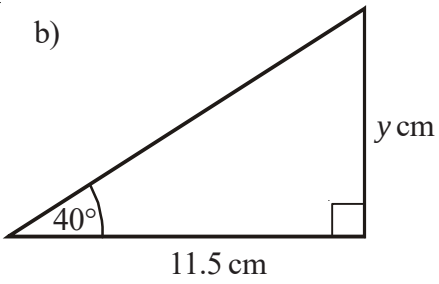
Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

3) a)



Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

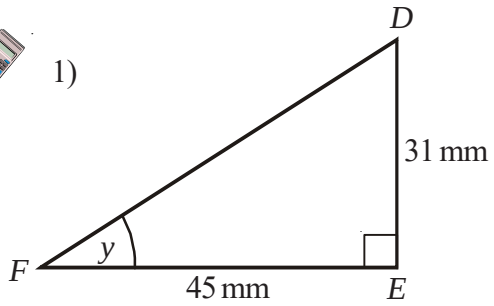
b)



Calculate the value of *y*.
Give your answer correct to one decimal place.

Trigonometry

1)

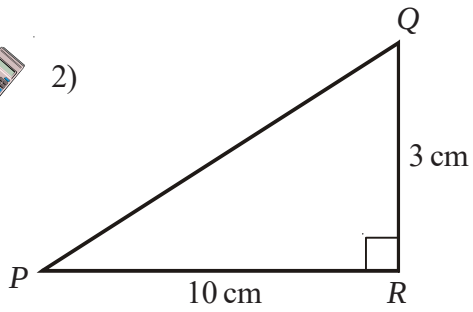


DEF is a right-angled triangle.
DE = 31 mm
FE = 45 mm

Calculate the size of angle *y*.
Give your answer correct to one decimal place.

34.6°

2)

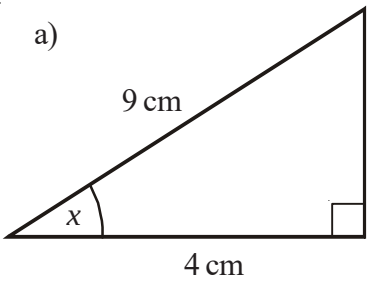


PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

16.7°

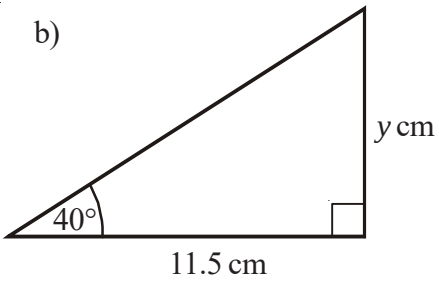
3) a)



Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

63.6°

b)

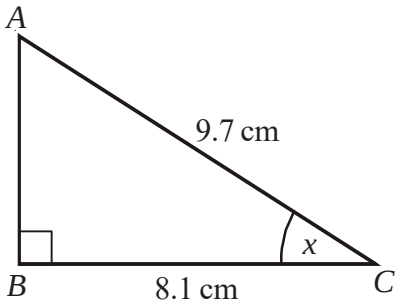


Calculate the value of *y*.
Give your answer correct to one decimal place.

y = 9.6

Trigonometry

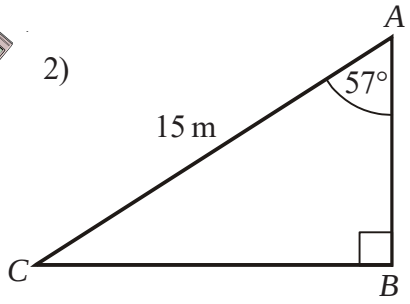
1)



ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

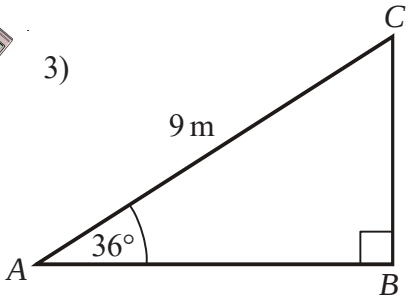
2)



ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

3)

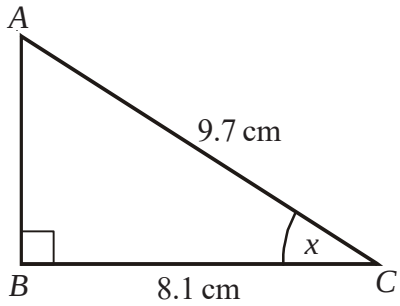


ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

Trigonometry

1)

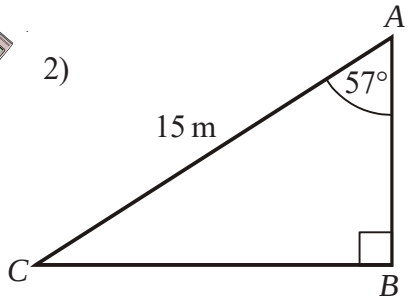


ABC is a right-angled triangle.
AC = 9.7 cm
BC = 8.1 cm

Calculate the size of the angle marked *x*.
Give your answer correct to three significant figures.

33.4°

2)

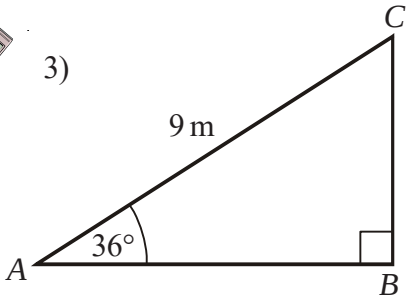


ABC is a right-angled triangle.
AC = 15 m
Angle *CAB* = 57°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

8.17 cm

3)



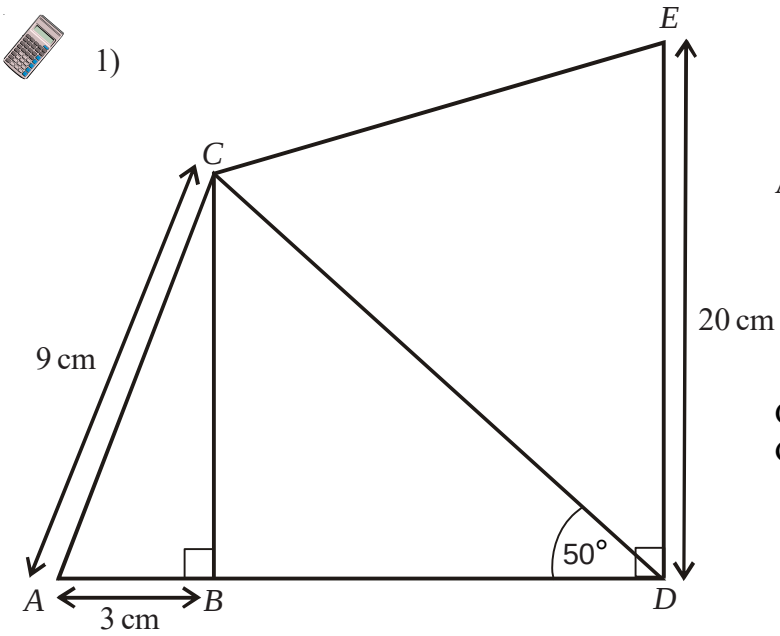
ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

7.28 cm

Trigonometry

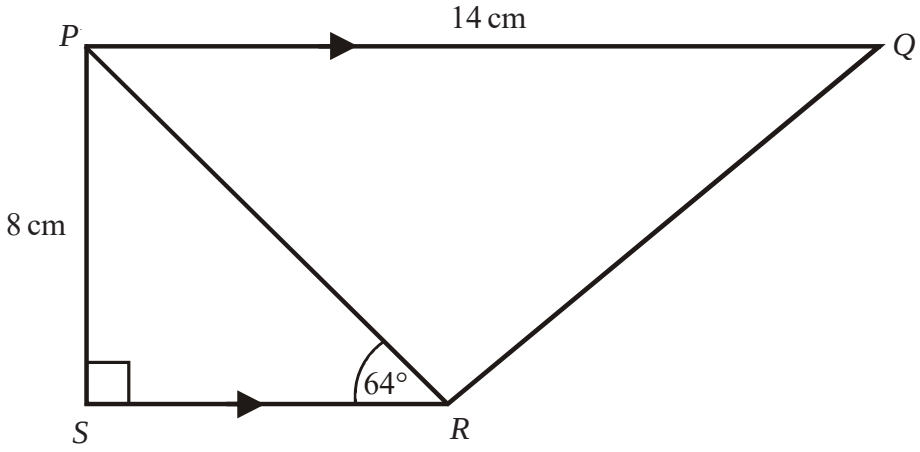
1)



$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle $BDE = 90°$

Calculate the length of CD.
Give your answer to 3 significant figures.

2)

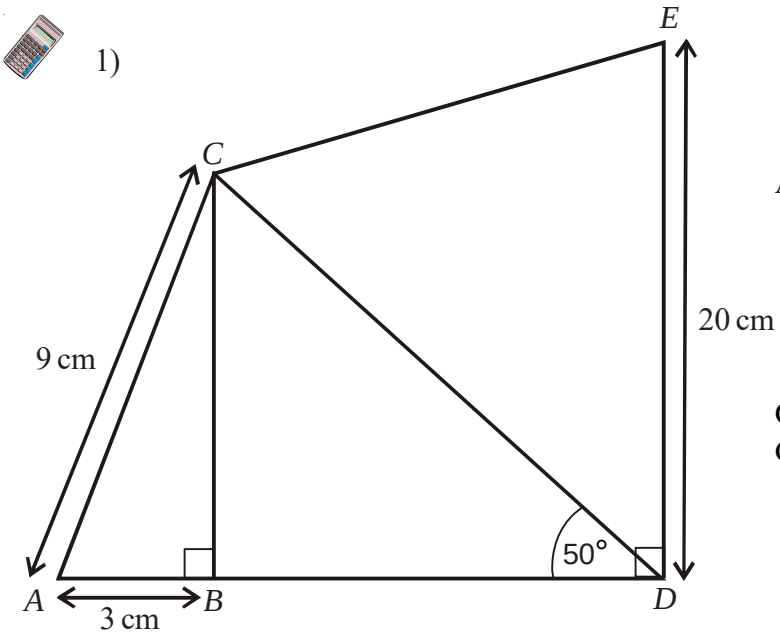


$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

Work out the length of PR.
Give your answer correct to 3 significant figures.

Trigonometry

1)

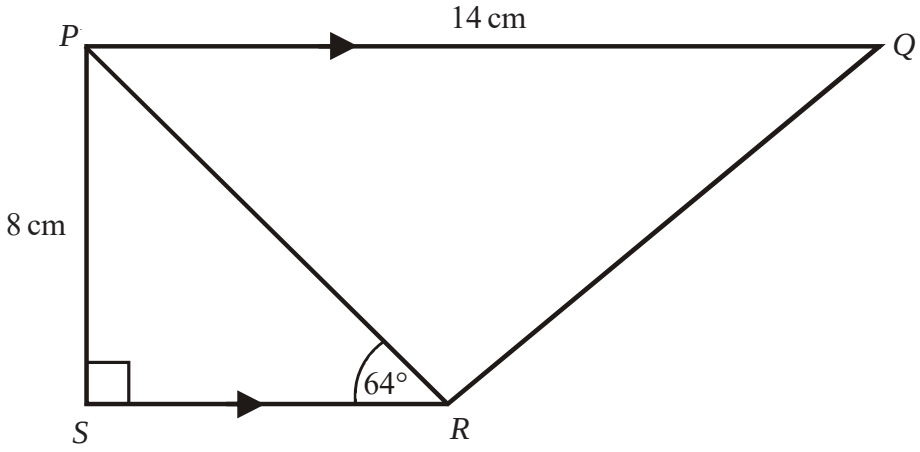


$AC = 9$ cm
$AB = 3$ cm
$DE = 20$ cm
Angle ABC = angle CBD = angle $BDE = 90°$

Calculate the length of CD.
Give your answer to 3 significant figures.

11.1 cm

2)



$PQRS$ is a trapezium.
PQ is parallel to SR.
Angle $PSR = 90°$
Angle $PRS = 64°$
$PQ = 14$ cm.
$PS = 8$ cm.

Work out the length of PR.
Give your answer correct to 3 significant figures.

8.90 cm

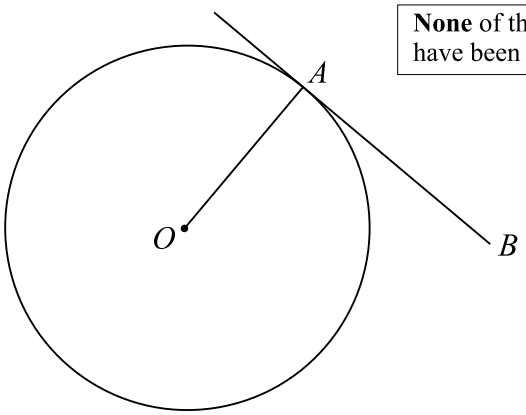
Circle Theorems - Introduction

None of the diagrams have been drawn accurately.

1) *O* is the centre of the circle.
AB is a tangent to the circle.

a) Write down the size of angle *OAB*.

b) Give a reason for your answer.



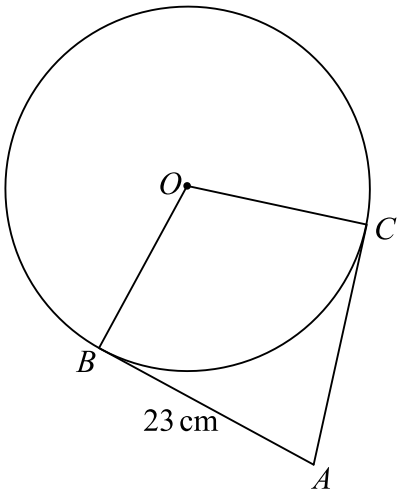
2) *O* is the centre of the circle.
AB and *AC* are tangents to the circle.
AB = 23 cm

a) Write down the length of *AC*.

b) Give a reason for your answer.

c) Write down the size of angle *ACO*.

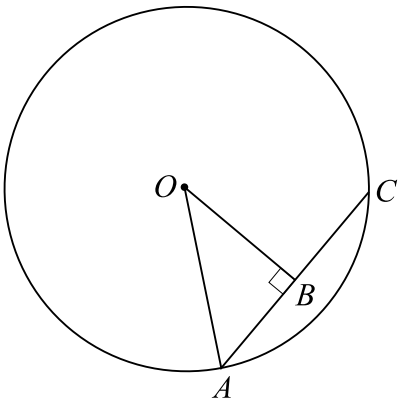
d) Give a reason for your answer.



3) *O* is the centre of the circle.
AC is a chord.
AB = 8 cm

a) Write down the length of chord *AC*.

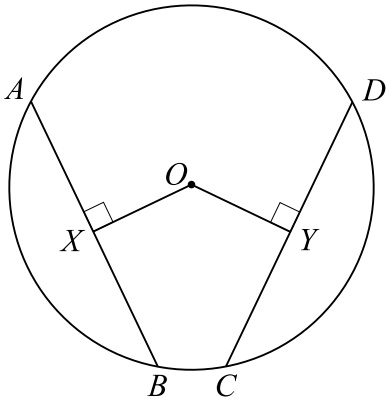
b) Give a reason for your answer.



4) *O* is the centre of the circle.
AB and *CD* are chords, *AB* = 12 cm.
OX = *OY*

a) Write down the length of chord *CD*.

b) Give a reason for your answer.



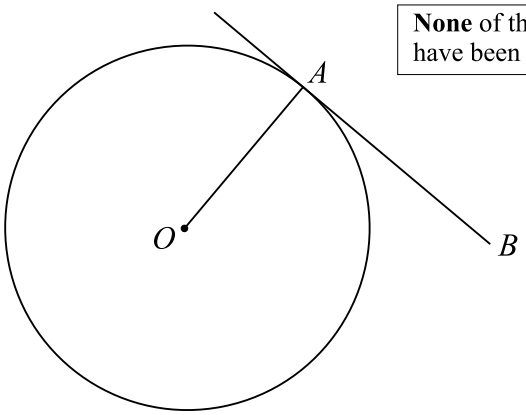
Circle Theorems - Introduction

None of the diagrams have been drawn accurately.

1) O is the centre of the circle.
AB is a tangent to the circle.

a) Write down the size of angle OAB. 90°

b) Give a reason for your answer.
Tangent meets a radius at 90°.



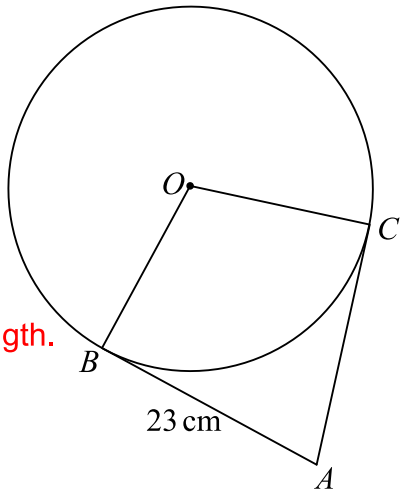
2) O is the centre of the circle.
AB and AC are tangents to the circle.
$AB = 23$ cm

a) Write down the length of AC. 23 cm

b) Give a reason for your answer.
Tangents to a circle from the same point are equal in length.

c) Write down the size of angle ACO. 90°

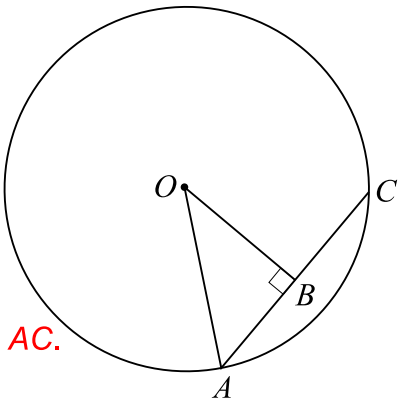
d) Give a reason for your answer.
Tangent meets a radius at 90°.



3) O is the centre of the circle.
AC is a chord.
$AB = 8$ cm

a) Write down the length of chord AC. 16 cm

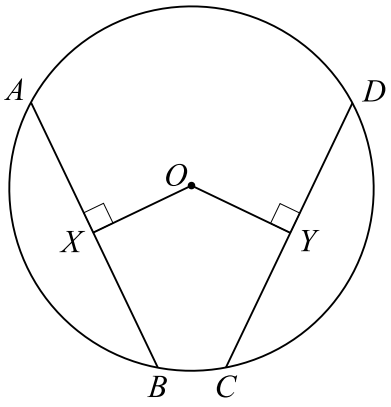
b) Give a reason for your answer.
The perpendicular from centre O bisects chord AC.



4) O is the centre of the circle.
AB and CD are chords, $AB = 12$ cm.
$OX = OY$

a) Write down the length of chord CD. 12 cm

b) Give a reason for your answer.
Equal chords are equidistant from the centre.

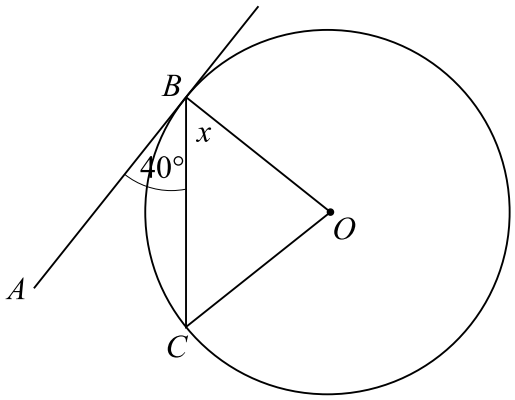


Circle Theorems - Introduction

None of the diagrams have been drawn accurately.

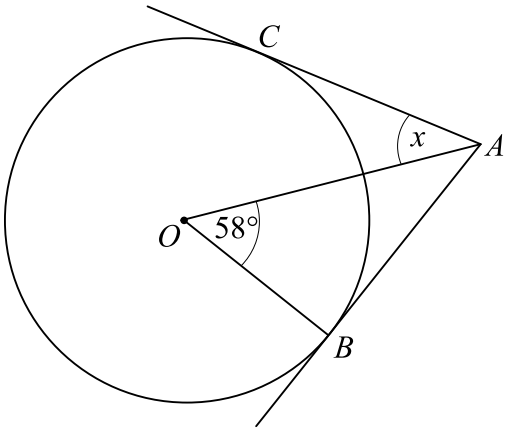
1) *O* is the centre of the circle.
AB is a tangent to the circle.
Angle *ABC* = 40°

Work out the size of angle *x*.



2) *O* is the centre of the circle.
AB and *AC* are tangents to the circle.
Angle *BOA* = 58°

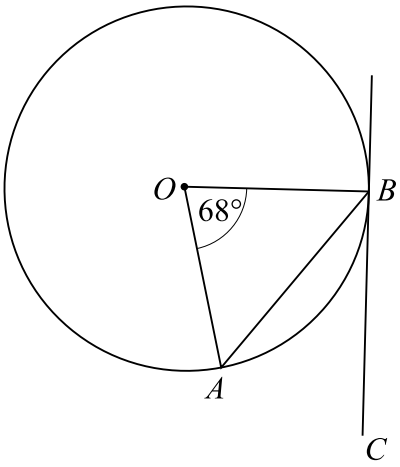
Work out the size of angle *x*.



3) *O* is the centre of the circle.
CB is a tangent to the circle.
Angle *AOB* = 68°

Work out the size of angle *ABC*.

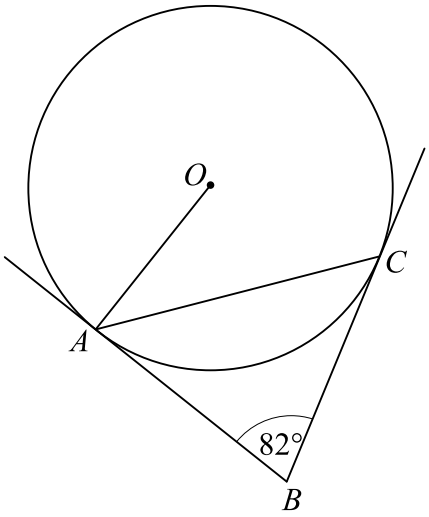
Give a reason for each step of your working.



4) *O* is the centre of the circle.
BA and *BC* are tangents to the circle.
Angle *ABC* = 82°

Work out the size of angle *OAC*.

Give a reason for each step of your working.

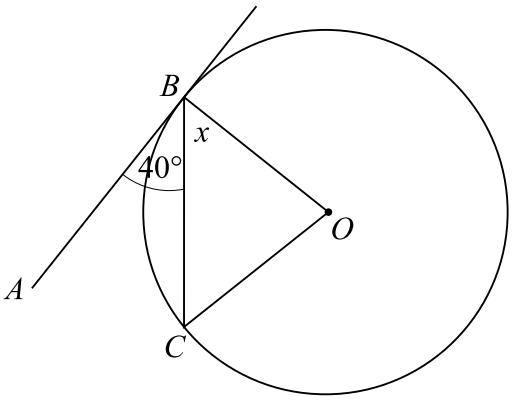


Circle Theorems - Introduction

None of the diagrams have been drawn accurately.

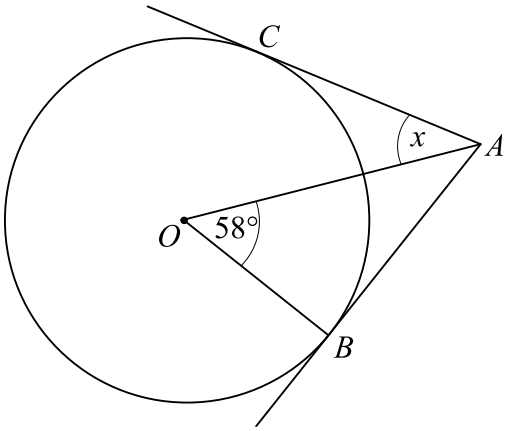
1) *O* is the centre of the circle.
AB is a tangent to the circle.
Angle *ABC* = 40°

Work out the size of angle *x*. 50°



2) *O* is the centre of the circle.
AB and *AC* are tangents to the circle.
Angle *BOA* = 58°

Work out the size of angle *x*. 32°

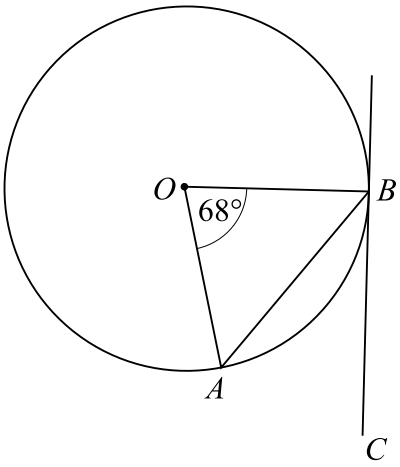


3) *O* is the centre of the circle.
CB is a tangent to the circle.
Angle *AOB* = 68°

Work out the size of angle *ABC*. 34°

Give a reason for each step of your working.

Angle *ABO* = (180 – 68)÷2 = 56
because triangle *AOB* is isosceles.
Angle *ABC* = 90 – 56 = 34° because a tangent meets a radius at 90°.

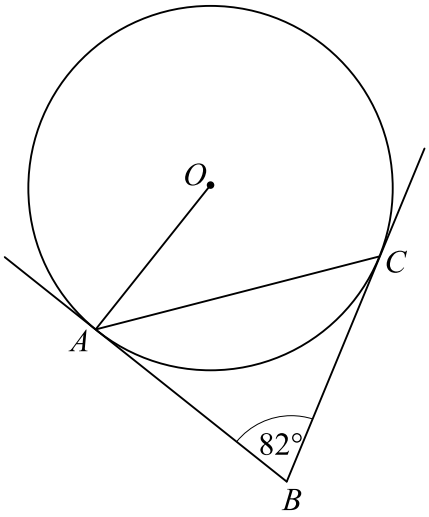


4) *O* is the centre of the circle.
BA and *BC* are tangents to the circle.
Angle *ABC* = 82°

Work out the size of angle *OAC*. 41°

Give a reason for each step of your working.

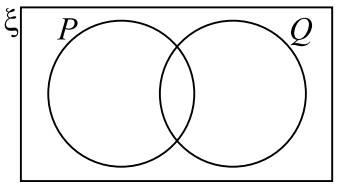
Angle *BAC* = (180 – 82)÷2 = 49
because triangle *ABC* is isosceles
(tangents to a circle from a single point have equal length).
Angle *OAC* = 90 – 49 = 41° because a tangent meets a radius at 90°.



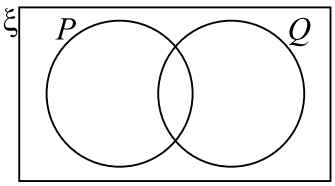
Venn Diagrams - Notation

1) Shade the region represented by each set notation.

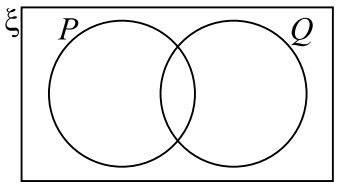
a) $P \cup Q$



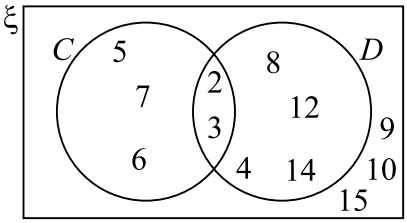
b) Q'



c) $P \cap Q$



2) Here is a Venn diagram.

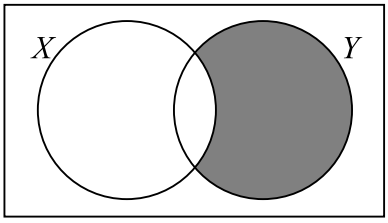


a) List the elements of $C \cap D$.

b) List the elements of $(C \cup D)'$.

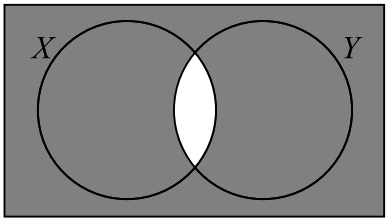
3) For each diagram below, circle the option that represents the shaded region.

a) ξ



A X' B $X \cup Y'$ C $X' \cap Y$ D $X' \cap Y'$

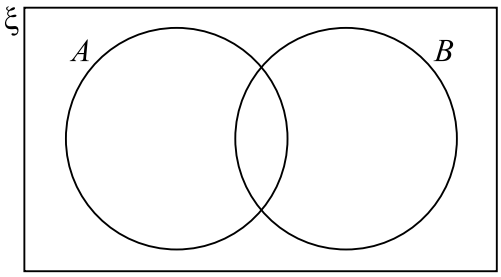
b) ξ



A $X \cap Y$ B $(X \cap Y)'$ C $X' \cap Y'$ D $(X \cup Y)'$

4) ξ = {odd numbers between 0 and 22}
A = {5, 15}
B = {3, 5, 7, 11, 13, 17, 19}

a) Complete the Venn diagram to represent this information.

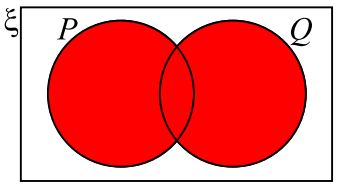


b) List the elements that belong to B'.

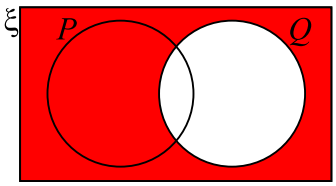
Venn Diagrams - Notation

1) Shade the region represented by each set notation.

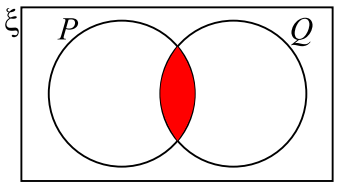
a) $P \cup Q$



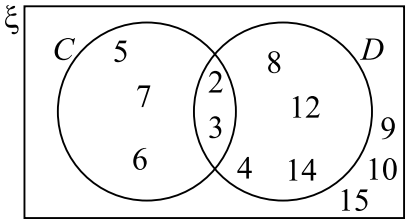
b) Q'



c) $P \cap Q$



2) Here is a Venn diagram.

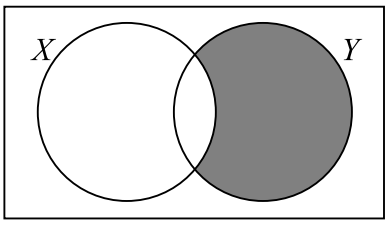


a) List the elements of $C \cap D$. 2, 3

b) List the elements of $(C \cup D)'$. 9, 10, 15

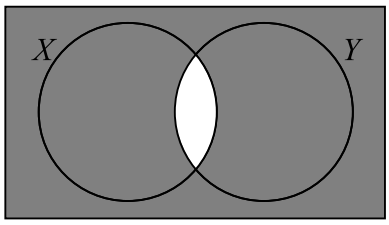
3) For each diagram below, circle the option that represents the shaded region.

a) ξ



A X' B $X \cup Y'$ C $X' \cap Y$ D $X' \cap Y'$

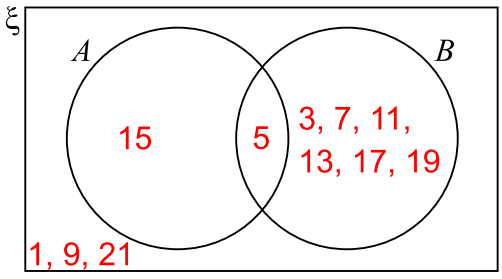
b) ξ



A $X \cap Y$ B $(X \cap Y)'$ C $X' \cap Y'$ D $(X \cup Y)'$

4) ξ = {odd numbers between 0 and 22}
A = {5, 15}
B = {3, 5, 7, 11, 13, 17, 19}

a) Complete the Venn diagram to represent this information.



b) List the elements that belong to B'. 1, 9, 15, 21

Estimate for the Mean

1) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (t minutes)	**Frequency**		
$0 < t \leqslant 6$	15		
$6 < t \leqslant 12$	23		
$12 < t \leqslant 18$	28		
$18 < t \leqslant 24$	19		
$24 < t \leqslant 30$	15		

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place.

2) The table shows some information about the heights (h cm) of 100 plants.

Height (h cm)	**Frequency**		
$120 < h \leqslant 130$	9		
$130 < h \leqslant 140$	18		
$140 < h \leqslant 150$	27		
$150 < h \leqslant 160$	31		
$160 < h \leqslant 170$	15		

a) Find the class interval in which the median lies.

b) Work out an estimate for the mean height of the plants.

3) The table gives information about the number of books sold in a shop during each of the last 30 weeks.

Number of books (n)	**Frequency**		
$0 < n \leqslant 40$	2		
$40 < n \leqslant 80$	6		
$80 < n \leqslant 120$	13		
$120 < n \leqslant 160$	6		
$160 < n \leqslant 200$	3		

Calculate an estimate for the mean number of books sold each week.

Give your answer correct to 1 decimal place.

Estimate for the Mean

1) Sindy recorded the time, in minutes, that her train was late over 100 days.
Information about these times is shown in the table.

Time (*t* minutes)	**Frequency**	Midpoint	MP × Frequency
$0 < t \leqslant 6$	15	3	45
$6 < t \leqslant 12$	23	9	207
$12 < t \leqslant 18$	28	15	420
$18 < t \leqslant 24$	19	21	399
$24 < t \leqslant 30$	15	27	405
	100		**1476**

Calculate an estimate for the mean time that her train was late.
Give your answer to 1 decimal place. 14.8 minutes

2) The table shows some information about the heights (h cm) of 100 plants.

Height (*h* cm)	**Frequency**	Midpoint	MP × Frequency
$120 < h \leqslant 130$	9	125	1125
$130 < h \leqslant 140$	18	135	2430
$140 < h \leqslant 150$	27	145	3915
$150 < h \leqslant 160$	31	155	4805
$160 < h \leqslant 170$	15	165	2475
	100		**14750**

a) Find the class interval in which the median lies. $140 < h \leqslant 150$

b) Work out an estimate for the mean height of the plants. 147.5 cm

3) The table gives information about the number of books sold in a shop during each of the last 30 weeks.

Number of books (n)	**Frequency**	Midpoint	MP × Frequency
$0 < n \leqslant 40$	2	20	40
$40 < n \leqslant 80$	6	60	360
$80 < n \leqslant 120$	13	100	1300
$120 < n \leqslant 160$	6	140	840
$160 < n \leqslant 200$	3	180	540
	30		**3080**

Calculate an estimate for the mean number of books sold each week.

Give your answer correct to 1 decimal place. 102.7 books

Inverse Proportion - Introduction

1) 1 person can cut a large area of grass in 5 hours.
a) At the same rate, how long would it take 2 people to cut the grass?

b) At the same rate, how long would it take 5 people to cut the grass?

2) 2 people can assemble a shed in 1 hour.
a) Work out how long it would take 4 people (working at the same rate).

b) Work out how long it would take just 1 person (working at the same rate).

3) A local lottery draw is won by 5 people and they each receive £125 300
Work out how much they would each have got if only 4 people had won.

4) It takes 5 people 12 hours to build a wall.
a) Work out how long it would take 3 people to build the wall (working at the same rate).

b) Work out how long it would take 6 people to build the wall (working at the same rate).

5) It takes 3 people 8 hours to complete a job.
a) At the same rate, how long would it take 4 people to complete the same job?

b) At the same rate, how long would it take 2 people to complete the same job?

6) 6 people can paint a bridge in 18 days.
a) At the same rate, how long would it take 9 people?

b) At the same rate, how long would it take 36 people?

7) It takes 24 minutes for a person riding at 30 km/h to get to work from home.
How long would it take that person if they travelled at 36 km/h instead?

Inverse Proportion - Introduction

1) 1 person can cut a large area of grass in 5 hours.

a) At the same rate, how long would it take 2 people to cut the grass? 2.5 hours

b) At the same rate, how long would it take 5 people to cut the grass? 1 hour

2) 2 people can assemble a shed in 1 hour.

a) Work out how long it would take 4 people (working at the same rate). 30 minutes

b) Work out how long it would take just 1 person (working at the same rate). 2 hours

3) A local lottery draw is won by 5 people and they each receive £125 300

Work out how much they would each have got if only 4 people had won. £156 625

4) It takes 5 people 12 hours to build a wall.

a) Work out how long it would take 3 people to build the wall (working at the same rate). 20 hours

b) Work out how long it would take 6 people to build the wall (working at the same rate). 10 hours

5) It takes 3 people 8 hours to complete a job.

a) At the same rate, how long would it take 4 people to complete the same job? 6 hours

b) At the same rate, how long would it take 2 people to complete the same job? 12 hours

6) 6 people can paint a bridge in 18 days.

a) At the same rate, how long would it take 9 people? 12 days

b) At the same rate, how long would it take 36 people? 3 days

7) It takes 24 minutes for a person riding at 30 km/h to get to work from home.

How long would it take that person if they travelled at 36 km/h instead? 20 minutes

Recurring Decimals to Fractions

Write each recurring decimal as an exact fraction,
in its lowest terms.

a) $0.\dot{5}$

b) $0.\dot{7}$

c) $0.\dot{4}$

d) $0.\dot{2}\dot{4}$

e) $0.\dot{7}\dot{5}$

f) $0.\dot{8}\dot{2}$

g) $0.\dot{6}1\dot{7}$

h) $0.\dot{2}1\dot{6}$

i) $0.\dot{7}1\dot{4}$

j) $0.\dot{3}2\dot{4}$

k) $0.\dot{7}2357\dot{}$

l) $0.\dot{6}5214\dot{}$

Recurring Decimals to Fractions

Write each recurring decimal as an exact fraction,
in its lowest terms.

a) $0.\dot{5}$ $\frac{5}{9}$

b) $0.\dot{7}$ $\frac{7}{9}$

c) $0.\dot{4}$ $\frac{4}{9}$

d) $0.\dot{2}\dot{4}$ $\frac{8}{33}$

e) $0.\dot{7}\dot{5}$ $\frac{25}{33}$

f) $0.\dot{8}\dot{2}$ $\frac{82}{99}$

g) $0.\dot{6}1\dot{7}$ $\frac{617}{999}$

h) $0.\dot{2}1\dot{6}$ $\frac{8}{37}$

i) $0.\dot{7}1\dot{4}$ $\frac{238}{333}$

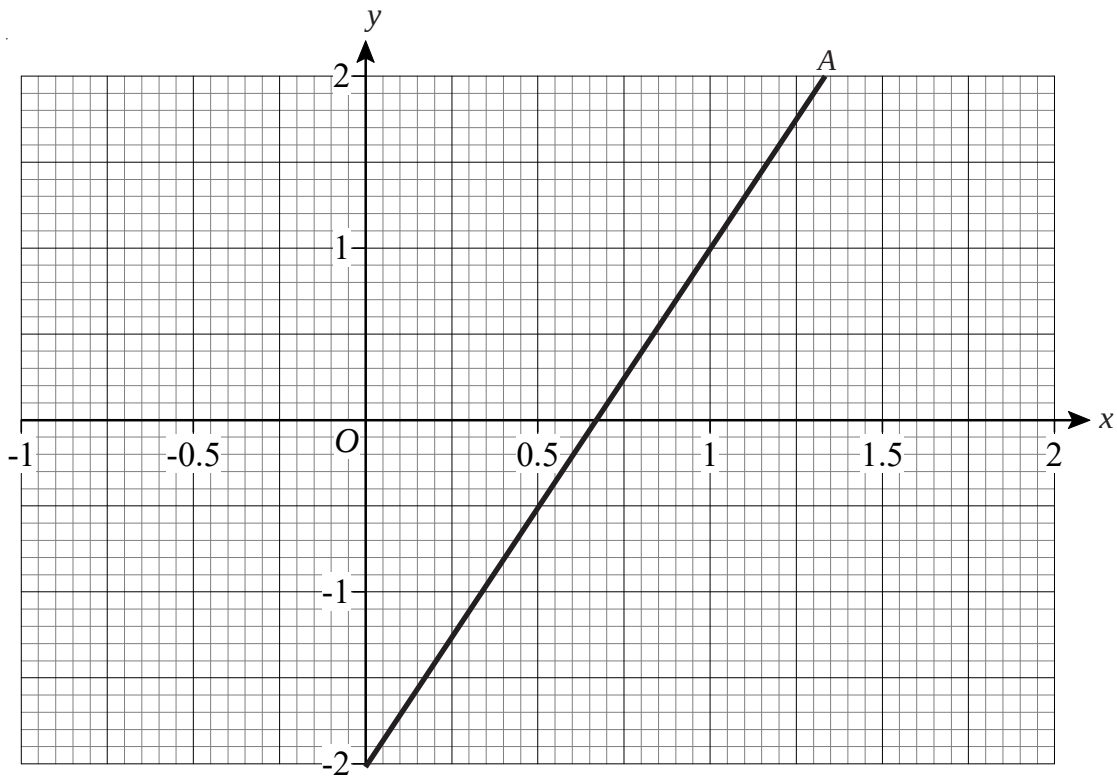
j) $0.\dot{3}2\dot{4}$ $\frac{12}{37}$

k) $0.\dot{7}2357\dot{}$ $\frac{89}{123}$

l) $0.\dot{6}5214\dot{}$ $\frac{7246}{11111}$

Finding the Equation of a Straight Line

1) Find the equation of line *A* on the grid below.



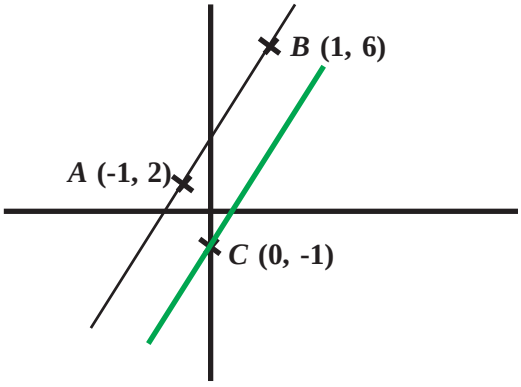
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation?

3) A straight line passes through points (0, 7) and (2, -1).
What is its equation?

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation?

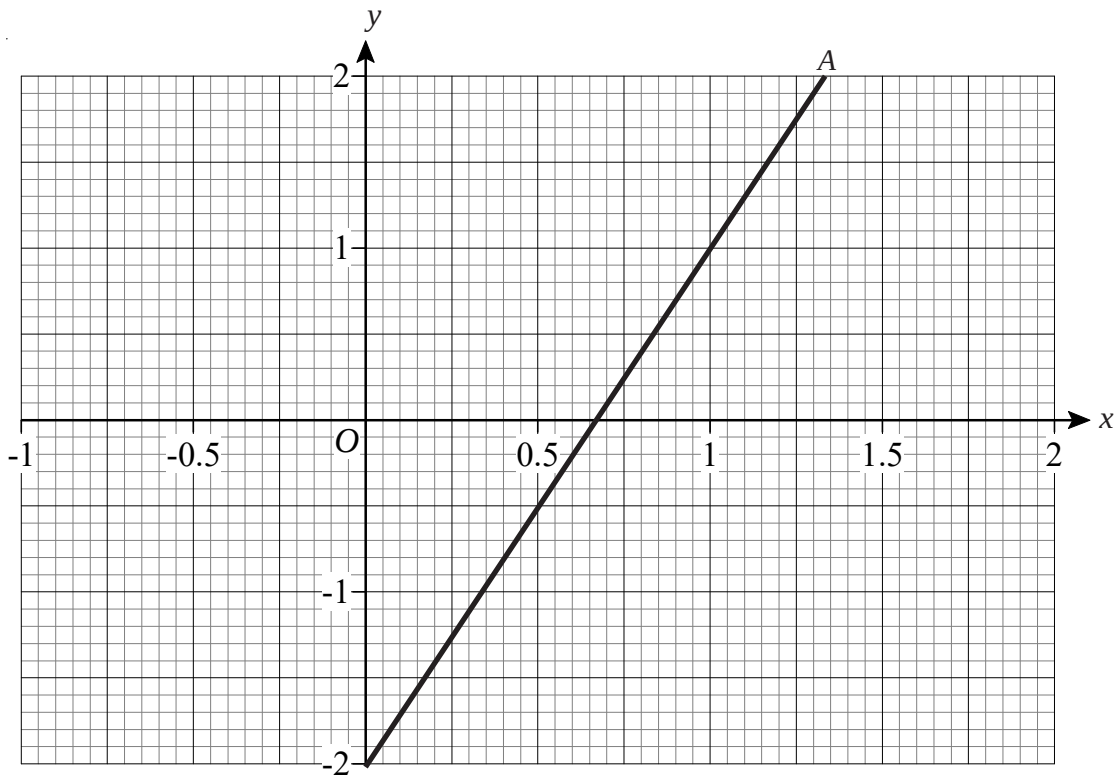
5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation?

6) *A* is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through *C* and is parallel to *AB*.



Finding the Equation of a Straight Line

1) Find the equation of line *A* on the grid below. $y = 3x - 2$



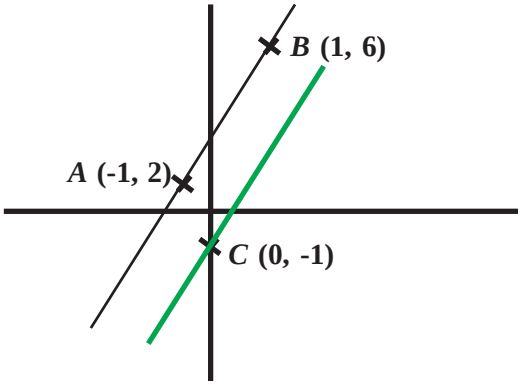
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation? $y = 3x + 4$

3) A straight line passes through points (0, 7) and (2, -1).
What is its equation? $y = -4x + 7$

4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation? $y = 3x + 5$

5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation? $y = 2x - 4$

6) *A* is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through *C* and is parallel to *AB*. $y = 2x - 1$



Product of Three Binomials

1) Expand and simplify:

   a) $x(x + 2)(x + 3)$

   b) $x(x + 4)(x + 7)$

   c) $x(x + 1)(x + 9)$

2) Expand and simplify:

   a) $x(x + 5)(x - 2)$

   b) $x(x - 4)(x + 3)$

   c) $x(x + 8)(x - 3)$

3) Expand and simplify:

   a) $(x + 1)(x + 5)(x + 2)$

   b) $(x - 3)(x - 2)(x - 1)$

   c) $(x - 2)(x + 5)(x - 1)$

4) Expand and simplify:

   a) $(x - 4)(x + 4)(x - 2)$

   b) $(x - 3)(x - 1)(x + 3)$

   c) $(x + 6)(x + 2)(x - 6)$

5) Expand and simplify:

   a) $(2x - 1)(x + 3)(x + 1)$

   b) $(x + 5)(2x - 3)(3x + 1)$

   c) $(2x - 1)(3x - 2)(4x - 3)$

Product of Three Binomials

1) Expand and simplify:

a) $x(x+2)(x+3)$ $x^3 + 5x^2 + 6x$

b) $x(x+4)(x+7)$ $x^3 + 11x^2 + 28x$

c) $x(x+1)(x+9)$ $x^3 + 10x^2 + 9x$

2) Expand and simplify:

a) $x(x+5)(x-2)$ $x^3 + 3x^2 - 10x$

b) $x(x-4)(x+3)$ $x^3 - x^2 - 12x$

c) $x(x+8)(x-3)$ $x^3 + 5x^2 - 24x$

3) Expand and simplify:

a) $(x+1)(x+5)(x+2)$ $x^3 + 8x^2 + 17x + 10$

b) $(x-3)(x-2)(x-1)$ $x^3 - 6x^2 + 11x - 6$

c) $(x-2)(x+5)(x-1)$ $x^3 + 2x^2 - 13x + 10$

4) Expand and simplify:

a) $(x-4)(x+4)(x-2)$ $x^3 - 2x^2 - 16x + 32$

b) $(x-3)(x-1)(x+3)$ $x^3 - x^2 - 9x + 9$

c) $(x+6)(x+2)(x-6)$ $x^3 + 2x^2 - 36x - 72$

5) Expand and simplify:

a) $(2x-1)(x+3)(x+1)$ $2x^3 + 7x^2 + 2x - 3$

b) $(x+5)(2x-3)(3x+1)$ $6x^3 + 23x^2 - 38x - 15$

c) $(2x-1)(3x-2)(4x-3)$ $24x^3 - 46x^2 + 29x - 6$

Cubic and Reciprocal Graphs

1) a) Complete this table of values for

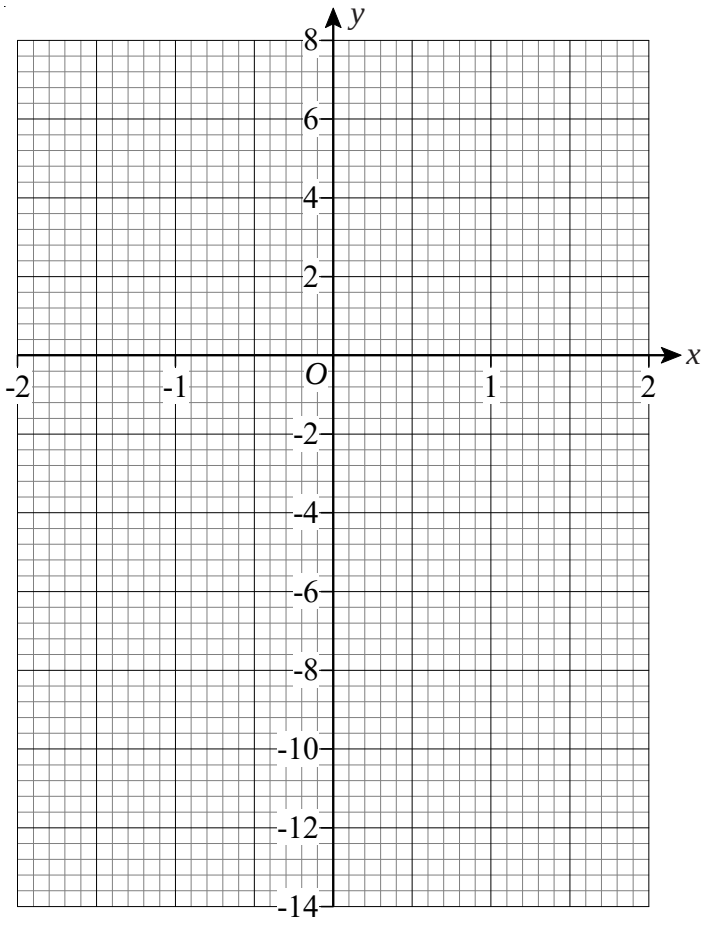
$y = x^3 + x - 4$

x	–2	–1	0	1	2
y	–14			–2	

b) On the grid, draw the graph of

$y = x^3 + x - 4$

c) Use the graph to find the value of x when $y = 2$



2) a) Complete this table of values for

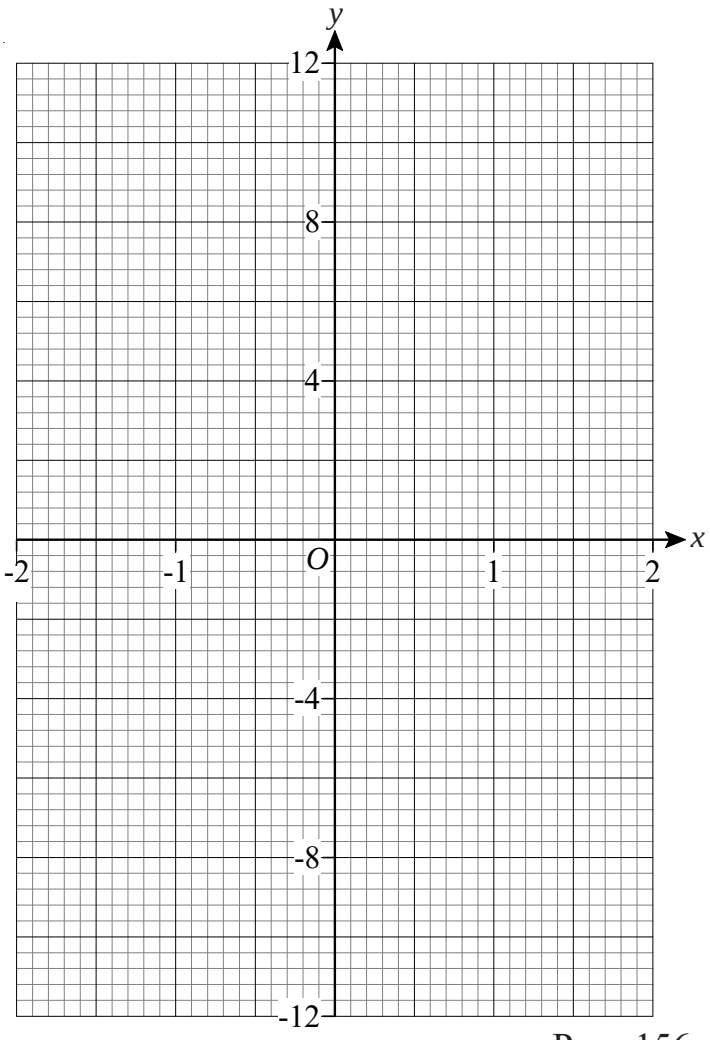
$y = x^3 + 2x$

x	–2	–1	0	1	2
y	–12		0		

b) On the grid, draw the graph of

$y = x^3 + 2x$

c) Use the graph to find the value of x when $y = -6$



3) Sketch the graph of $y = 1 + \frac{1}{x}$

Cubic and Reciprocal Graphs

1) a) Complete this table of values for

$y = x^3 + x - 4$

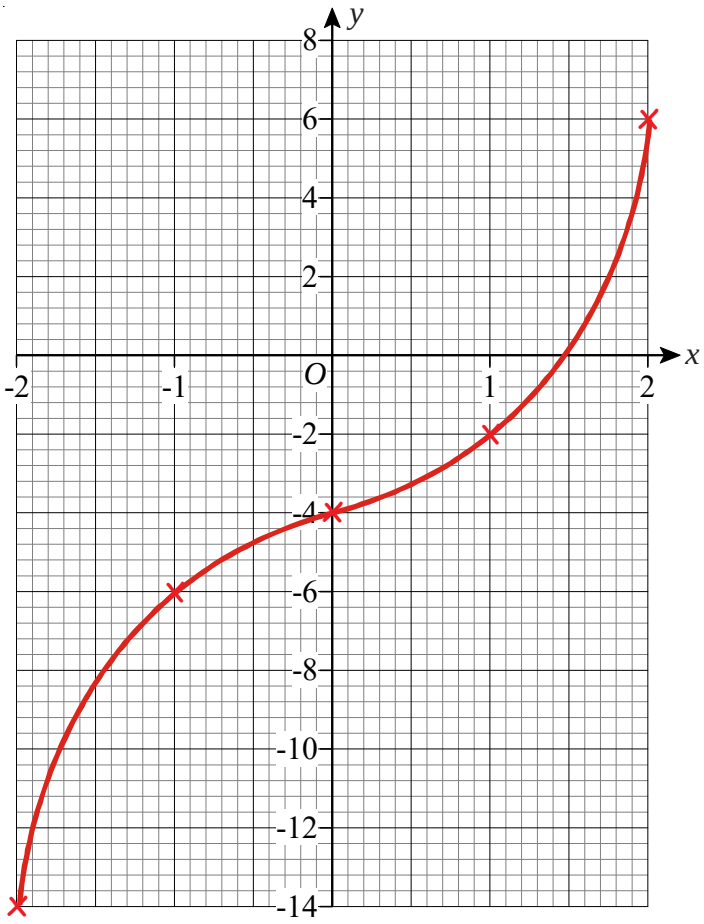
x	–2	–1	0	1	2
y	–14	-6	-4	–2	6

b) On the grid, draw the graph of

$y = x^3 + x - 4$

c) Use the graph to find the value of x when $y = 2$

$x = 1.75$



2) a) Complete this table of values for

$y = x^3 + 2x$

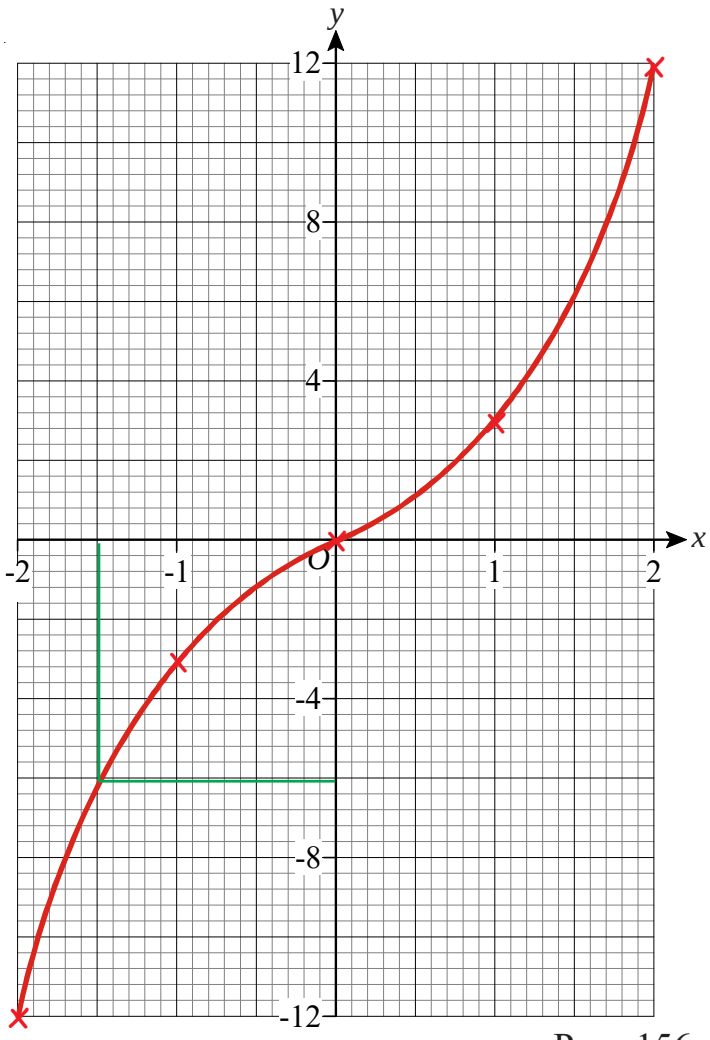
x	–2	–1	0	1	2
y	–12	-3	0	3	12

b) On the grid, draw the graph of

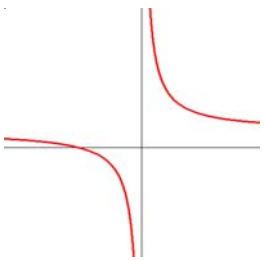
$y = x^3 + 2x$

c) Use the graph to find the value of x when $y = -6$

$x = -1.5$

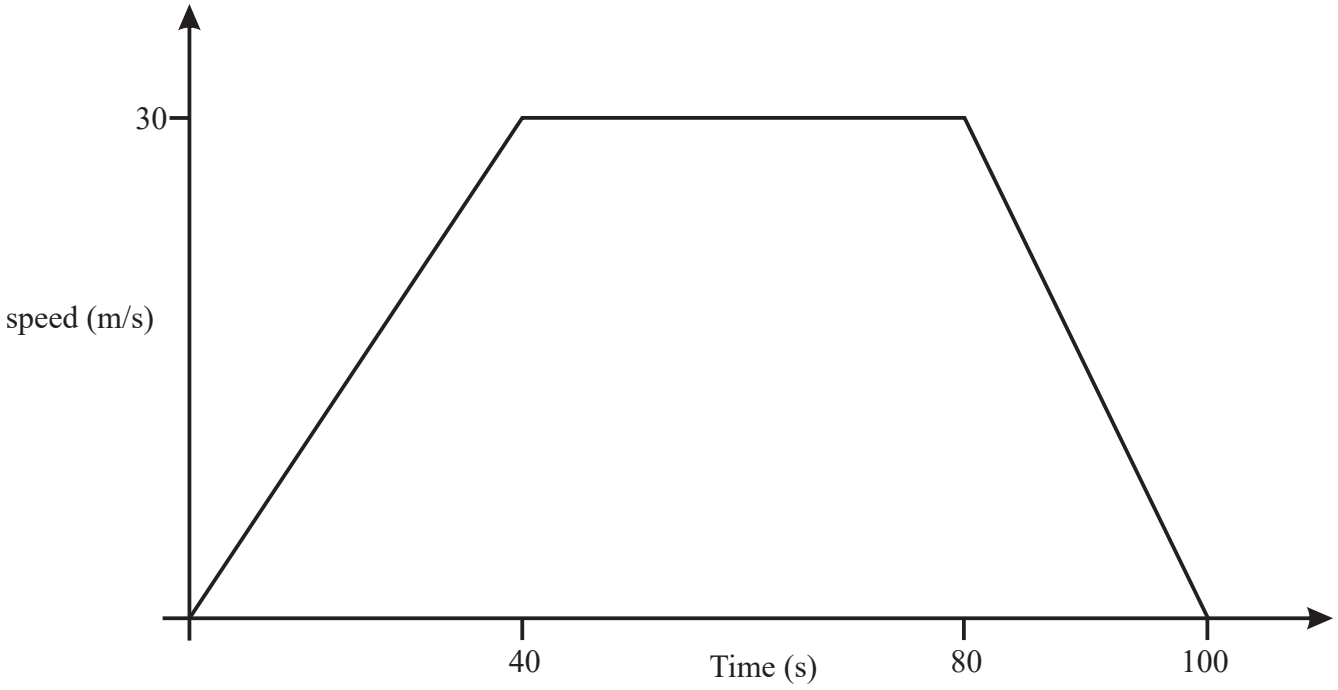


3) Sketch the graph of $y = 1 + \frac{1}{x}$



Velocity-Time Graphs

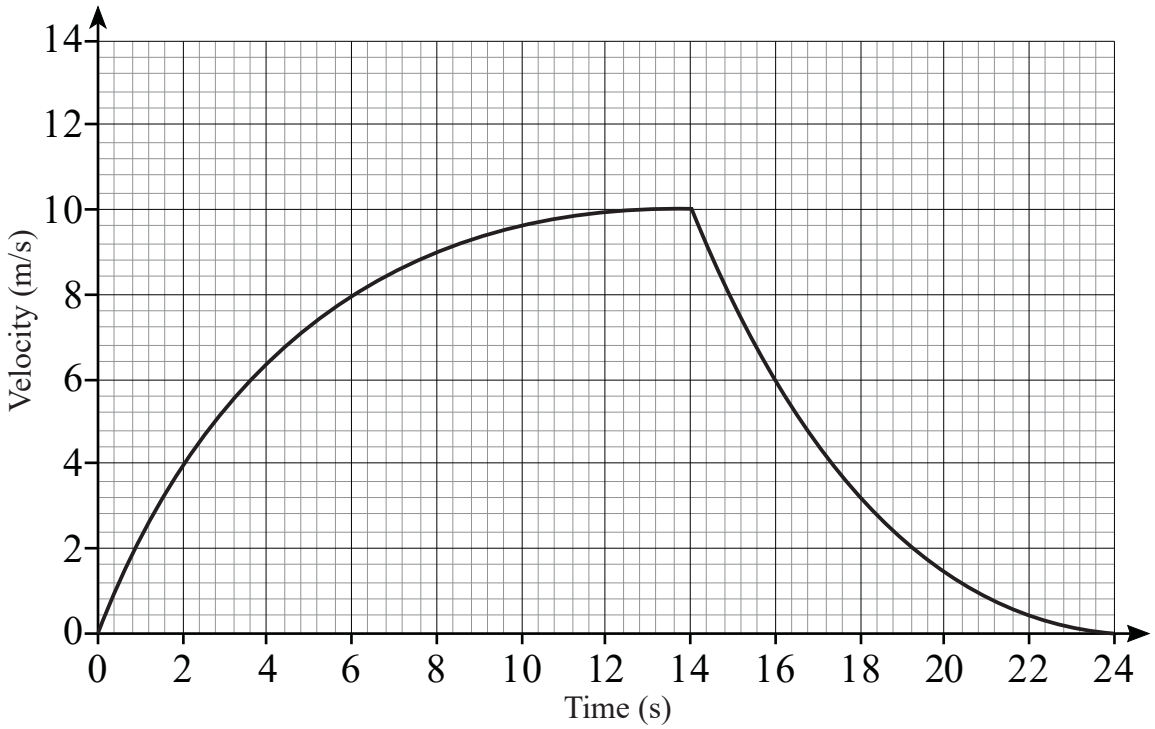
1) The graph shows the speed of a coach between two bus stations.



a) What was the acceleration of the coach in m/s^2 for the first 40 seconds?

b) What is the distance, in metres, between the two stations?

2) The velocity-time graph for a car is shown.

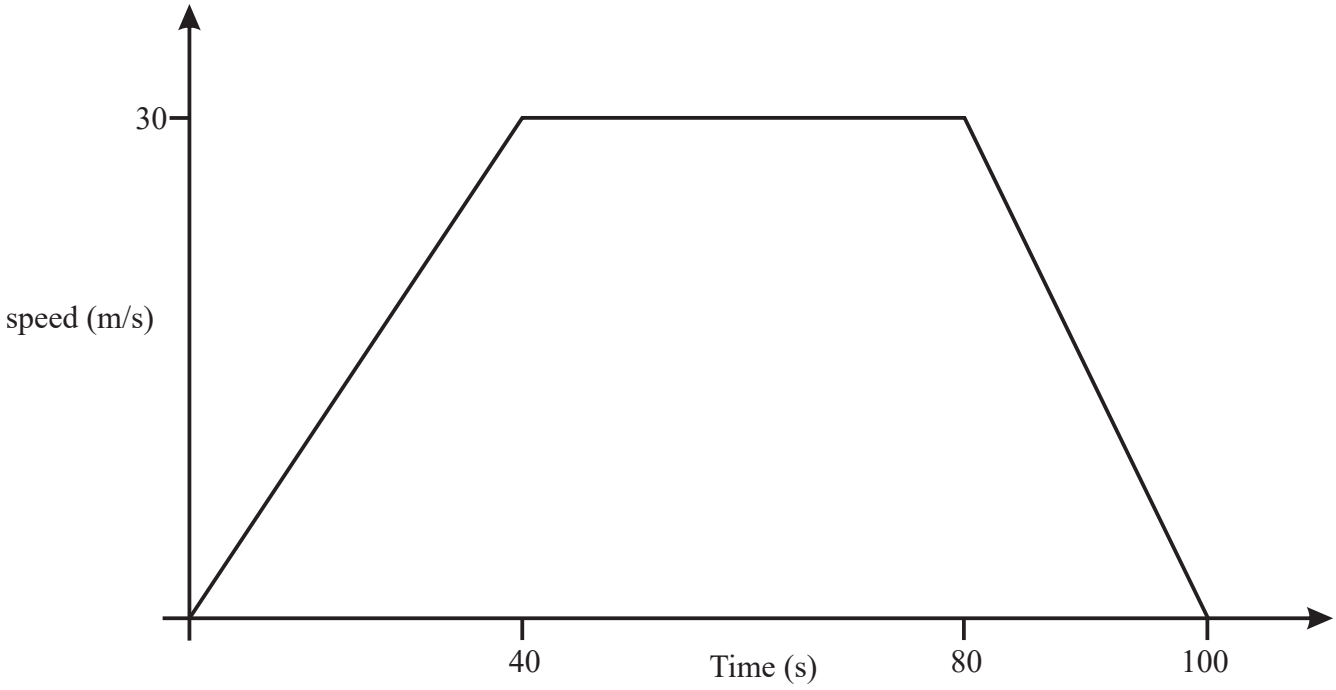


a) Estimate the acceleration of the car at 6 seconds.

b) Find an estimate for how far the car has travelled in the first 14 seconds.
Show all your working.

Velocity-Time Graphs

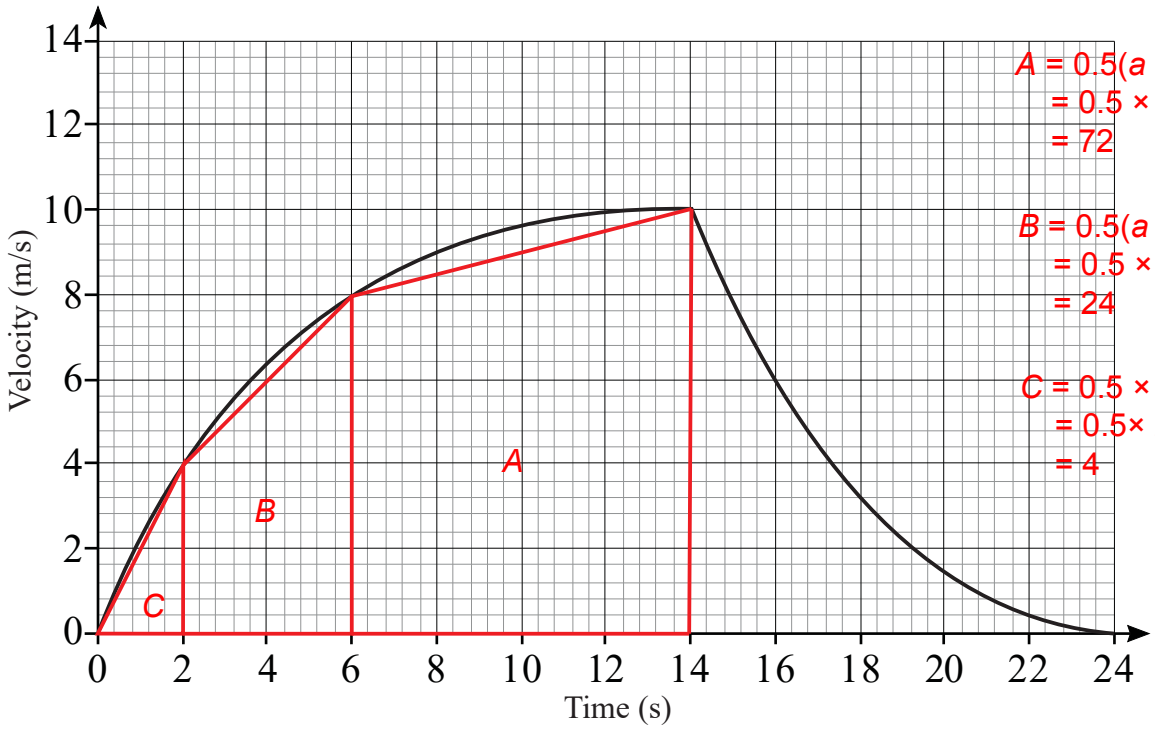
1) The graph shows the speed of a coach between two bus stations.



a) What was the acceleration of the coach in m/s² for the first 40 seconds? 0.75 m/s²

b) What is the distance, in metres, between the two stations? 2100 m

2) The velocity-time graph for a car is shown.



$A = 0.5(a + b)h$
$= 0.5 \times (8 + 10) \times 8$
$= 72$

$B = 0.5(a + b)h$
$= 0.5 \times (4 + 8) \times 4$
$= 24$

$C = 0.5 \times b \times h$
$= 0.5 \times 2 \times 4$
$= 4$

a) Estimate the acceleration of the car at 6 seconds. 0.6 m/s²

b) Find an estimate for how far the car has travelled in the first 14 seconds.
Show all your working. 72 + 24 + 4 = 100 m

Solving Quadratics with the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.

2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.

3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.

4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.

5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.

6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.

7) Solve the equation $x^2 - 14x - 161.25 = 0$

8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.

9) $x^2 + 10x = 300$
Find the positive value of x.
Give your answer correct to 3 significant figures.

10) $(x + 2)(x - 3) = 1$

a) Show that $x^2 - x - 7 = 0$

b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.

Solving Quadratics with the Formula

1) Solve the equation $x^2 + 4x + 1 = 0$

Give your answers correct to 3 decimal places.

$x = -0.268$ or $x = -3.732$

2) Solve the equation $x^2 + 8x + 6 = 0$

Give your answers correct to 3 significant figures.

$x = -0.838$ or $x = -7.16$

3) Solve the equation $x^2 - 3x - 2 = 0$

Give your answers correct to 3 significant figures.

$x = -0.562$ or $x = 3.56$

4) Solve the equation $x^2 - 7x + 2 = 0$

Give your answers correct to 3 significant figures.

$x = 0.298$ or $x = 6.70$

5) Solve the equation $2x^2 + 6x - 1 = 0$

Give your answers correct to 3 significant figures.

$x = -3.16$ or $x = 0.158$

6) Solve the equation $3x^2 - 2x - 20 = 0$

Give your answers correct to 3 significant figures.

$x = -2.27$ or $x = 2.94$

7) Solve the equation $x^2 - 14x - 161.25 = 0$

$x = -7.5$ or $x = 21.5$

8) Solve the equation $17x^2 - 92x - 206 = 0$

Give your answers correct to 3 significant figures.

$x = -1.70$ or $x = 7.11$

9) $x^2 + 10x = 300$

Find the positive value of x.

Give your answer correct to 3 significant figures.

$x = 13.0$

10) $(x + 2)(x - 3) = 1$

$x^2 - 3x + 2x - 6 = 1$
$x^2 - x - 6 = 1$
$x^2 - x - 7 = 0$

a) Show that $x^2 - x - 7 = 0$

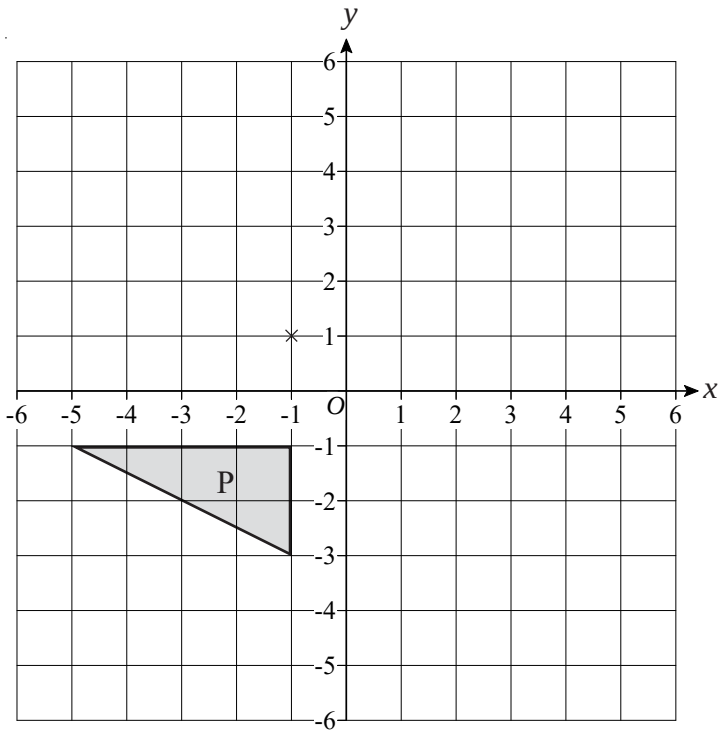
b) Solve the equation $x^2 - x - 7 = 0$

Give your answers correct to 3 significant figures.

$x = -2.19$ or $x = 3.19$

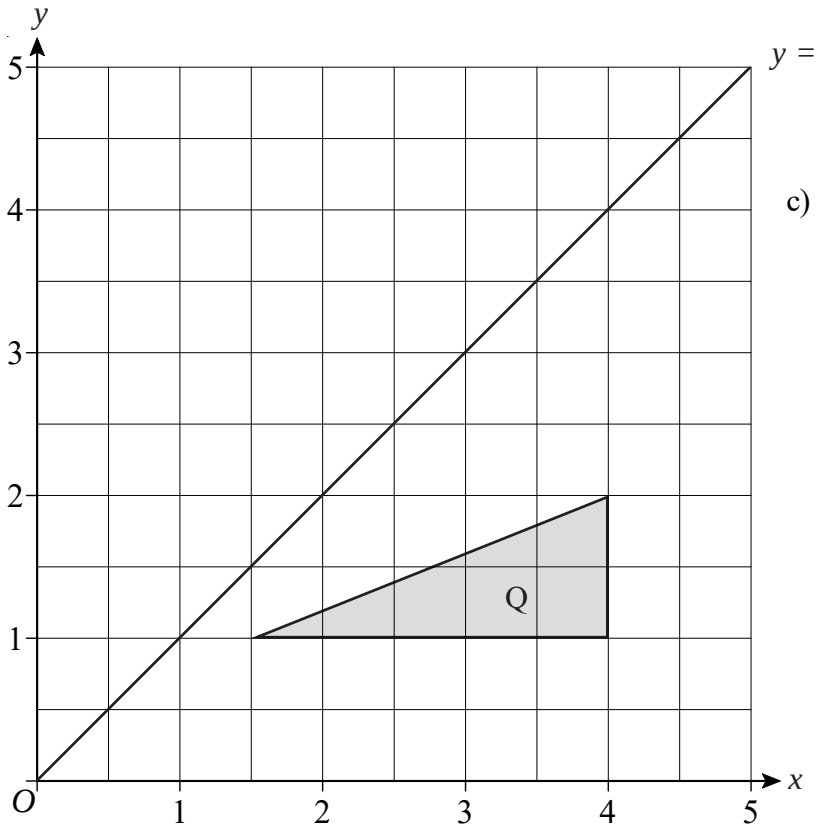
Combinations of Transformations

1)



a) Rotate triangle P 180° about the point (-1, 1).
Label the new triangle A.

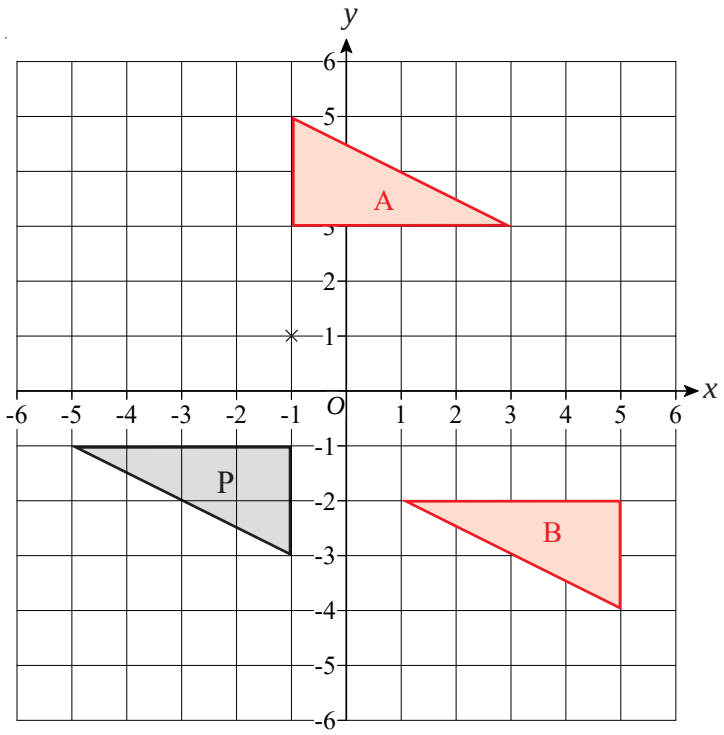
b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
Label the new triangle B.



c) Reflect triangle Q in the line $y = x$.
Label the new triangle C.

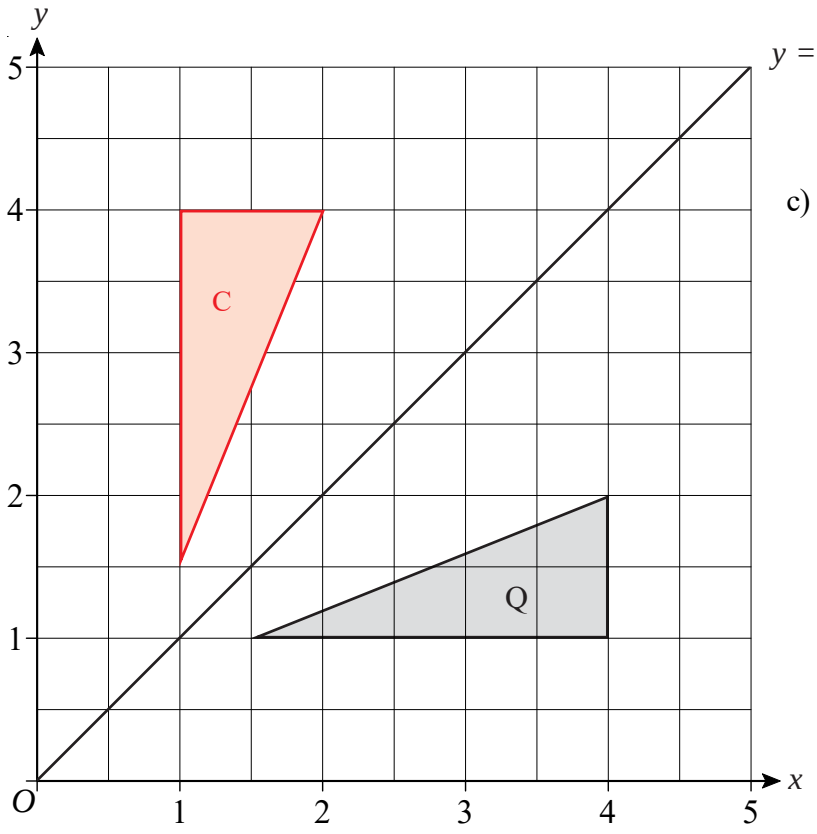
Combinations of Transformations

1)



a) Rotate triangle P 180° about the point (-1, 1).
Label the new triangle A.

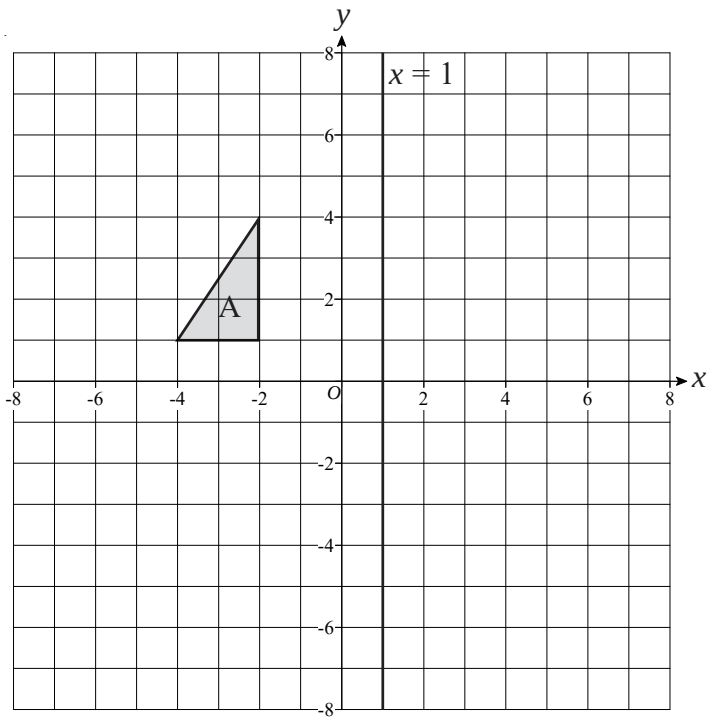
b) Translate triangle P by the vector $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$
Label the new triangle B.



c) Reflect triangle Q in the line $y = x$.
Label the new triangle C.

Combinations of Transformations

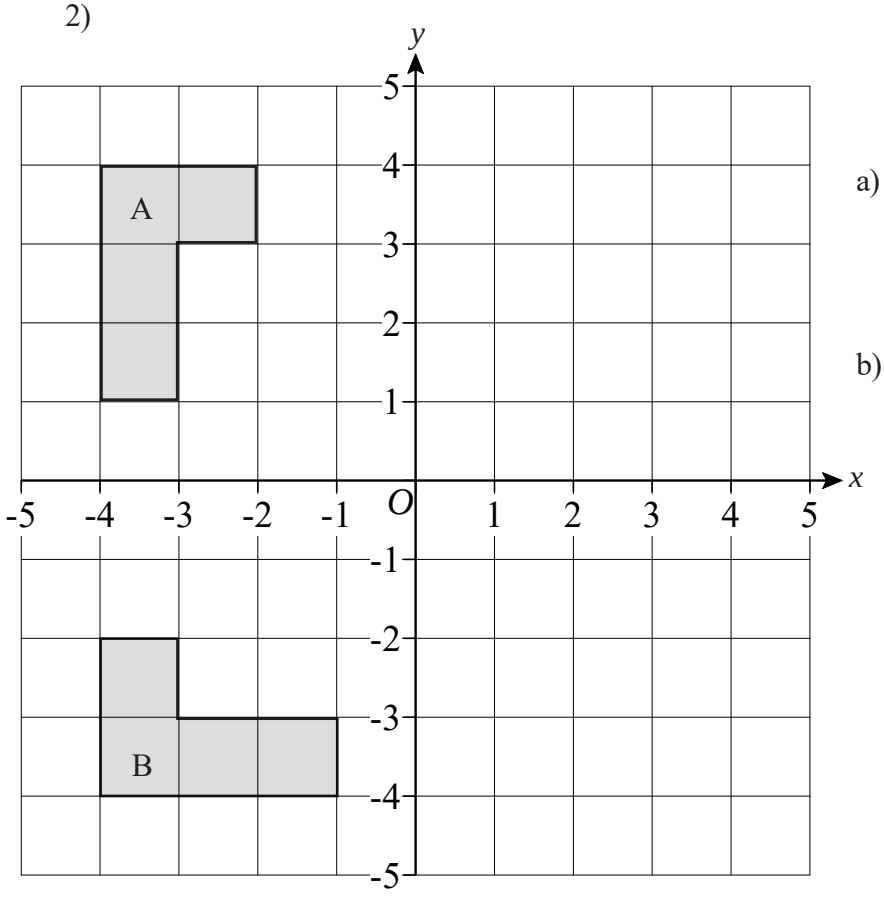
1)



Triangle A is reflected in the *x*-axis to give triangle B.
Triangle B is reflected in the line $x = 1$ to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.

2)

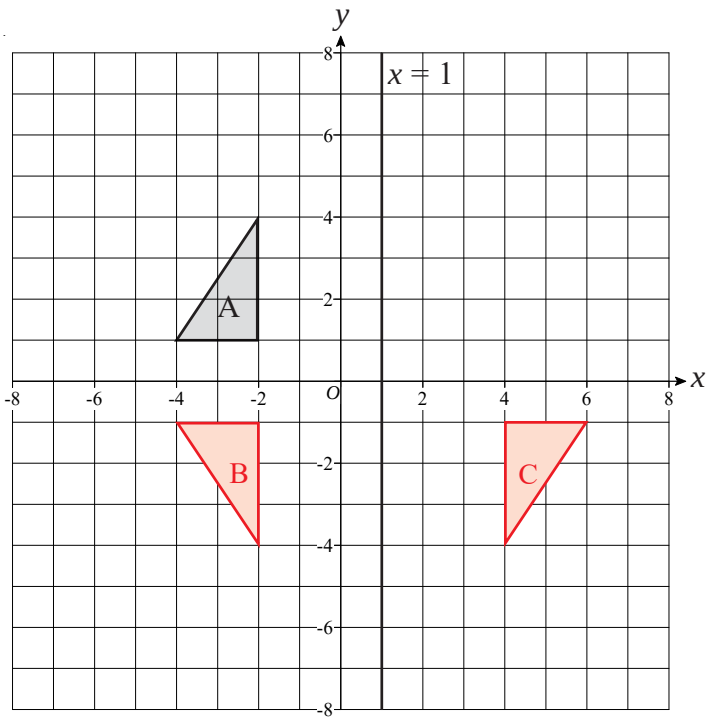


a) Reflect shape A in the *y*-axis.

b) Describe fully the **single** transformation which takes shape A to shape B.

Combinations of Transformations

1)

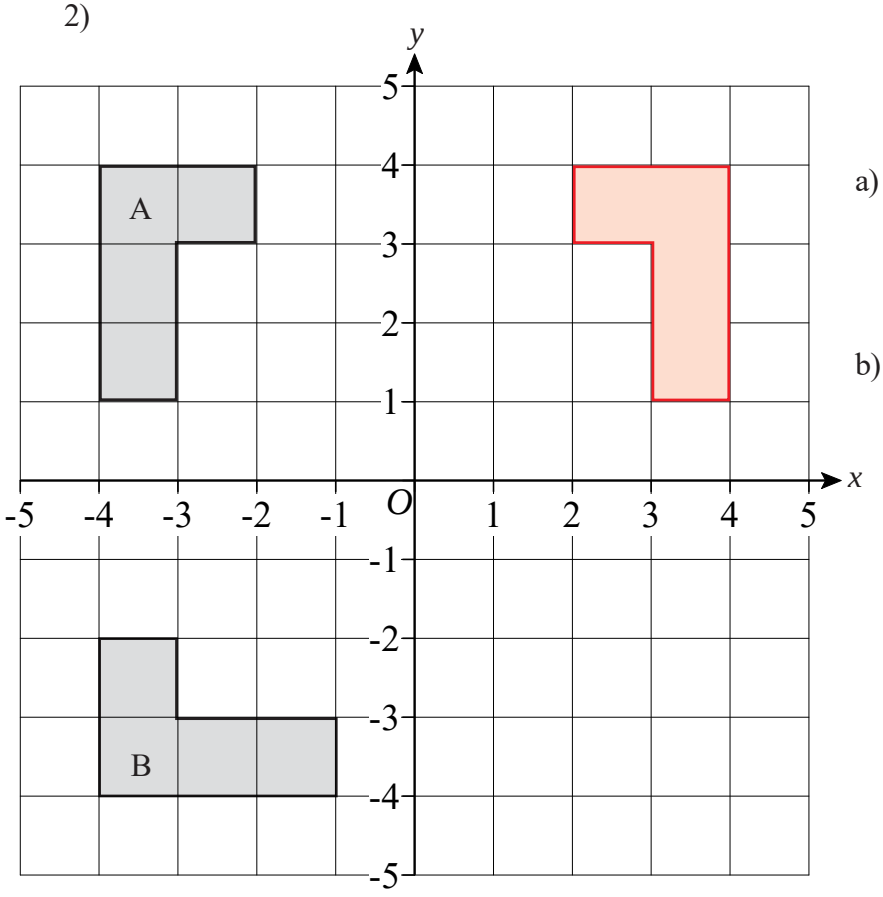


Triangle A is reflected in the x-axis to give triangle B.
Triangle B is reflected in the line $x = 1$ to give triangle C.

Describe fully the **single** transformation that takes triangle A to triangle C.

Rotation of 180° about the point (1, 0)

2)

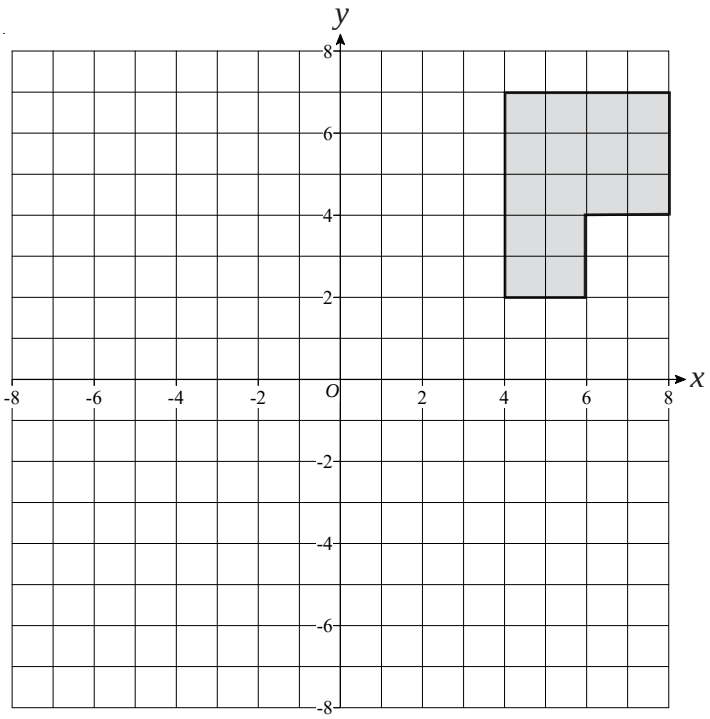


a) Reflect shape A in the y-axis.

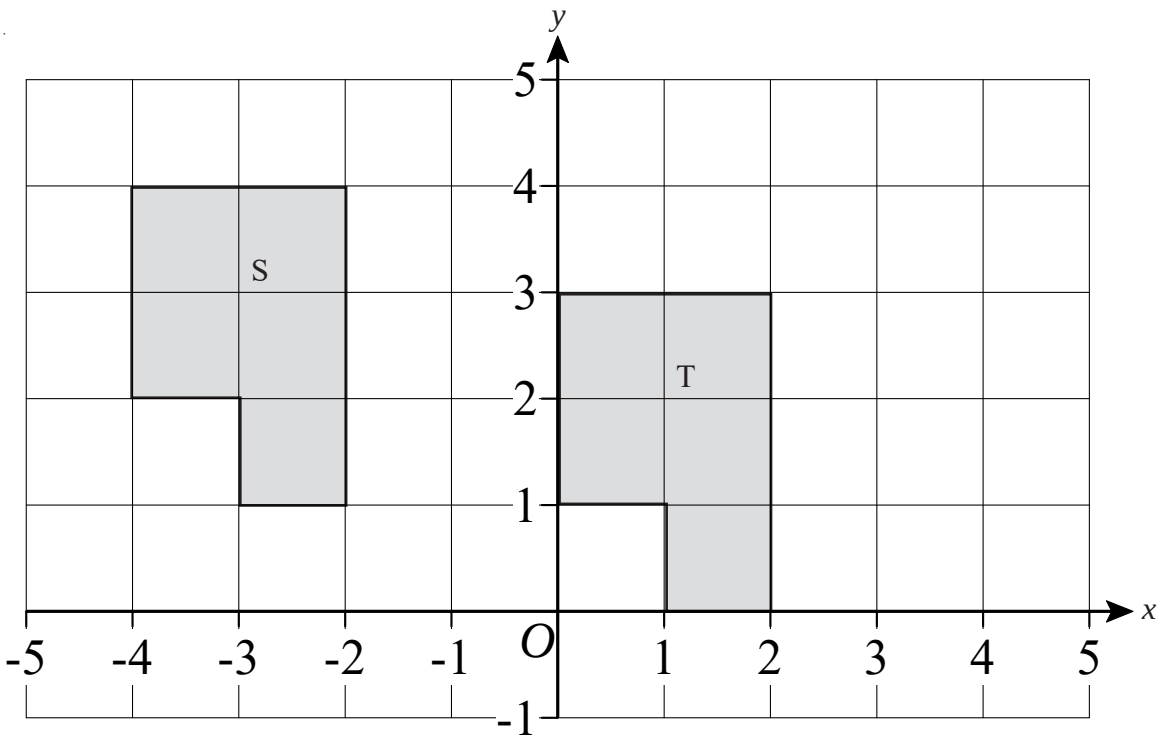
b) Describe fully the **single** transformation which takes shape A to shape B.

Rotation of 90° anticlockwise about the point (0, 0)

Combinations of Transformations

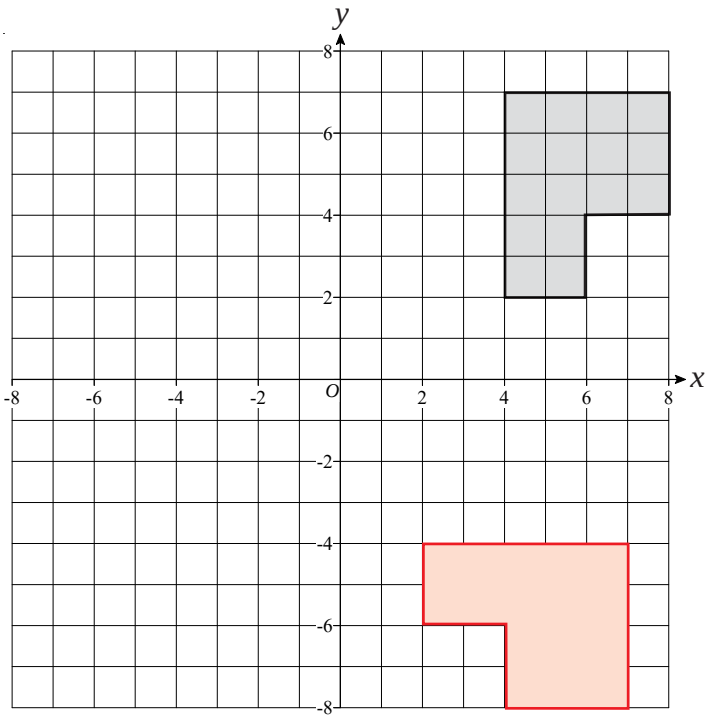


a) Rotate the shaded shape 90° clockwise about the point *0*.

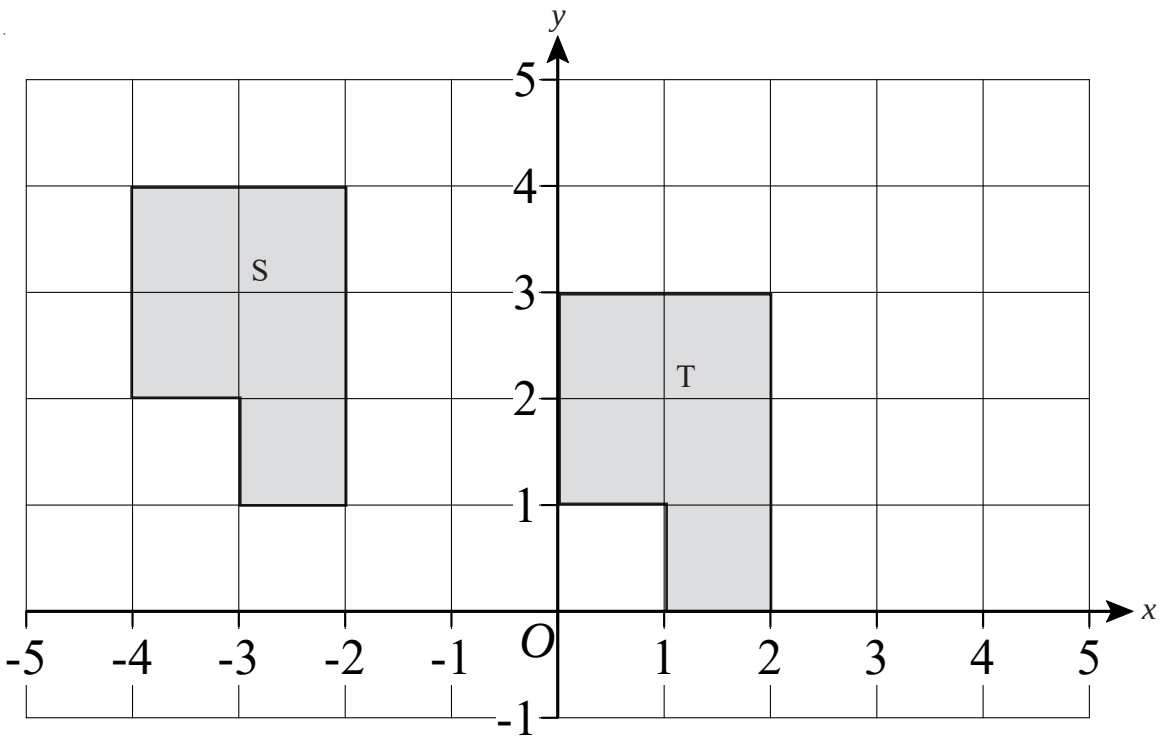


b) Describe fully the single transformation that will map shape S onto shape T.

Combinations of Transformations



a) Rotate the shaded shape 90° clockwise about the point *0*.

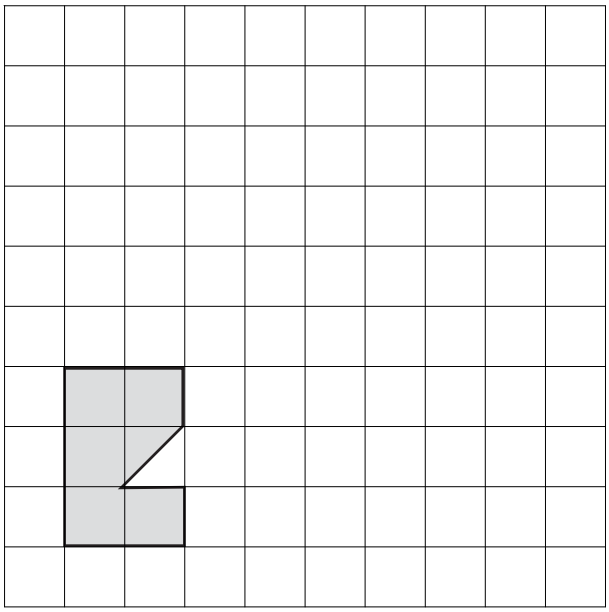


b) Describe fully the single transformation that will map shape S onto shape T.

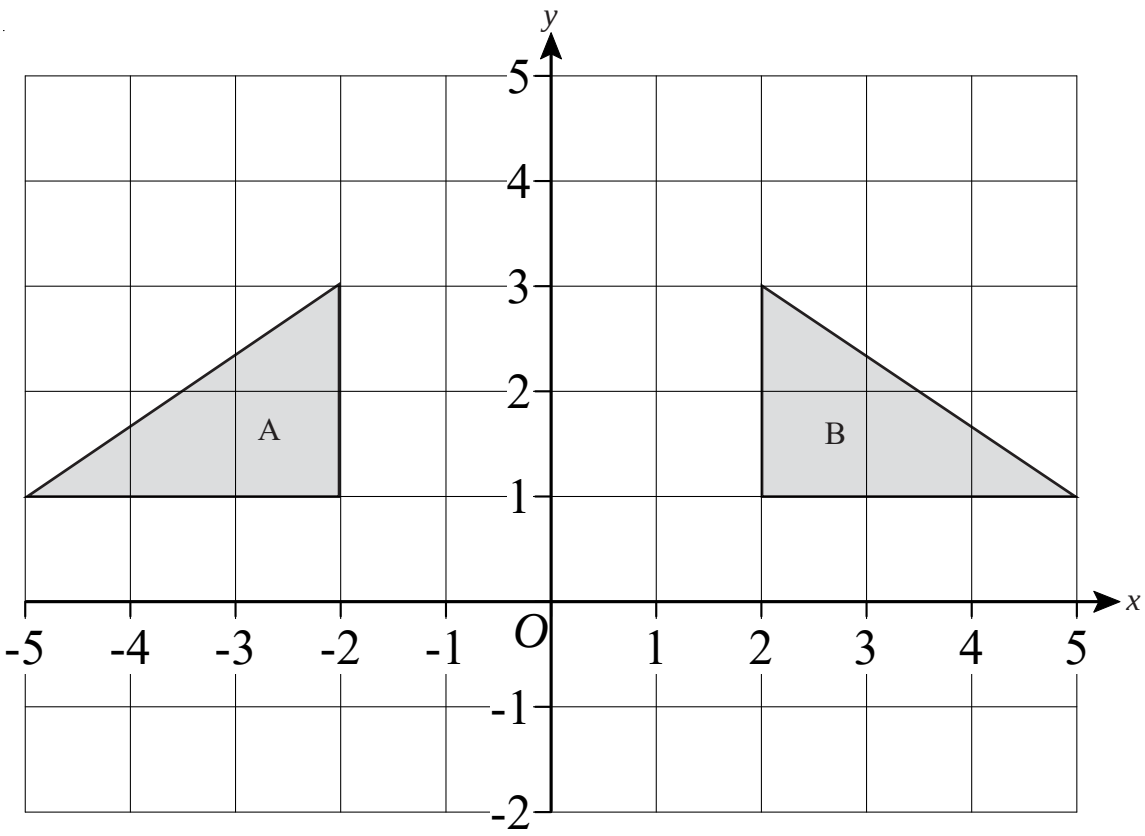
Translate shape S by the vector $\begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Combinations of Transformations

1)



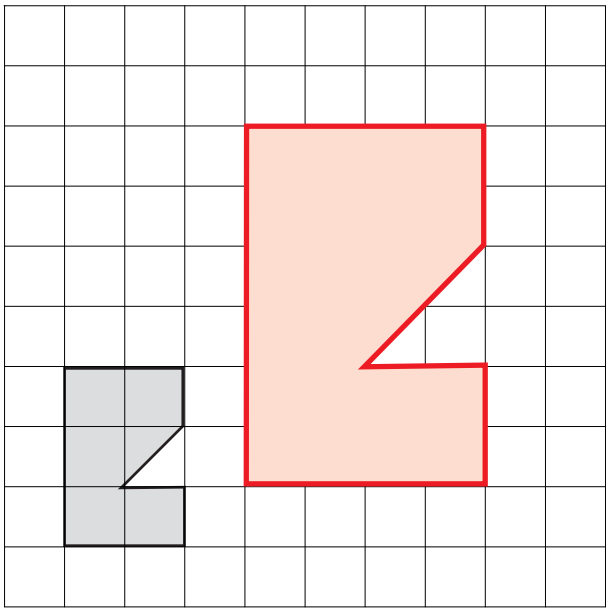
a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.



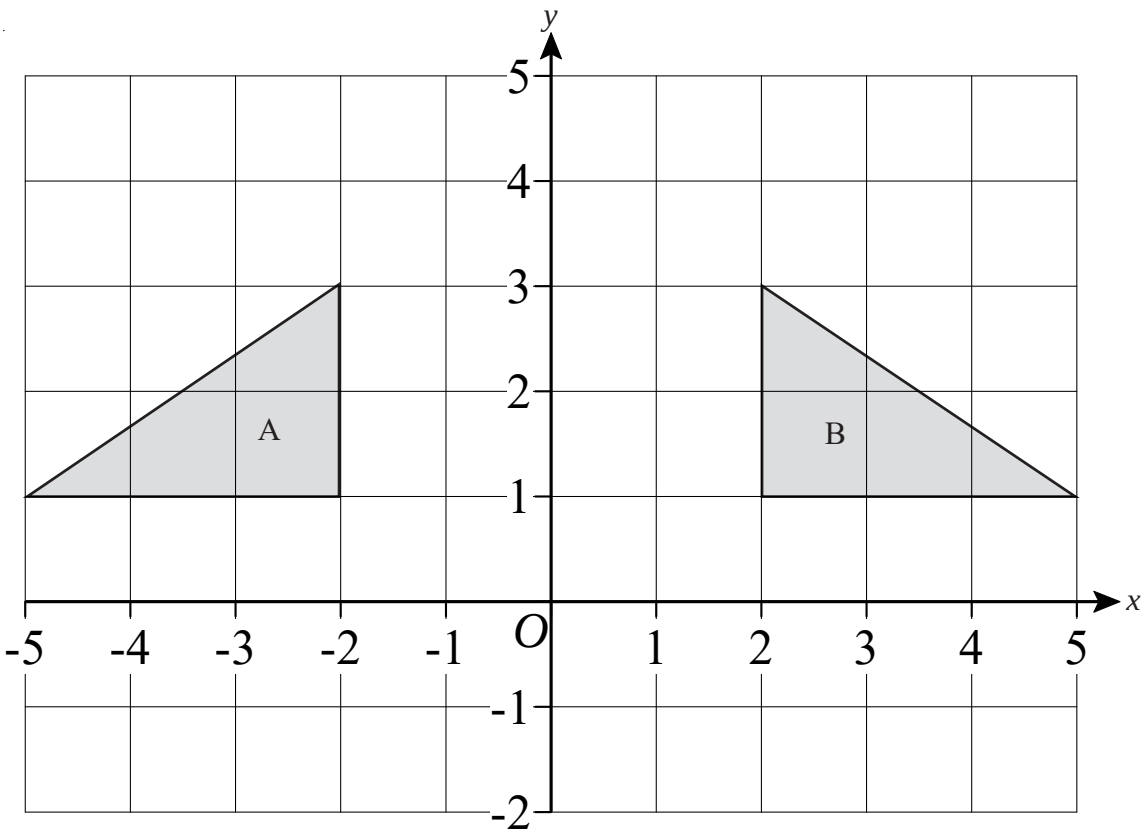
b) Describe fully the single transformation that maps triangle A onto triangle B.

Combinations of Transformations

1)



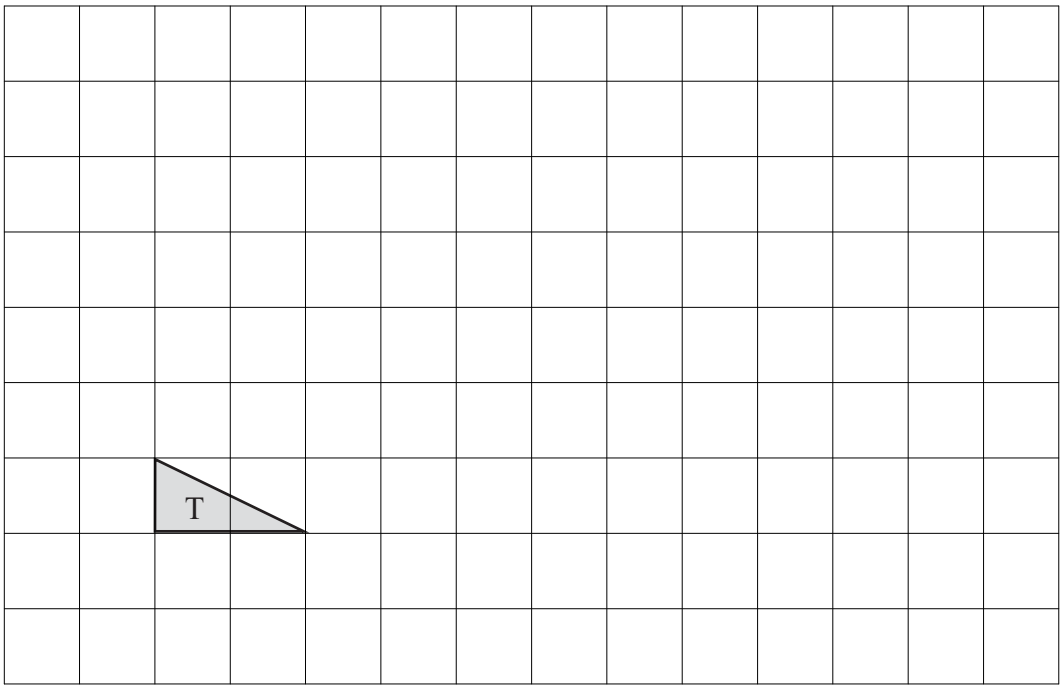
a) On the grid, draw an enlargement, scale factor 2, of the shaded shape.



b) Describe fully the single transformation that maps triangle A onto triangle B.

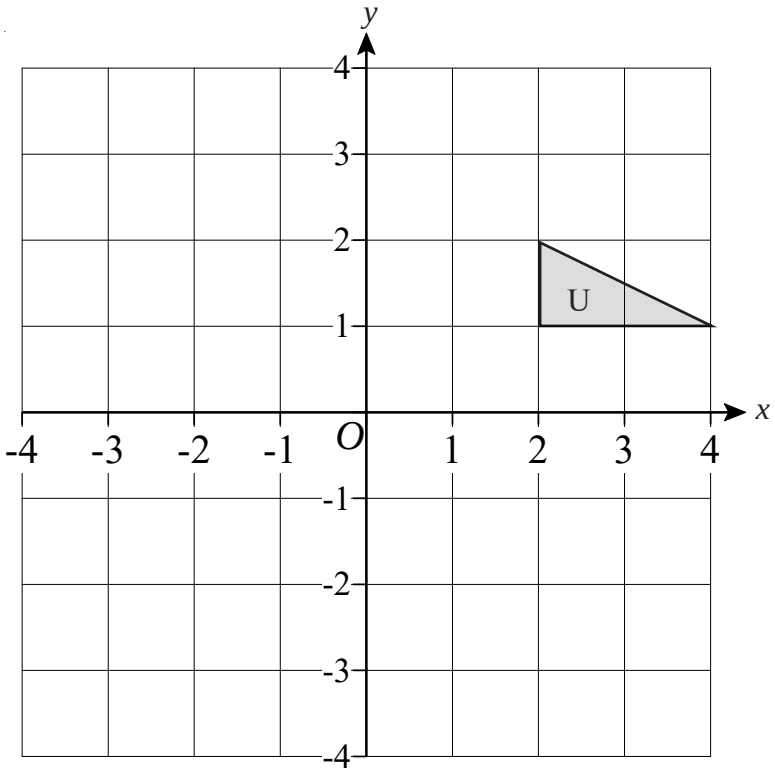
Reflection in the *y* - axis

Combinations of Transformations



Triangle T has been drawn on a grid.

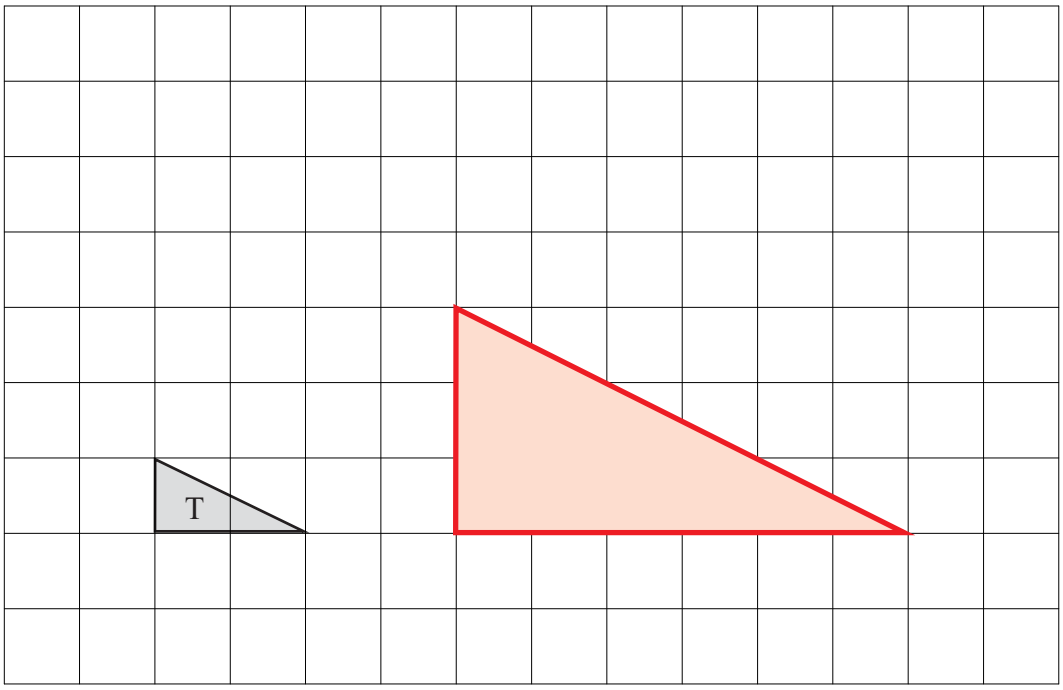
a) On the grid, draw an enlargement of the triangle T with scale factor 3.



Triangle U has been drawn on a grid.

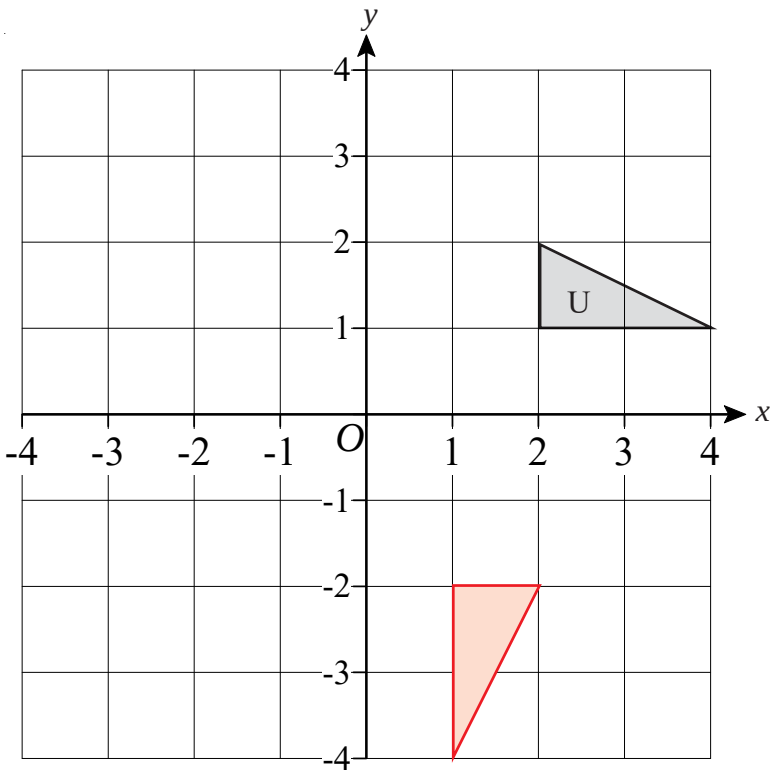
b) On the grid, rotate triangle U 90° clockwise about the centre *O*.

Combinations of Transformations



Triangle T has been drawn on a grid.

a) On the grid, draw an enlargement of the triangle T with scale factor 3.

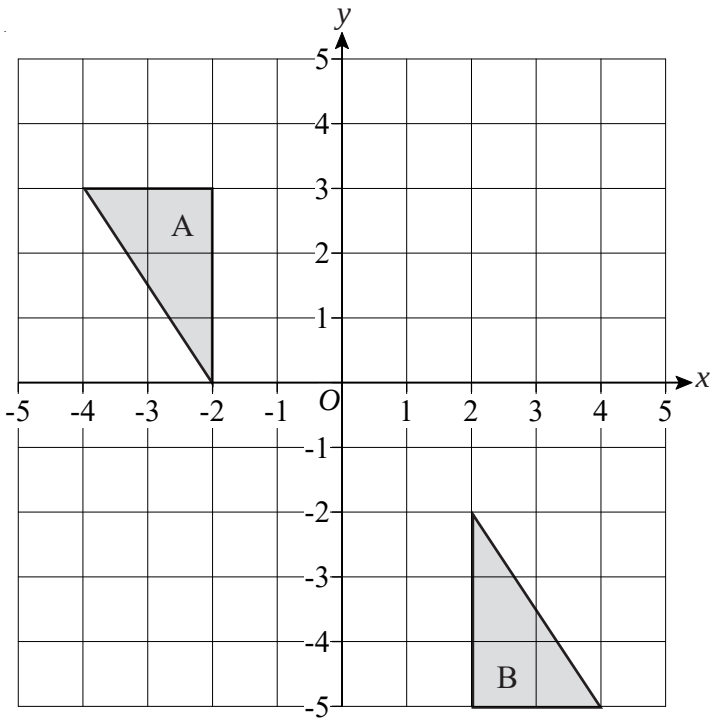


Triangle U has been drawn on a grid.

b) On the grid, rotate triangle U 90° clockwise about the centre *O*.

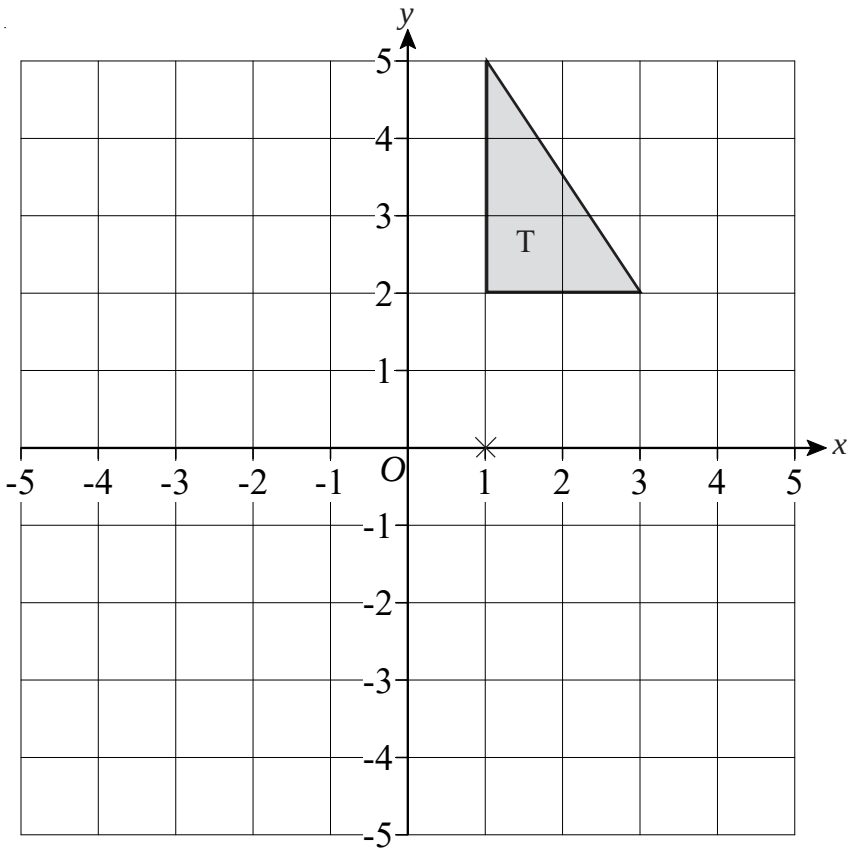
Combinations of Transformations

1)



Describe fully the single transformation that maps triangle A onto triangle B.

2)



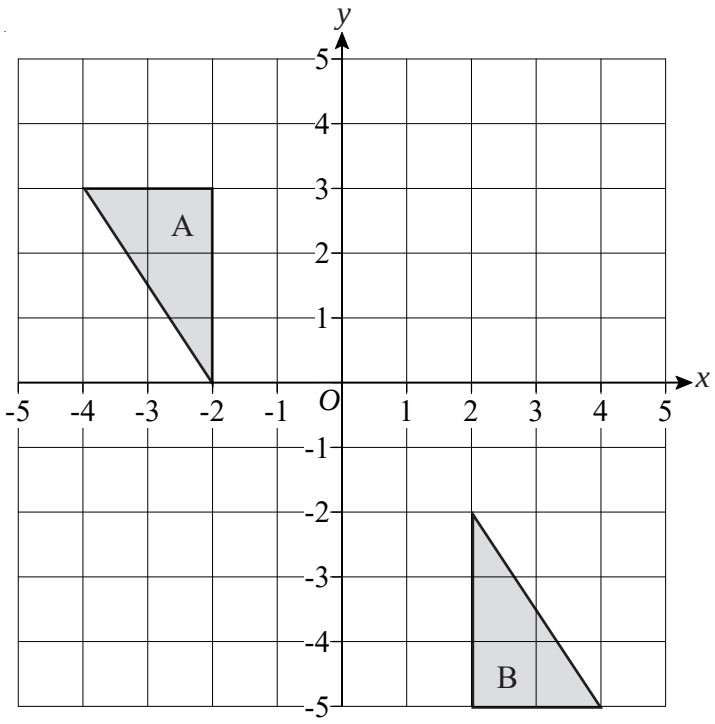
Triangle T has been drawn on the grid.

Rotate triangle T 180° about the point (1, 0)

Label the new triangle A.

Combinations of Transformations

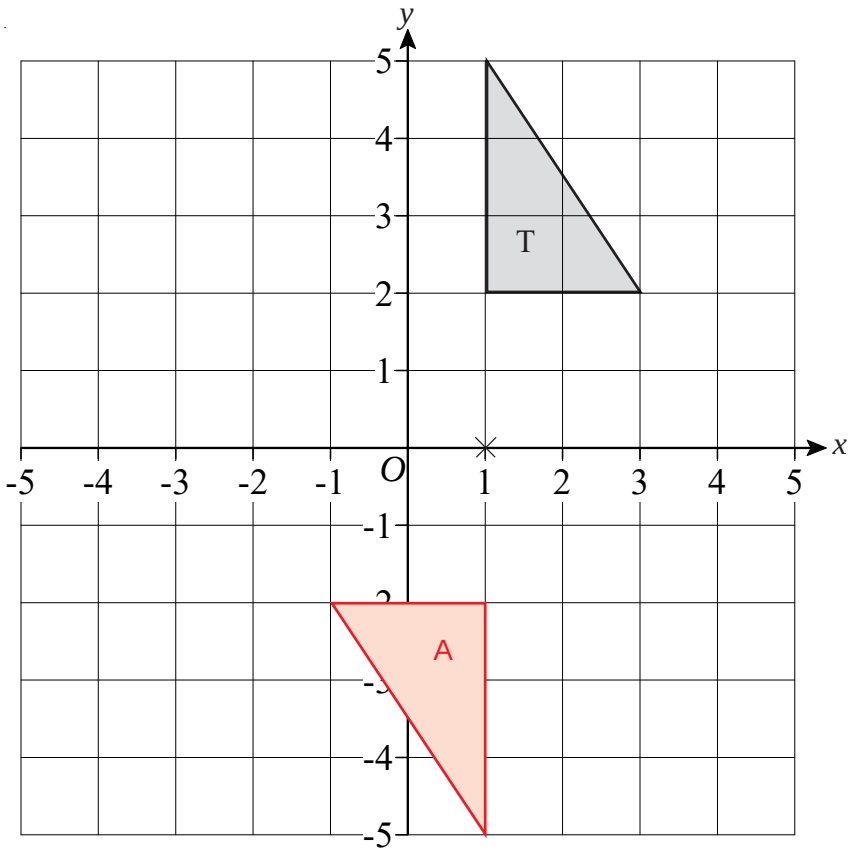
1)



Describe fully the single transformation that maps triangle A onto triangle B.

Rotation of 180° about the point (0, -1)

2)



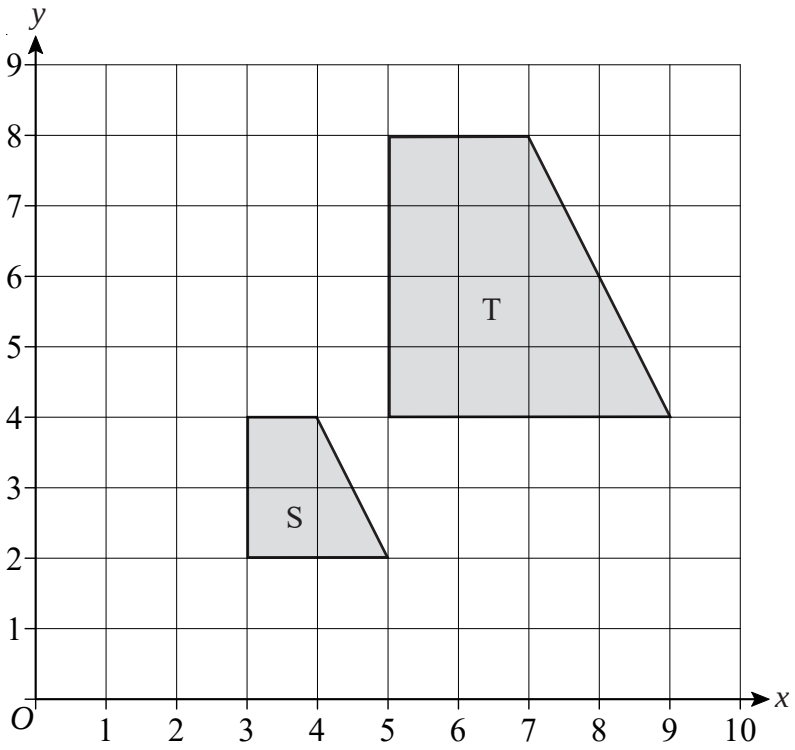
Triangle T has been drawn on the grid.

Rotate triangle T 180° about the point (1, 0)

Label the new triangle A.

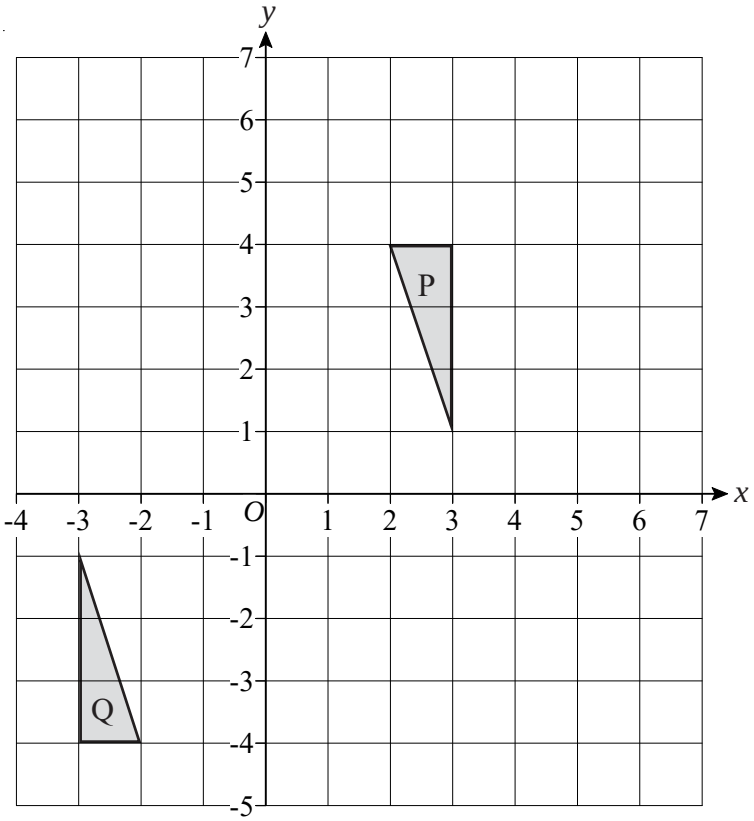
Combinations of Transformations

1)



Describe fully the single transformation which maps shape S onto shape T.

2)



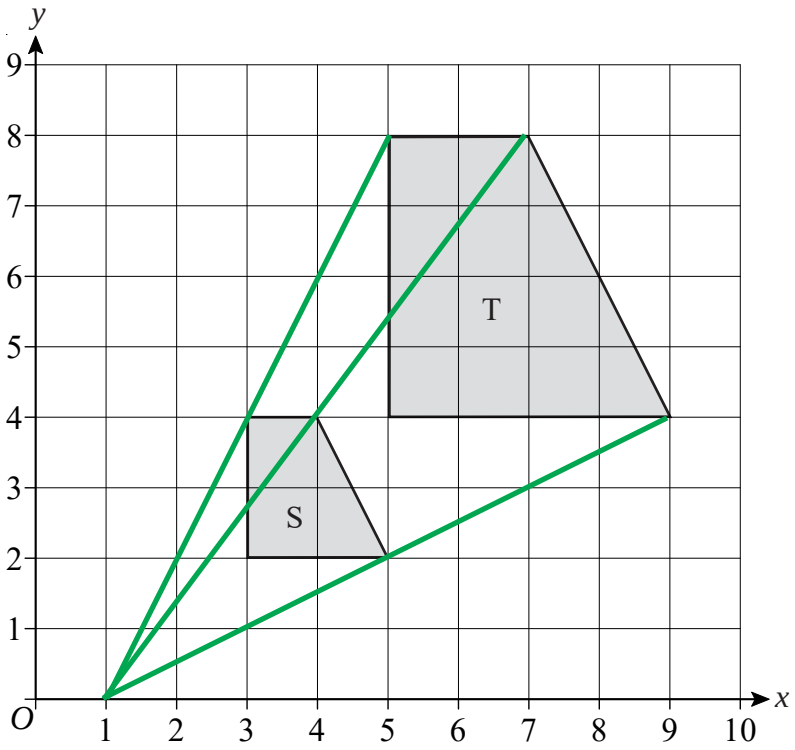
Triangle P and triangle Q are drawn on the grid.

a) Describe fully the single transformation which maps triangle P onto triangle Q.

b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$
Label the new triangle R.

Combinations of Transformations

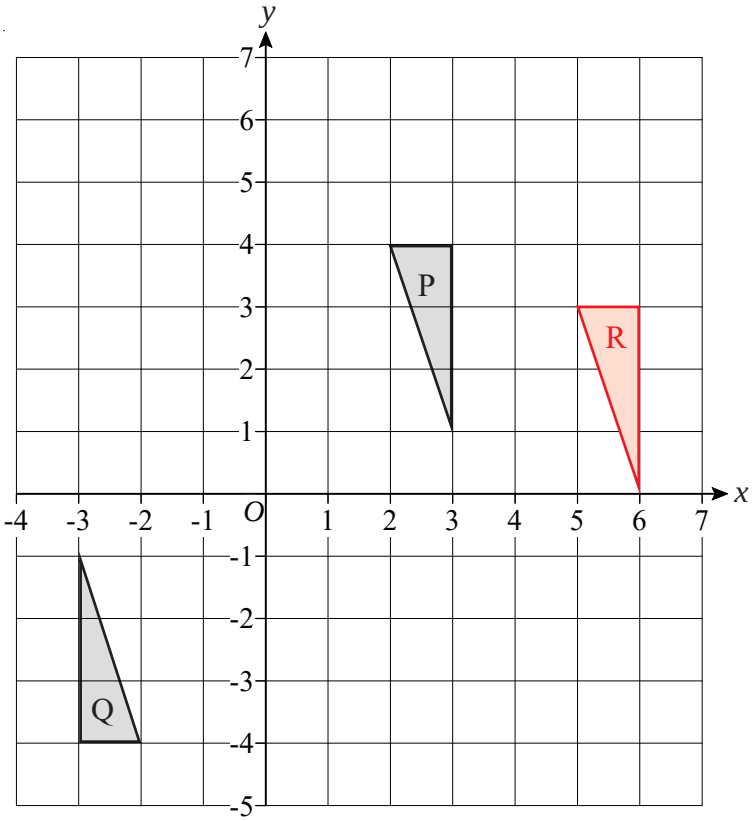
1)



Describe fully the single transformation which maps shape S onto shape T.

Enlargement scale factor 2 with (1, 0) as the centre of enlargement.

2)



Triangle P and triangle Q are drawn on the grid.

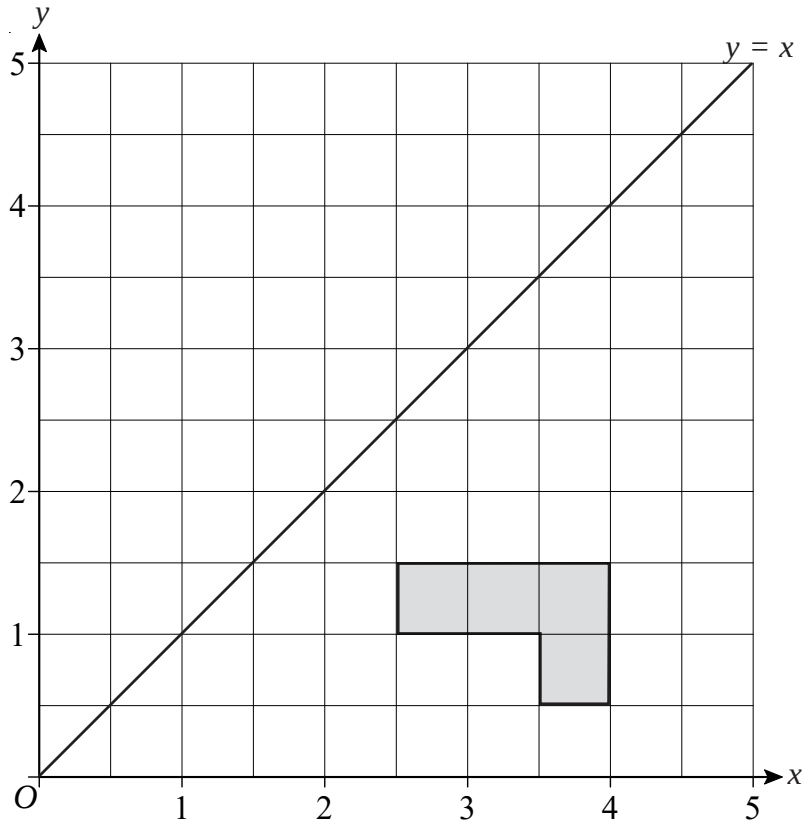
a) Describe fully the single transformation which maps triangle P onto triangle Q.

Rotation of 180° about the point (0, 0)

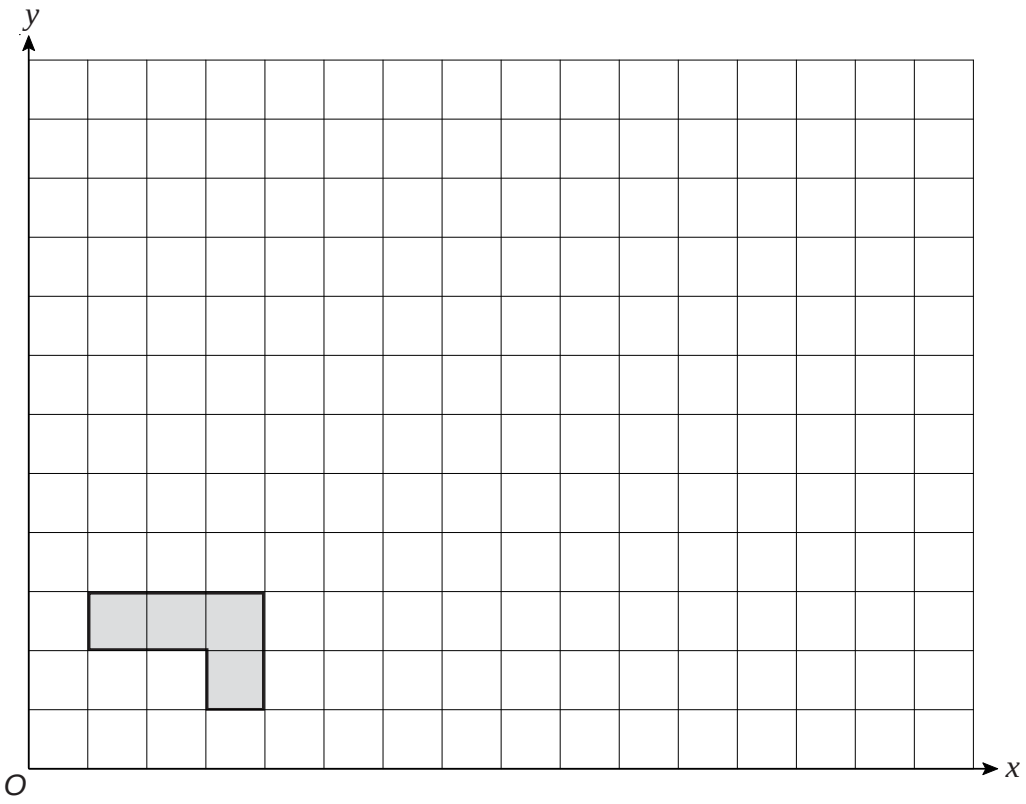
b) Translate triangle P by the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$

Label the new triangle R.

Combinations of Transformations

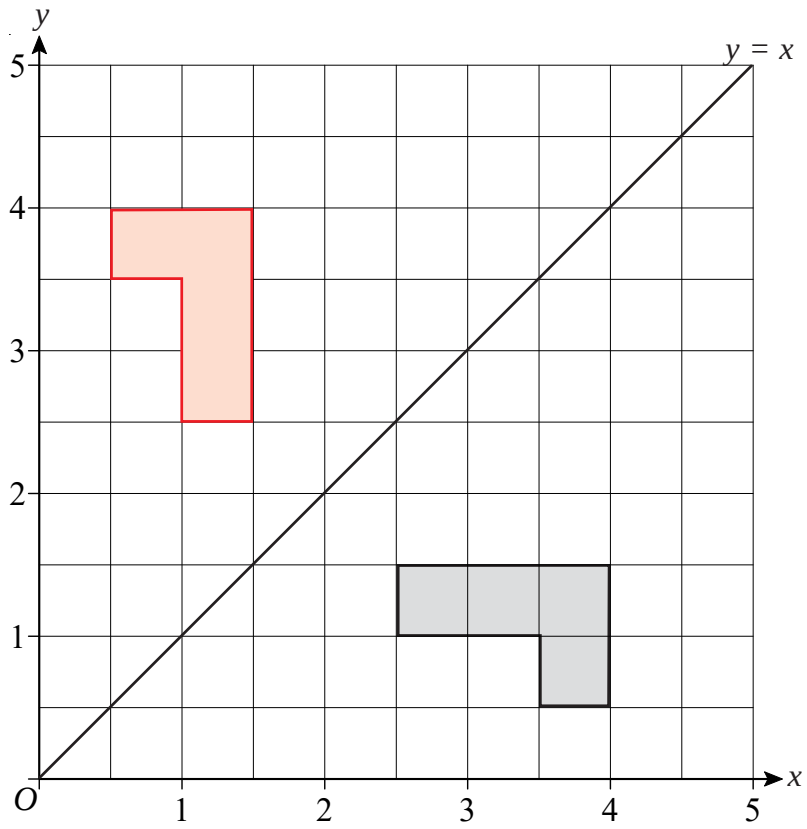


a) Reflect the shaded shape in the line $y = x$.

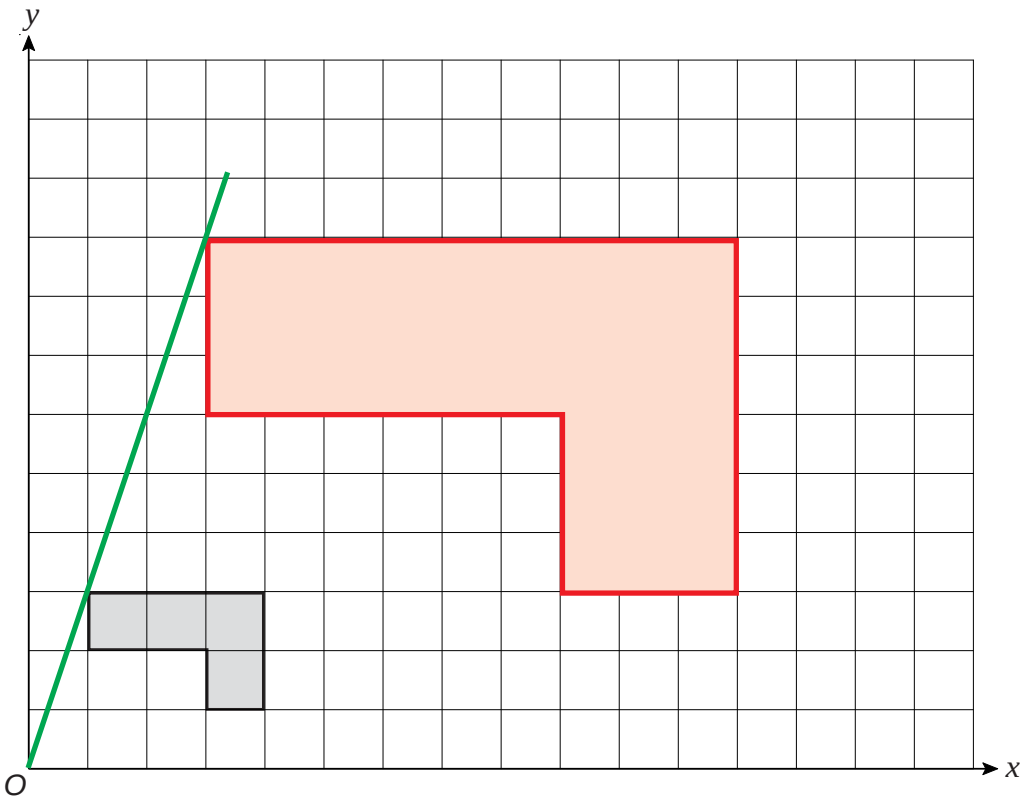


b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

Combinations of Transformations

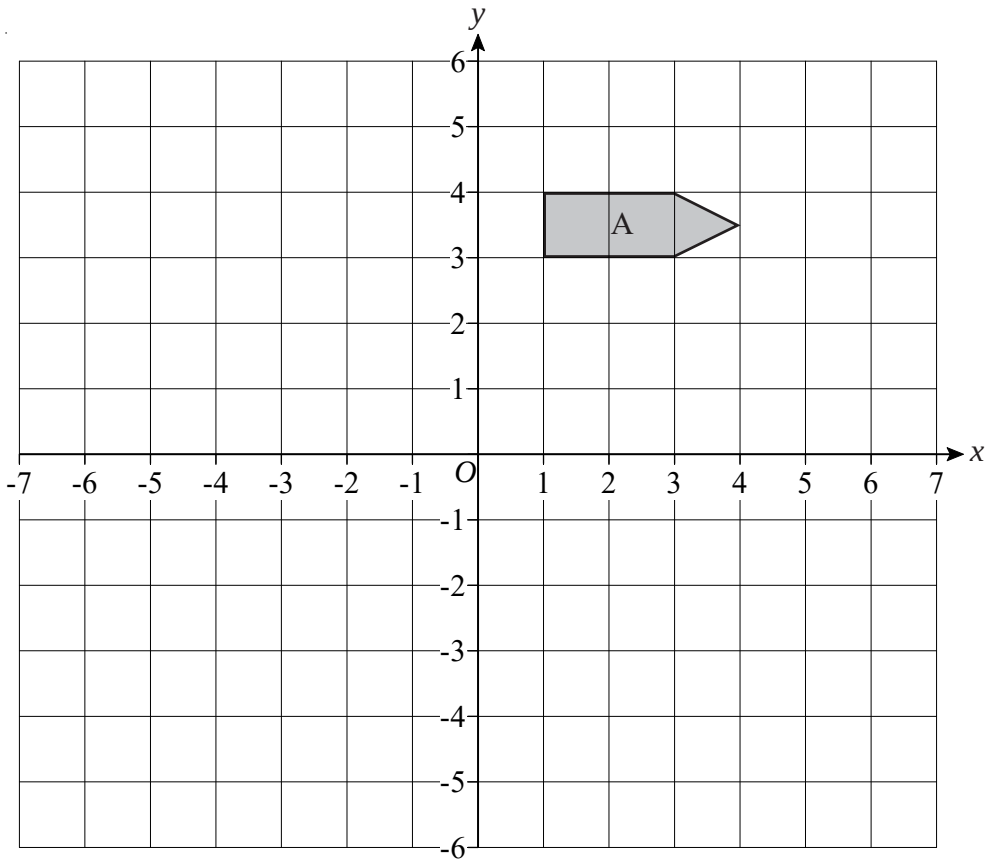


a) Reflect the shaded shape in the line $y = x$.

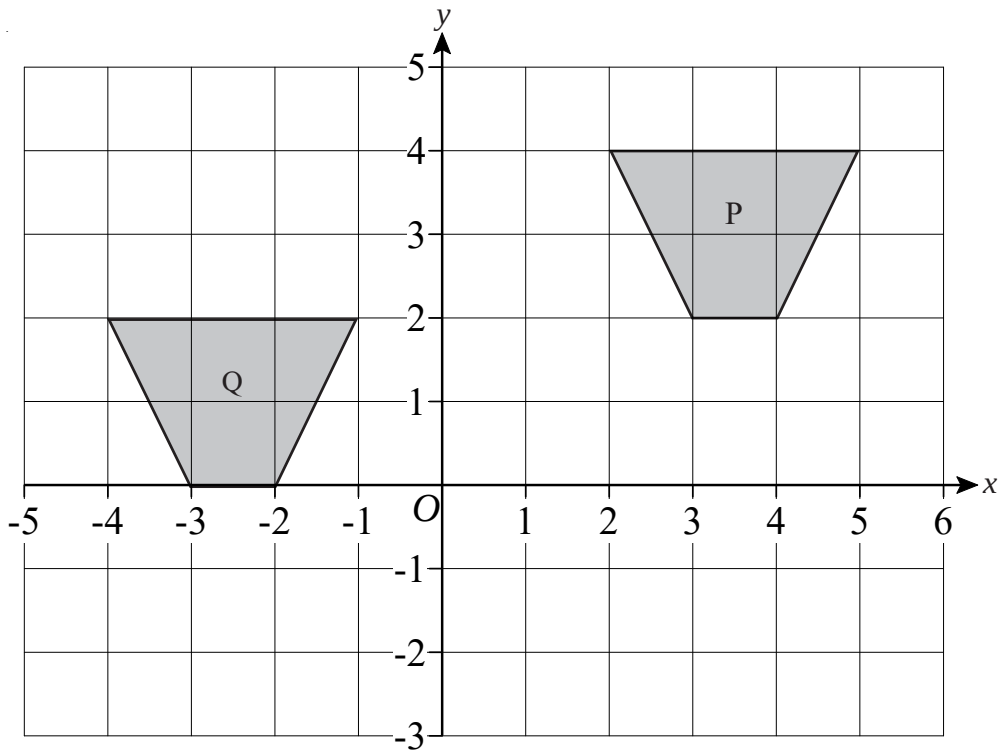


b) On the grid, enlarge the shaded shape by a scale factor of 3, centre O.

Combinations of Transformations

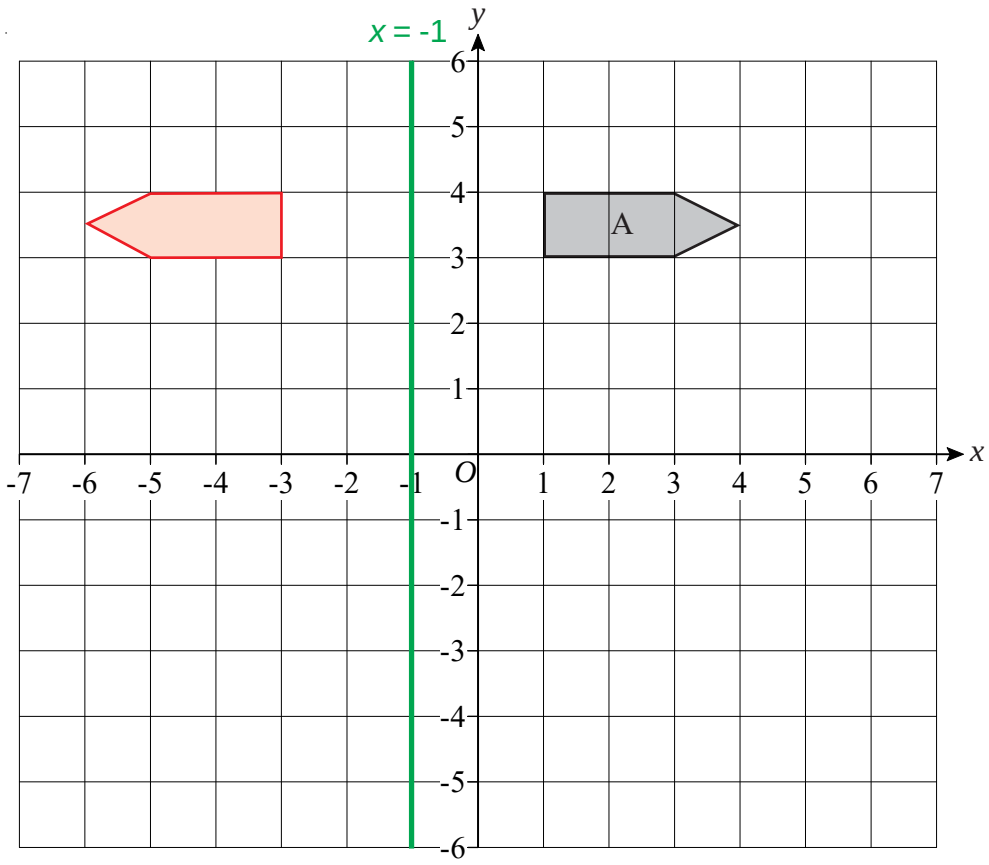


a) On the grid above, reflect shape A in the line $x = -1$

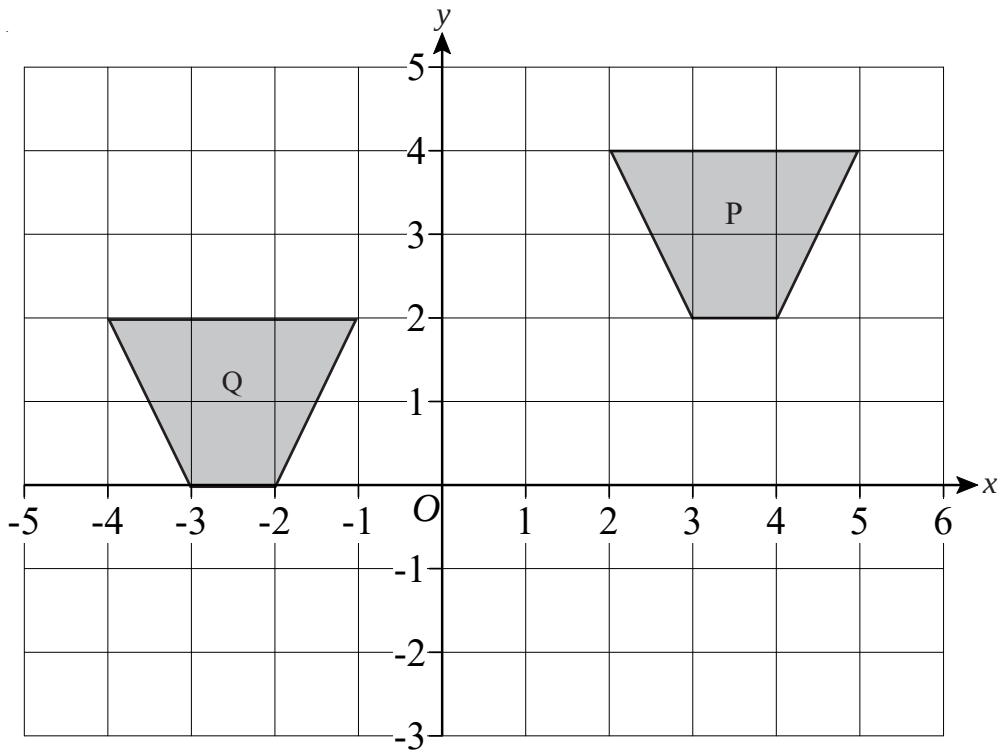


b) Describe fully the single transformation that will map shape P onto shape Q.

Combinations of Transformations



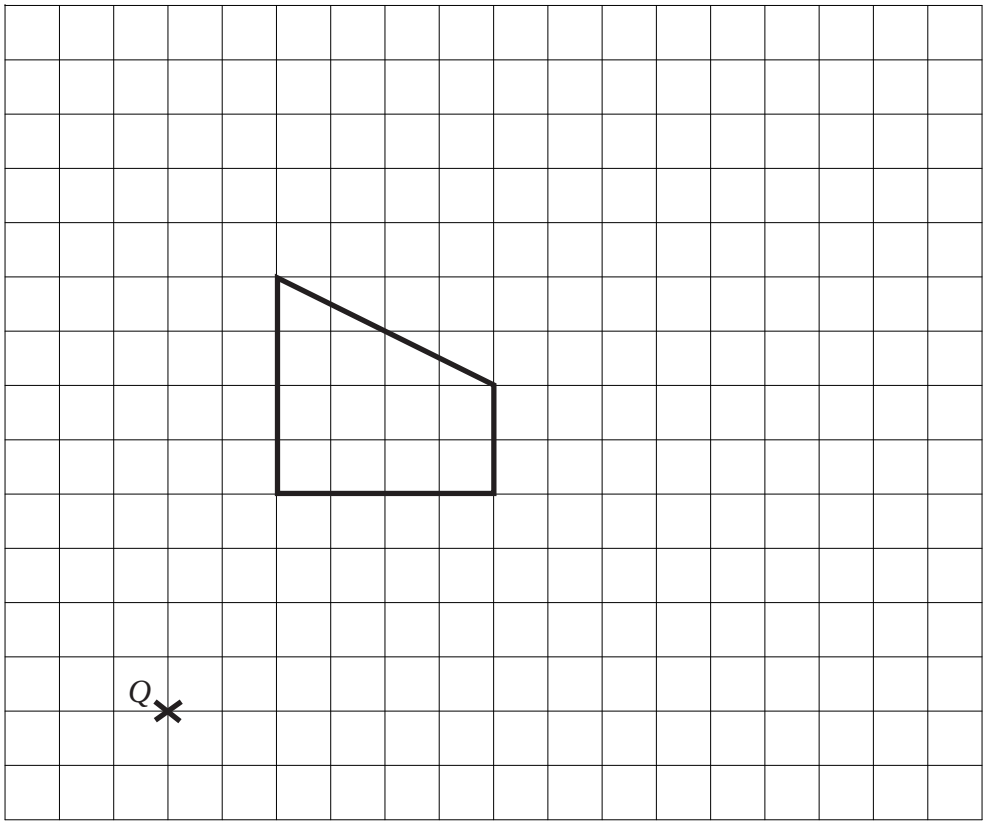
a) On the grid above, reflect shape A in the line $x = -1$



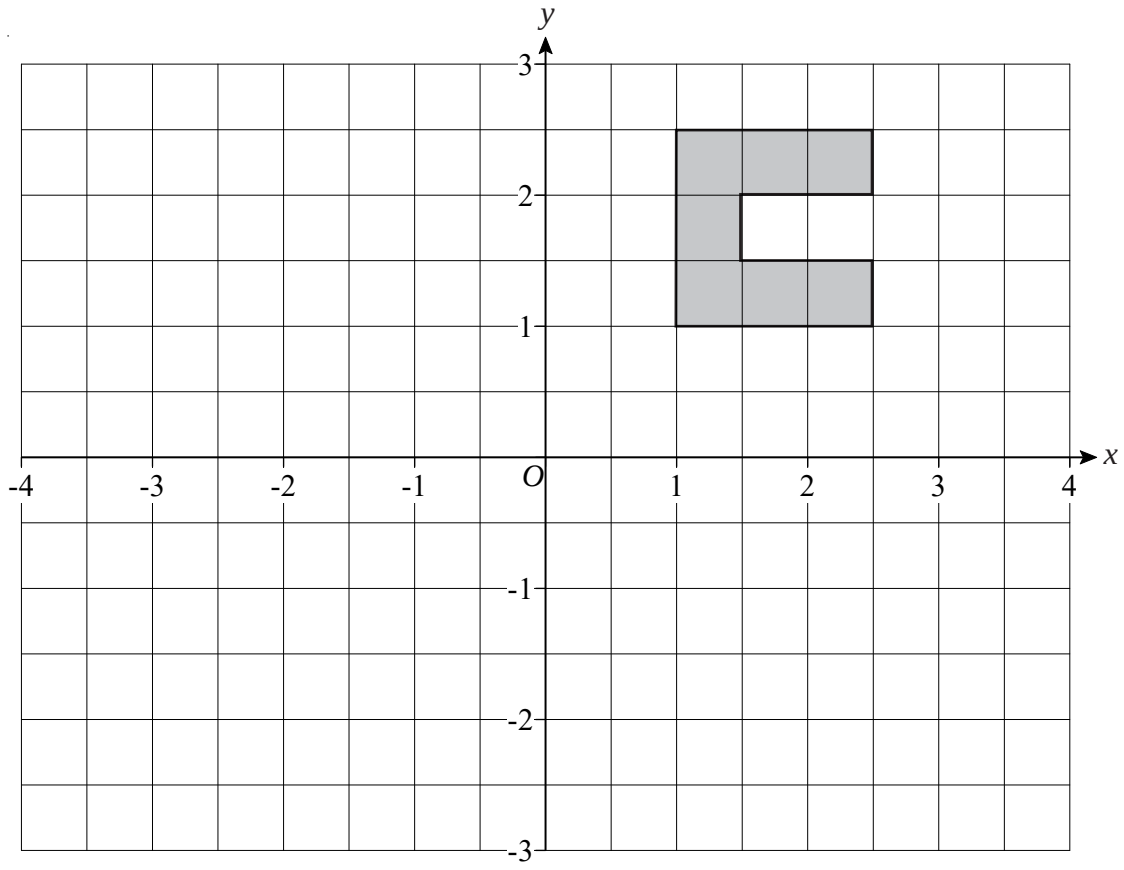
b) Describe fully the single transformation that will map shape P onto shape Q.

Translation by vector $\begin{pmatrix} -6 \\ -2 \end{pmatrix}$

Combinations of Transformations

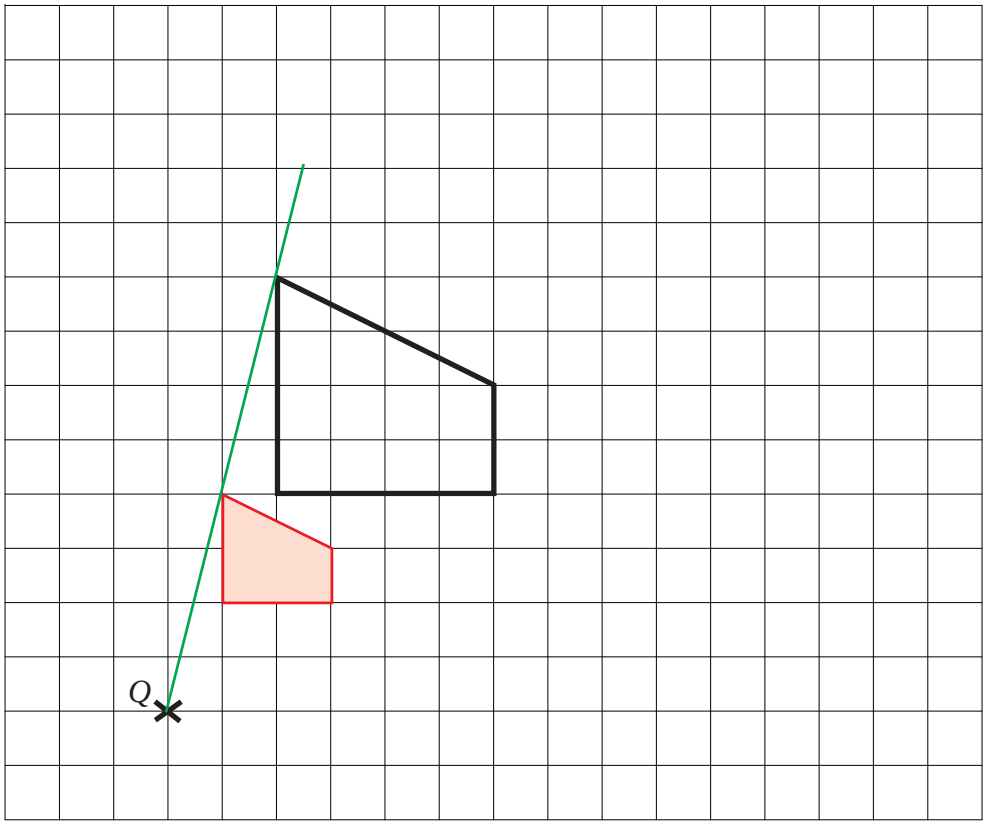


a) On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.

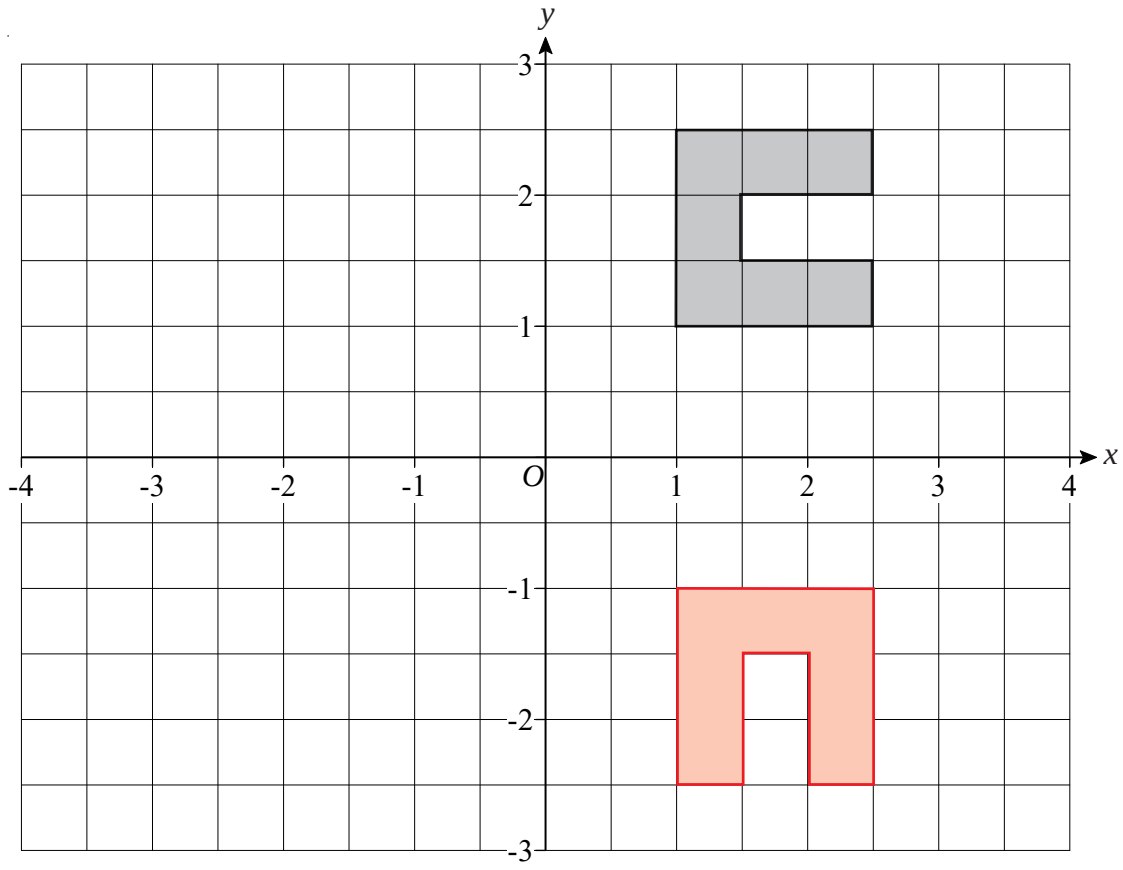


b) Rotate the shape 90° clockwise, centre O.

Combinations of Transformations



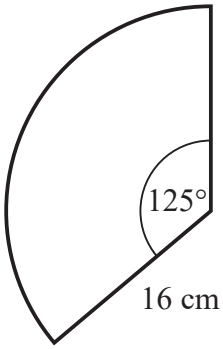
a) On the grid, enlarge the shape with scale factor $\frac{1}{2}$, centre Q.



b) Rotate the shape 90° clockwise, centre O.

Sectors of a Circle

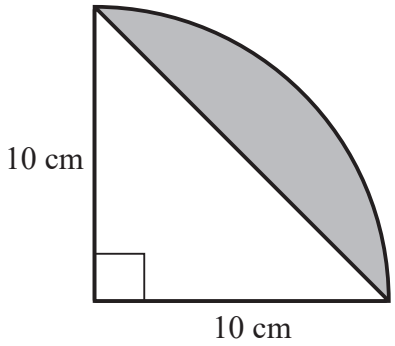
1) This sector of a circle has radius 16 cm.



a) Find the area of the sector.

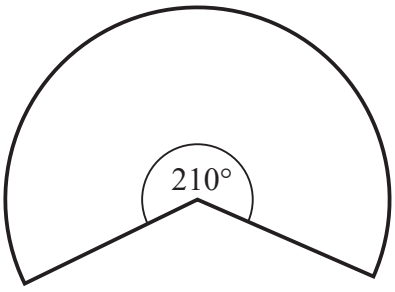
b) Find the perimeter of the sector.

2) A quadrant of a circle is shown.



Work out the area of the shaded section.

3) The diagram shows a sector of a circle.

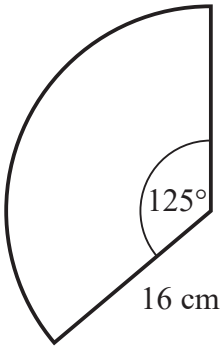


The arc length is 47.6 cm.

Work out the radius.

Sectors of a Circle

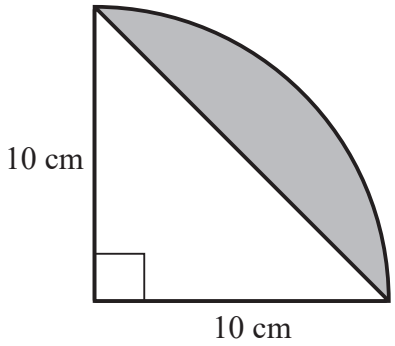
1) This sector of a circle has radius 16 cm.



a) Find the area of the sector. 279.29 cm^2

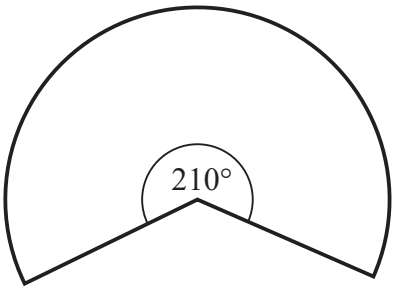
b) Find the perimeter of the sector. 66.91 cm

2) A quadrant of a circle is shown.



Work out the area of the shaded section. 28.55 cm^2

3) The diagram shows a sector of a circle.



The arc length is 47.6 cm.

Work out the radius. 13 cm

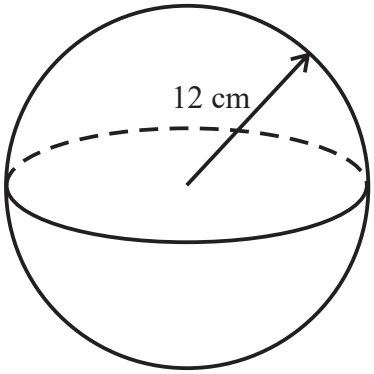
Spheres

Volume of a sphere = $\frac{4}{3}\pi r^3$

Surface area of a sphere = $4\pi r^2$

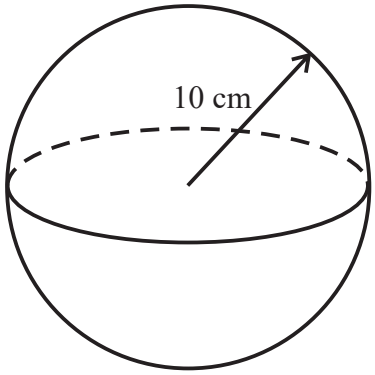
1) a) Work out the volume of the sphere.

b) Work out the surface area of the sphere.



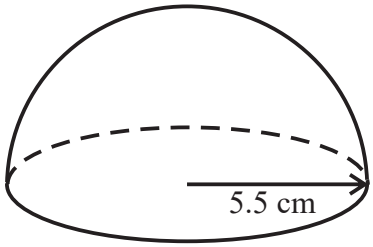
2) a) Work out the volume of the sphere, leaving your answer in terms of π.

b) Work out the surface area of the sphere, leaving your answer in terms of π.



3) a) Work out the volume of the solid hemisphere.

b) Work out the surface area of the solid hemisphere.



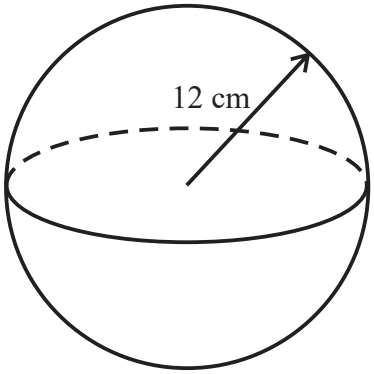
Spheres

Volume of a sphere = $\frac{4}{3}\pi r^3$

Surface area of a sphere = $4\pi r^2$

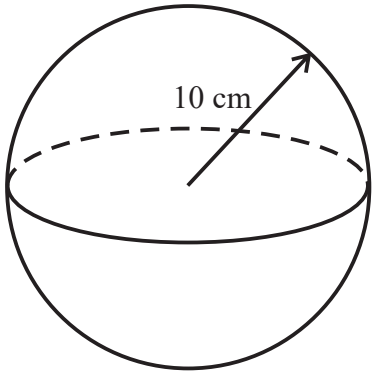
1) a) Work out the volume of the sphere. 7239.168 cm^3

b) Work out the surface area of the sphere. 1809.792 cm^2



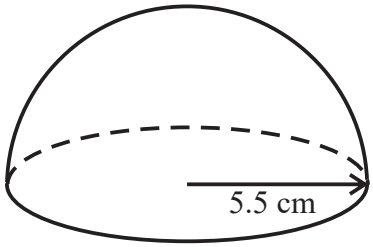
2) a) Work out the volume of the sphere, leaving your answer in terms of π. $\frac{4000}{3}$ π cm^3

b) Work out the surface area of the sphere, leaving your answer in terms of π. 400π cm^2



3) a) Work out the volume of the solid hemisphere. 348.50 cm^3

b) Work out the surface area of the solid hemisphere. 285.14 cm^2



Cones

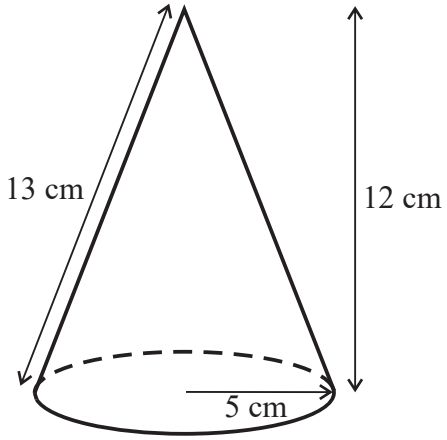
Volume of a cone = $\frac{1}{3}\pi r^2 h$

Curved surface area = πrl

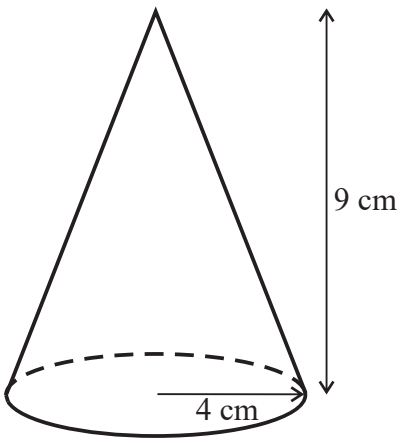
1) a) Work out the volume of the cone.

b) Work out the curved surface area of the cone.

c) The total surface area of the cone.



2) Work out the volume of the cone, leaving your answer in terms of π.



Cones

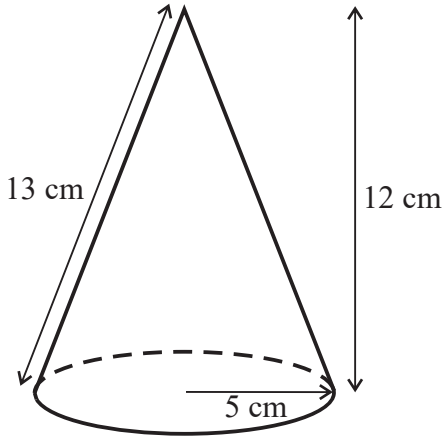
Volume of a cone = $\frac{1}{3}\pi r^2 h$

Curved surface area = πrl

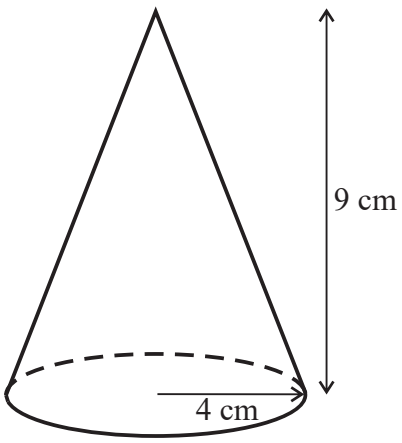
1) a) Work out the volume of the cone. 314.2 cm^3

b) Work out the curved surface area of the cone. 204.23 cm^2

c) The total surface area of the cone. 282.78 cm^2

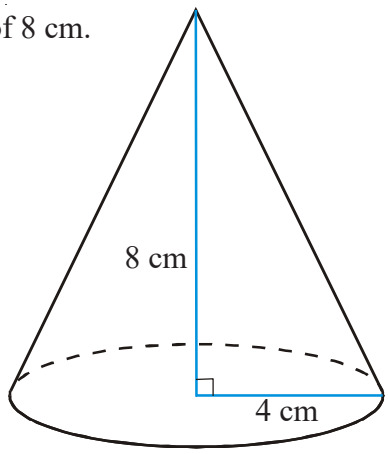


2) Work out the volume of the cone, leaving your answer in terms of π. 48π cm^3



Spheres and Cones

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

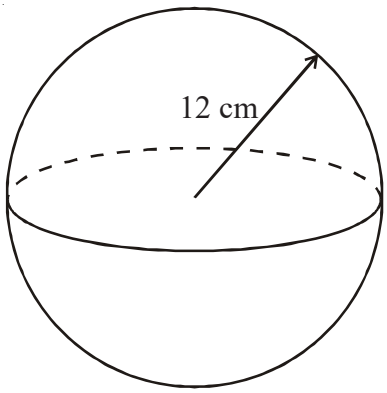


a) Calculate the volume of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Use Pythagoras' Theorem to find the slant height of the cone.
Give your answer correct to 1 decimal place.

c) Find the curved surface area of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

2) A sphere has a radius of 12cm.

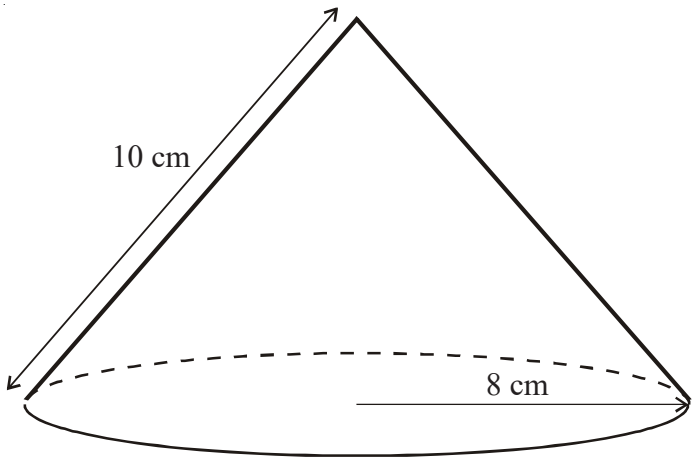


a) Calculate the volume of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Find the curved surface area of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

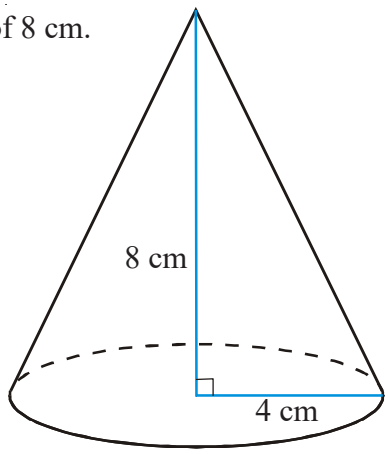
3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone.
Leave your answer in terms of π.



Spheres and Cones

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.



a) Calculate the volume of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

134 cm^3

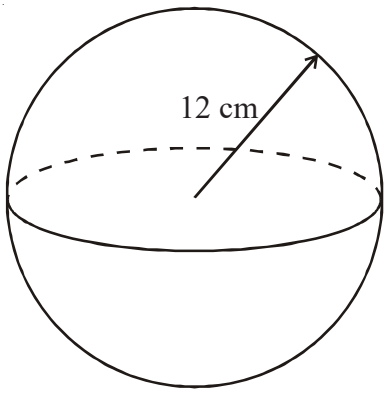
b) Use Pythagoras' Theorem to find the slant height of the cone.
Give your answer correct to 1 decimal place.

8.9 cm

c) Find the curved surface area of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

112 cm^2

2) A sphere has a radius of 12cm.



a) Calculate the volume of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

7240 cm^3

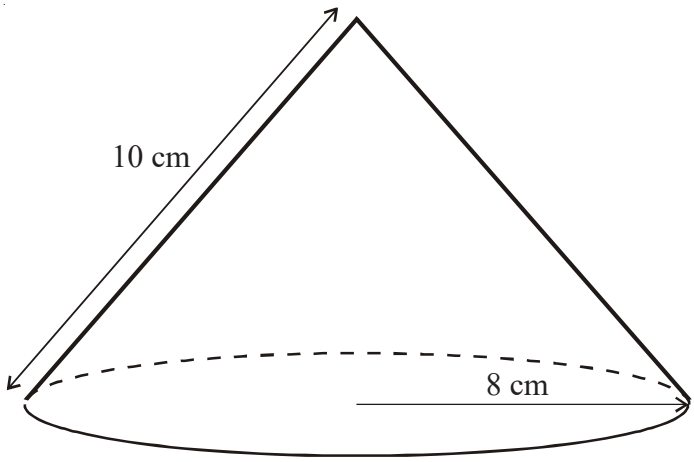
b) Find the curved surface area of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

1810 cm^2

3) A cone has a base radius of 8 cm and a slant height of 10 cm.

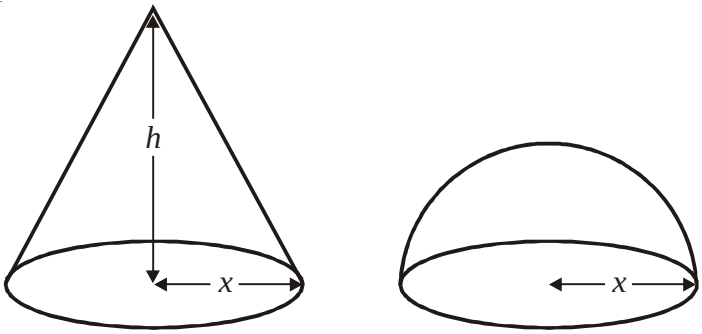
Calculate the volume of the cone.
Leave your answer in terms of π.

128π cm^3



Spheres and Cones

1)

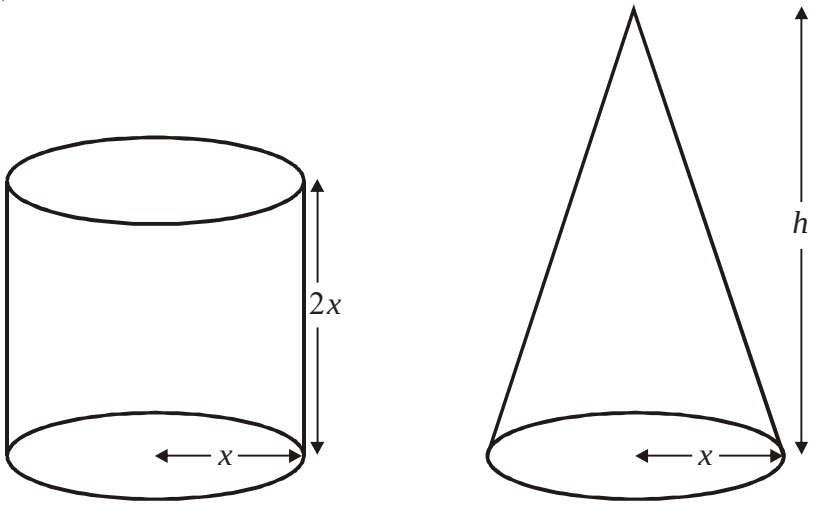


The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x.

2)



A cylinder has base radius x cm and height $2x$ cm.

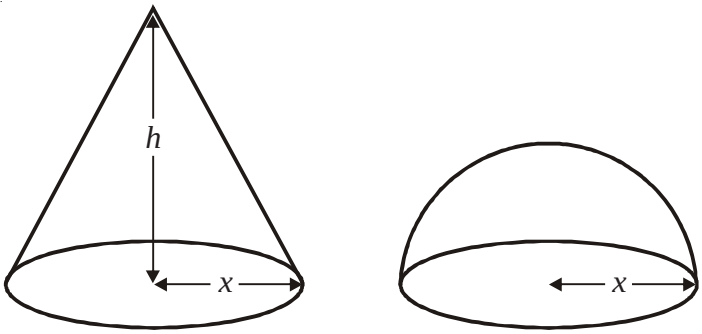
A cone has base radius x cm and height h cm.

The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form.

Spheres and Cones

1)

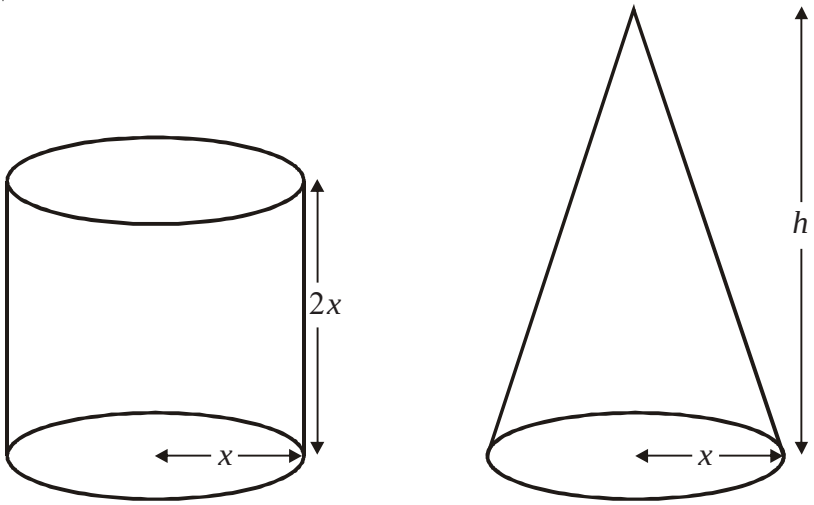


The diagram shows a solid cone and a solid hemisphere.

The cone has a base of radius x cm and a height of h cm.
The hemisphere has a base of radius x cm.
The surface area of the cone is equal to the surface area of the hemisphere.

Find an expression for h in terms of x. $h = \sqrt{3}\,x$ or $h = x\sqrt{3}$

2)



A cylinder has base radius x cm and height $2x$ cm.

A cone has base radius x cm and height h cm.

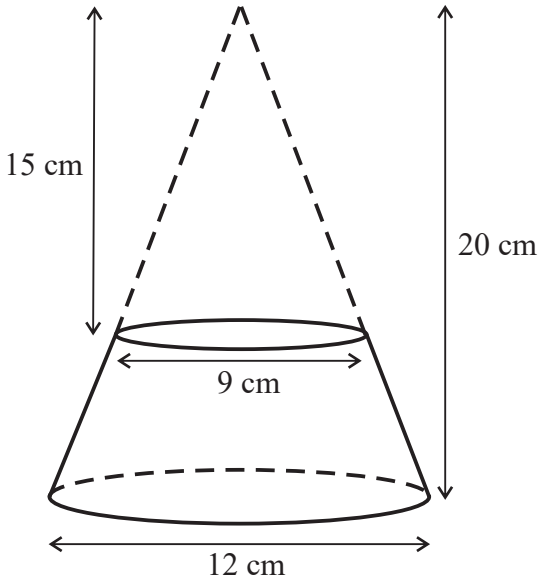
The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form. $h = 6x$

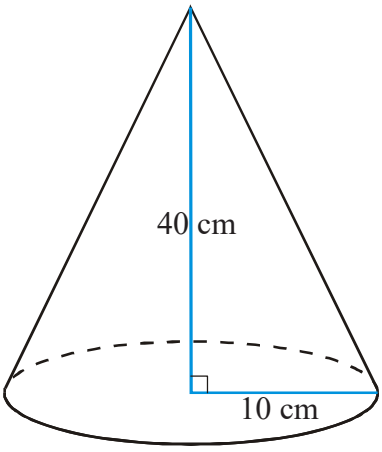
Frustums

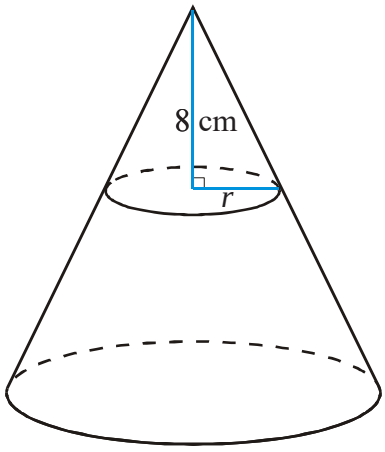
1) A frustum is made by removing a small cone from a similar larger cone.

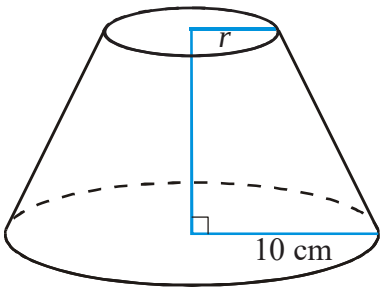
Work out the volume of the frustum.



2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.







a) Work out the radius r of the base of the smaller cone.

Calculate, to the nearest cm^3

b) The volume of the larger cone.

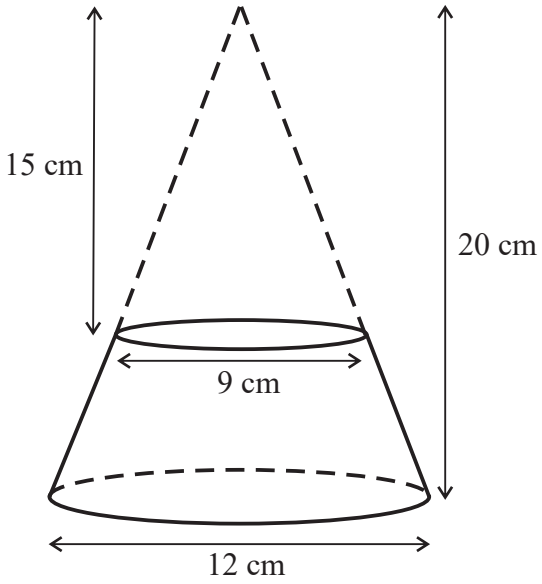
c) The volume of the smaller cone.

d) The volume of the frustum.

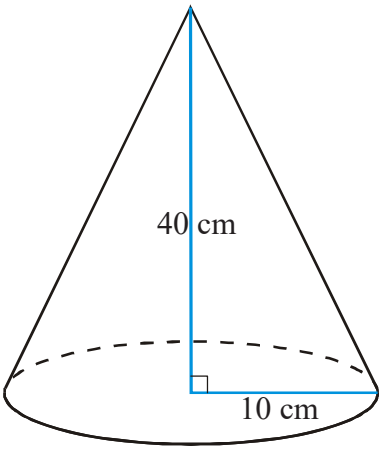
Frustums

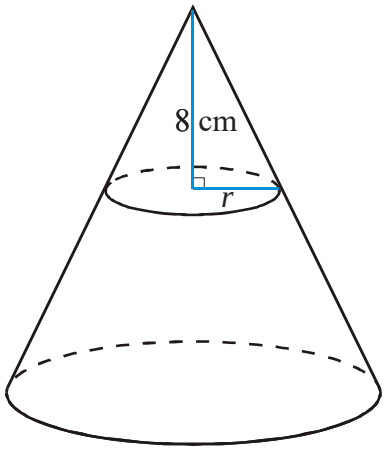
1) A frustum is made by removing a small cone from a similar larger cone.

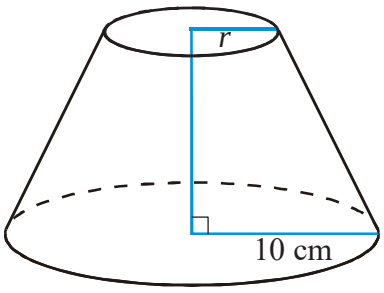
Work out the volume of the frustum. 435.9525 cm^3



2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.







a) Work out the radius r of the base of the smaller cone. 2 cm

Calculate, to the nearest cm^3

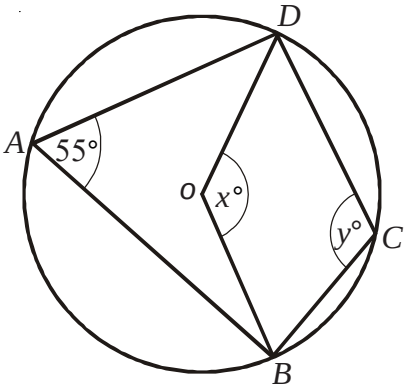
b) The volume of the larger cone. 4189 cm^3

c) The volume of the smaller cone. 34 cm^3

d) The volume of the frustum. 4156 cm^3

Circle Theorems

1)



In the diagram, *A, B, C,* and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

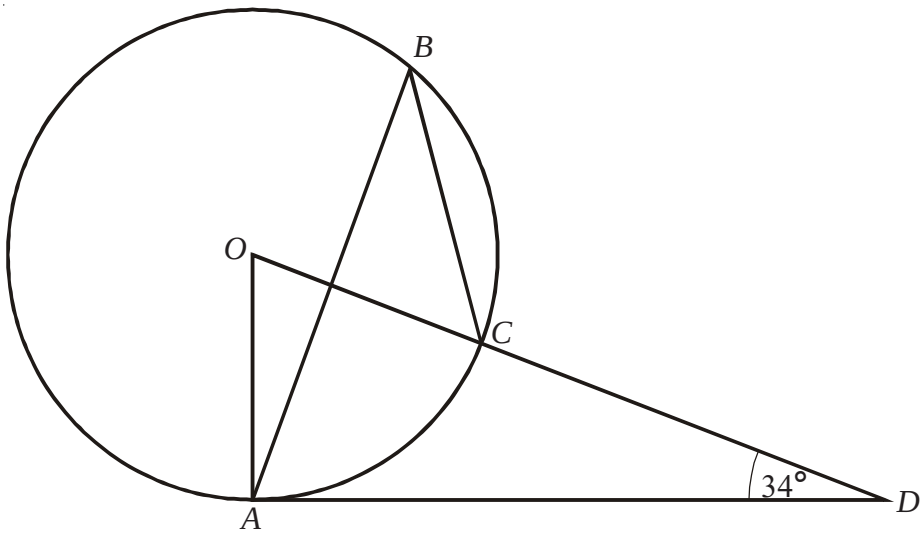
a) (i) Work out the value of *x*.

(ii) Give a reason for your answer.

b) (i) Work out the value of *y*.

(ii) Give a reason for your answer.

2)



The diagram shows a circle centre *O*.
A, B and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

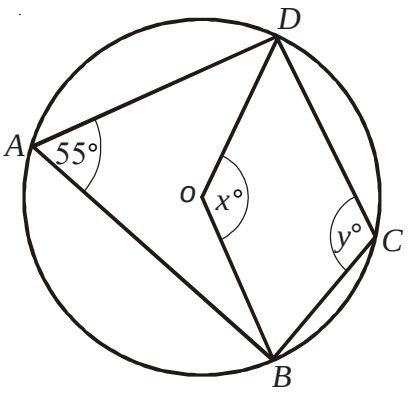
a) Work out the size of angle *AOD*.

b) (i) Work out the size of angle *ABC*.

(ii) Give a reason for your answer.

Circle Theorems

1)



In the diagram, *A*, *B*, *C*, and *D* are points on the circumference of a circle, centre *O*.
Angle *BAD* = 55°.
Angle *BOD* = *x*°.
Angle *BCD* = *y*°.

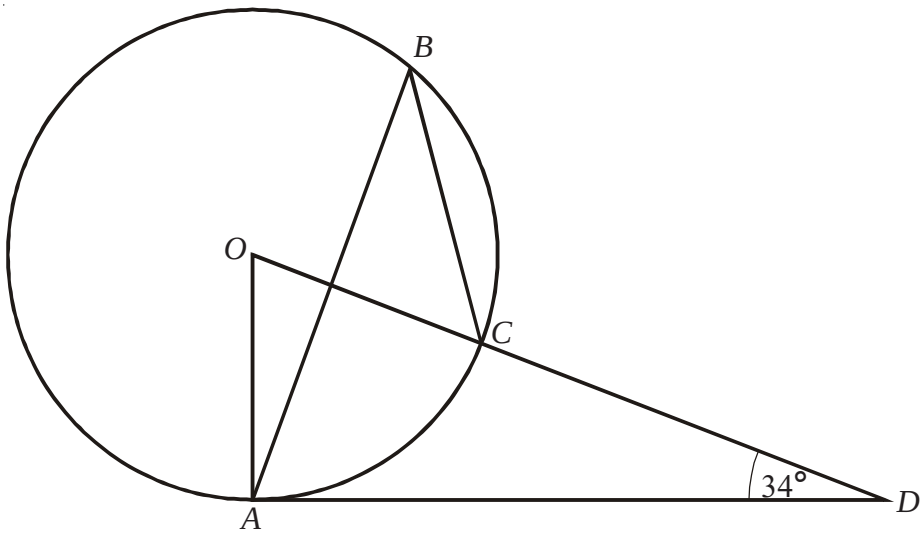
a) (i) Work out the value of *x*. 110°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

b) (i) Work out the value of *y*. 125°

(ii) Give a reason for your answer.
Opposite angles of cyclic quadrilateral add up to 180°

2)



The diagram shows a circle centre *O*.
A, *B* and *C* are points on the circumference.
DCO is a straight line and *DA* is a tangent to the circle.
Angle *ADO* = 34°

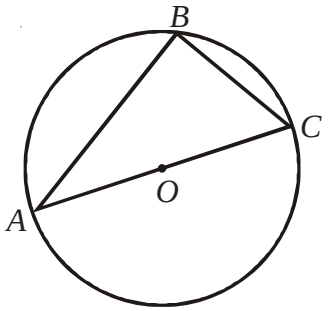
a) Work out the size of angle *AOD*. 56°

b) (i) Work out the size of angle *ABC*. 28°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

Circle Theorems

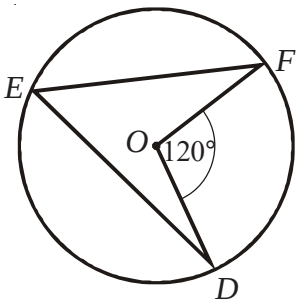
1)



A, *B* and *C* are points on the circumference of a circle centre *O*.
AC is a diameter of the circle.

a) (i) Write down the size of angle *ABC*.

(ii) Give a reason for your answer.



D, *E* and *F* are points on the circumference of a circle, centre *O*.
Angle *DOF* = 120°.

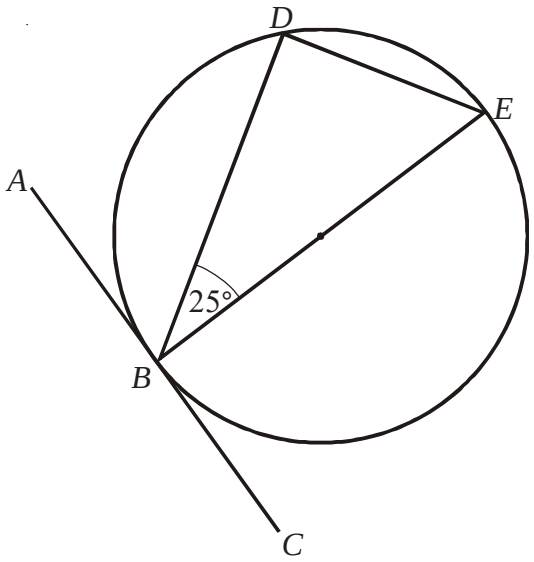
b) (i) Work out the size of angle *DEF*.

(ii) Give a reason for your answer.

2) *B*, *D* and *E* are points on a circle centre *O*.
ABC is a tangent to the circle.
BE is a diameter of the circle.
Angle *DBE* = 25°.

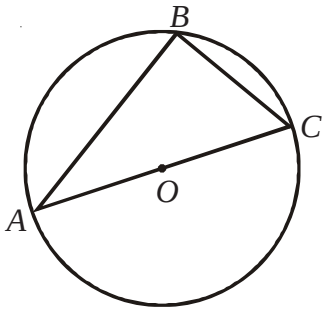
a) Find the size of angle *ABD*.
Give a reason for your answer.

b) Find the size of angle *DEB*.
Give a reason for your answer.



Circle Theorems

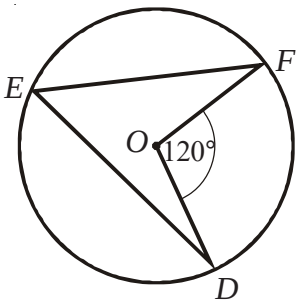
1)



A, *B* and *C* are points on the circumference of a circle centre *O*.
AC is a diameter of the circle.

a) (i) Write down the size of angle *ABC*. 90°

(ii) Give a reason for your answer.
Angle in a semi-circle is 90°



D, *E* and *F* are points on the circumference of a circle, centre *O*.
Angle *DOF* = 120°.

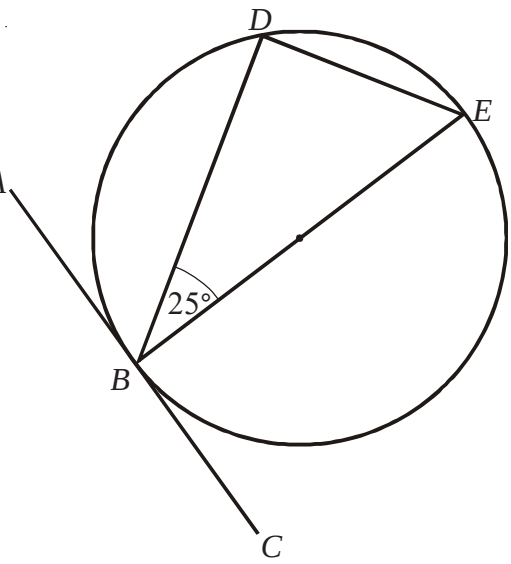
b) (i) Work out the size of angle *DEF*. 60°

(ii) Give a reason for your answer.
Angle at centre of circle is twice the angle on the circumference

2) *B*, *D* and *E* are points on a circle centre *O*.
ABC is a tangent to the circle.
BE is a diameter of the circle.
Angle *DBE* = 25°.

a) Find the size of angle *ABD*. 65°
Give a reason for your answer.
Radius meets a tangent at 90°

b) Find the size of angle *DEB*. 65°
Give a reason for your answer.
Alternate segment theorem



Circle Theorems

1) In the diagram, *A*, *B* and *C* are points on the circumference of a circle, centre *O*. *PA* and *PB* are tangents to the circle. Angle *ACB* = 72°.

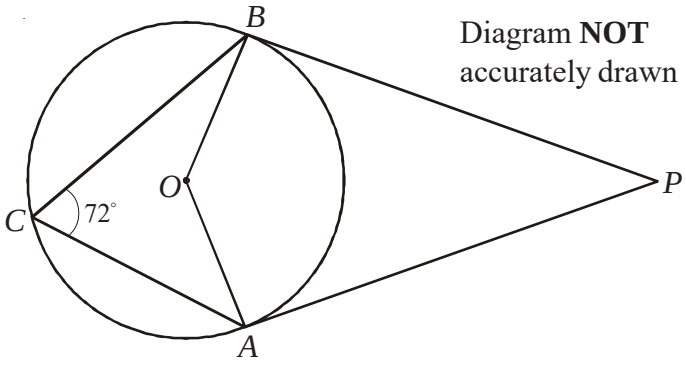


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle *AOB*.

(ii) Give a reason for your answer.

b) Work out the size of angle *APB*.

---

2) *P*, *Q*, *R* and *S* are points on the circle. *PQ* is a diameter of the circle. Angle *RPQ* = 32°.

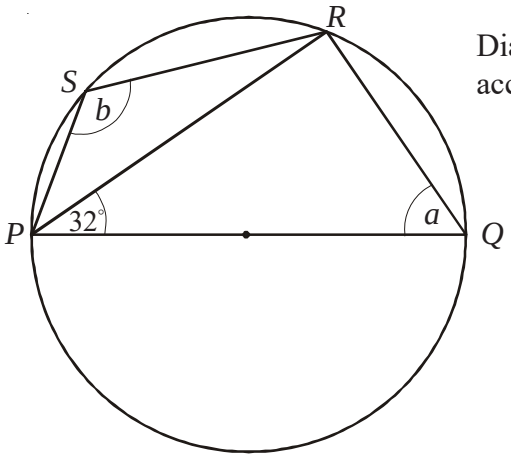


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle *PQR*.

(ii) Give reasons for your answer.

b) (i) Work out the size of angle *PSR*.

(ii) Give a reason for your answer.

---

3) The diagram shows a circle, centre *O*. *AC* is a diameter. Angle *BAC* = 31°. D is a point on *AC* such that angle *BDA* is a right angle.

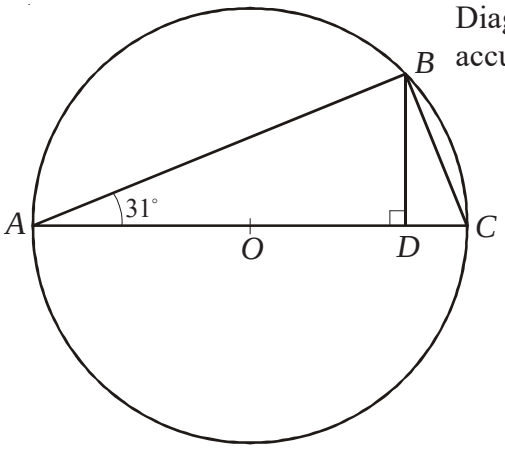


Diagram **NOT** accurately drawn

a) Work out the size of angle *BCA*. Give reasons for your answer.

b) Calculate the size of angle *DBC*.

c) Calculate the size of angle *BOA*.

---

4) *A*, *B*, *C* and *D* are four points on the circumference of a circle. *ABE* and *DCE* are straight lines. Angle *BAC* = 21°. Angle *EBC* = 58°.

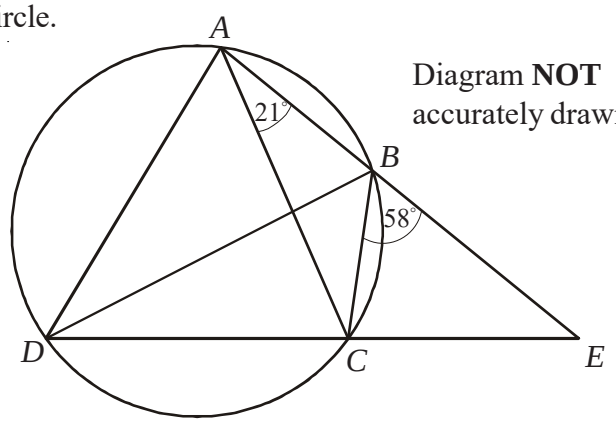


Diagram **NOT** accurately drawn

a) Find the size of angle *ADC*.

b) Find the size of angle *ADB*.

Angle *CAD* = 69°.

c) Is *BD* a diameter of the circle? You must explain your answer.

Circle Theorems

1) In the diagram, A, B and C are points on the circumference of a circle, centre O.
PA and PB are tangents to the circle.
Angle $ACB = 72^\circ$.

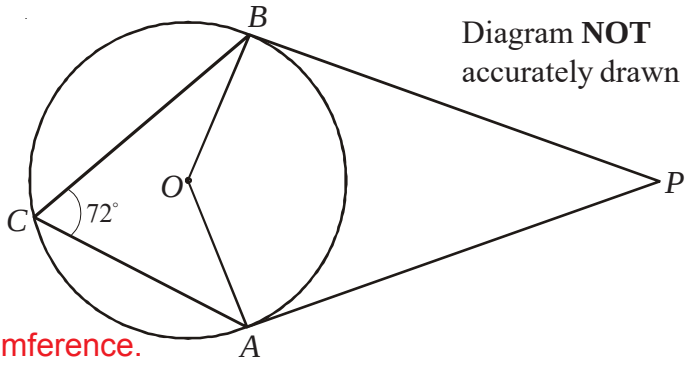


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle AOB. 144°

(ii) Give a reason for your answer.
Angle at centre is twice angle on circumference.

b) Work out the size of angle APB. 36°

---

2) P, Q, R and S are points on the circle.
PQ is a diameter of the circle.
Angle $RPQ = 32^\circ$.

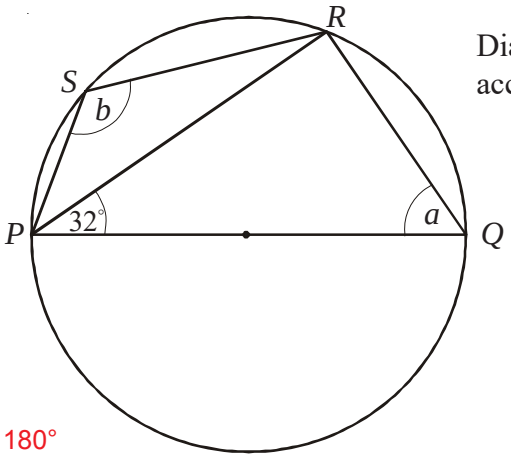


Diagram **NOT** accurately drawn

a) (i) Work out the size of angle PQR. 58°

(ii) Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) (i) Work out the size of angle PSR. 122°

(ii) Give a reason for your answer.
Opposite angles of a cyclic quadrilateral add to 180°

---

3) The diagram shows a circle, centre O.
AC is a diameter.
Angle $BAC = 31^\circ$.
D is a point on AC such that angle BDA is a right angle.

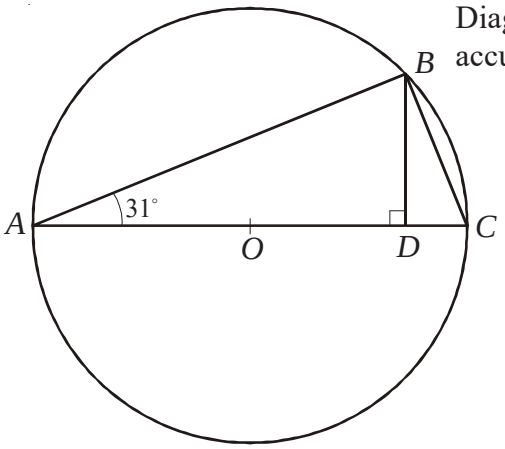


Diagram **NOT** accurately drawn

a) Work out the size of angle BCA. 59°
Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°

b) Calculate the size of angle DBC. 31°

c) Calculate the size of angle BOA. 118°

---

4) A, B, C and D are four points on the circumference of a circle.
ABE and DCE are straight lines.
Angle $BAC = 21^\circ$. Angle $EBC = 58^\circ$.

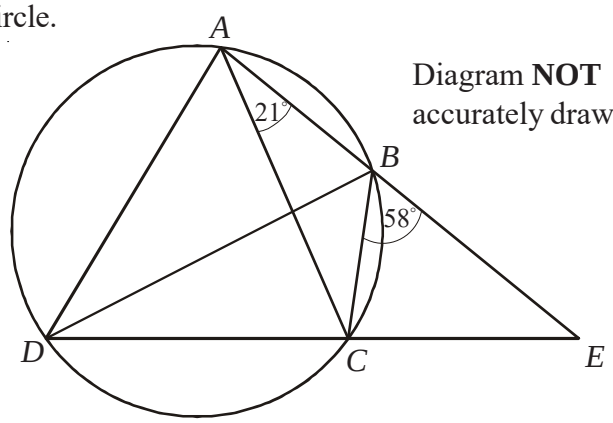


Diagram **NOT** accurately drawn

a) Find the size of angle ADC. 58°

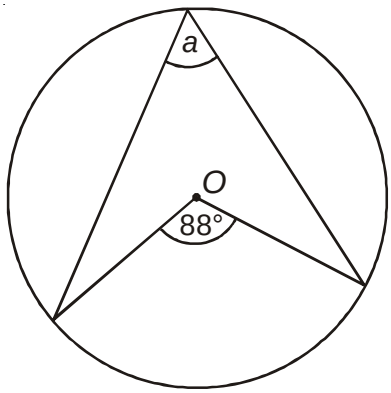
b) Find the size of angle ADB. 37°

Angle $CAD = 69^\circ$.

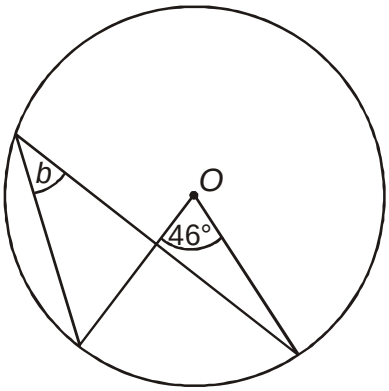
c) Is BD a diameter of the circle? Yes
You must explain your answer.
Angle DAB = 69° + 21° = 90°
BD subtends 90° on the circumference. Therefore BD is a diameter.

Circle Theorems

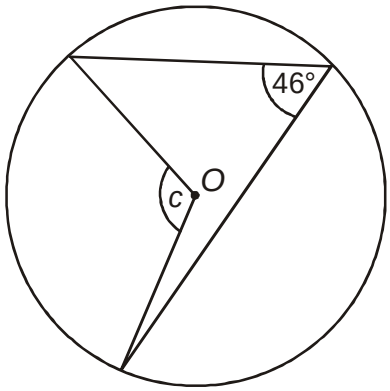
1) a = ____



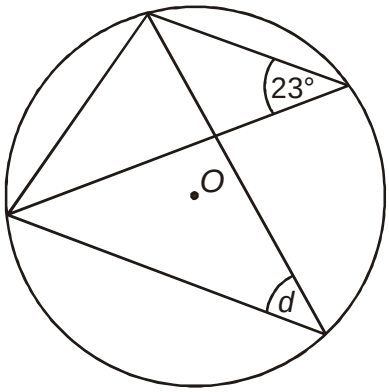
2) b = ____



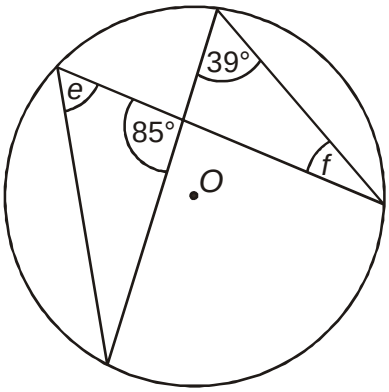
3) c = ____



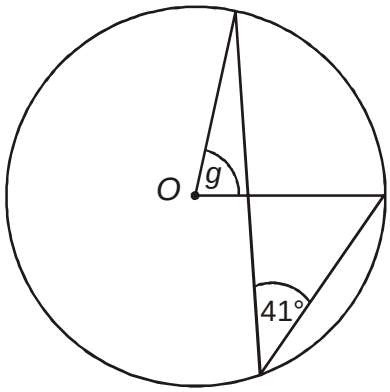
4) d = ____



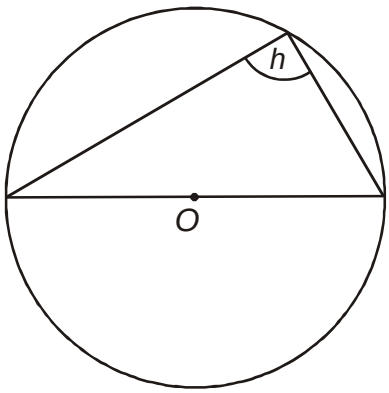
5) e = ____ f = ____



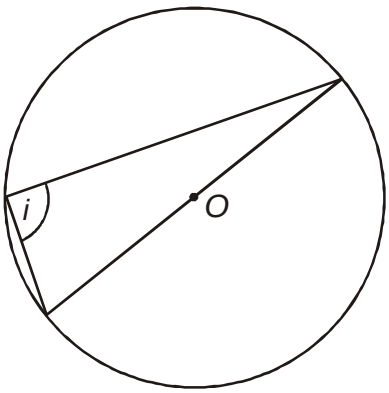
6) g = ____



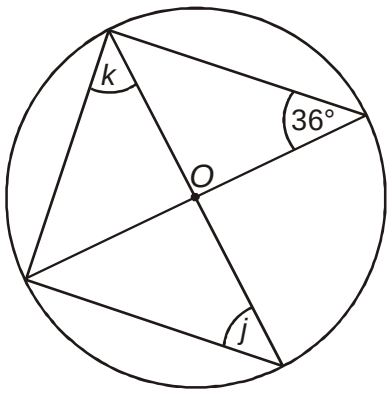
7) h = ____



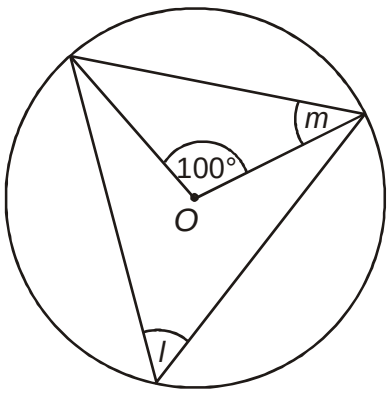
8) i = ____



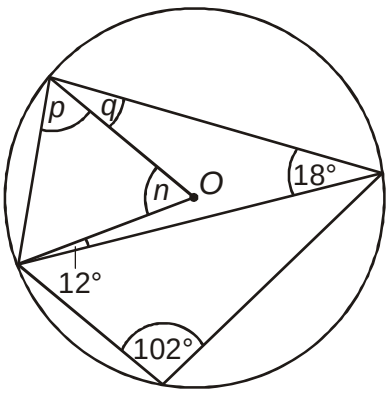
9) j = ____ k = ____



10) l = ____ m = ____

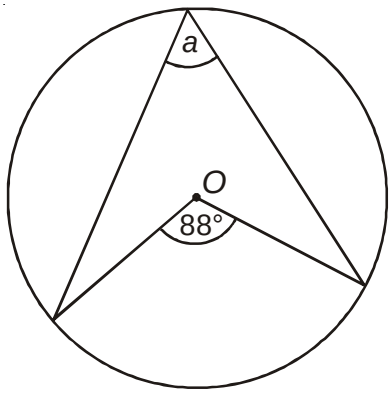


11) n = ____ p = ____ q = ____

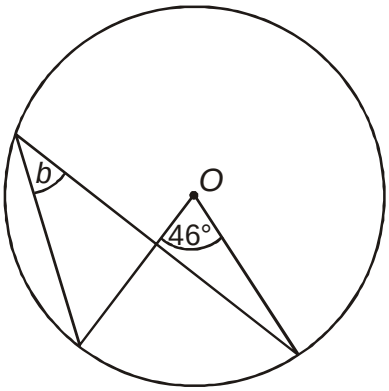


Circle Theorems

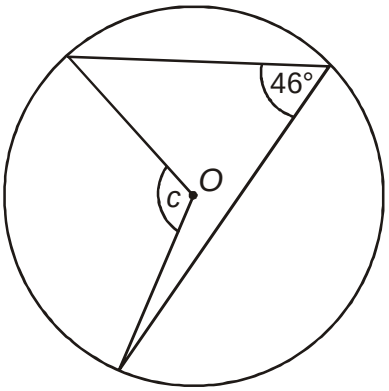
1) a = 44°



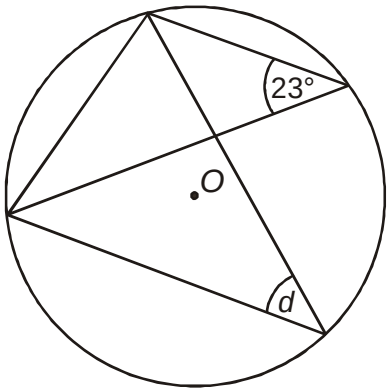
2) b = 23°



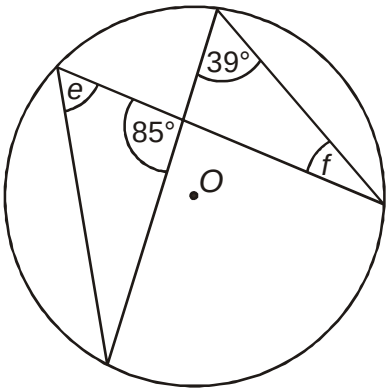
3) c = 92°



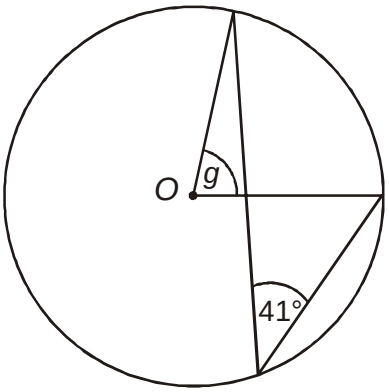
4) d = 23°



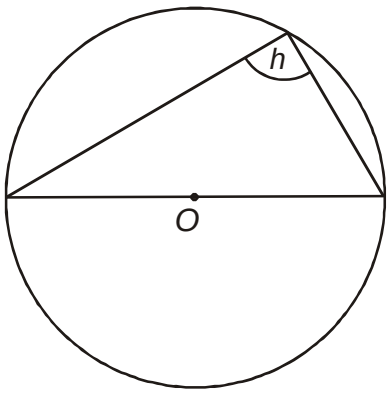
5) e = 39° f = 56°



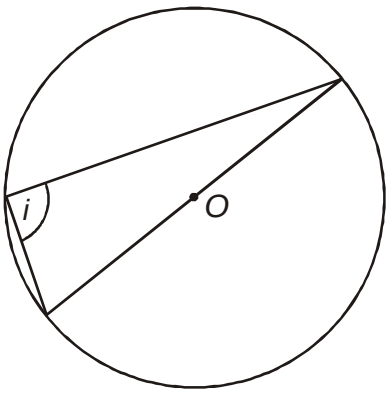
6) g = 82°



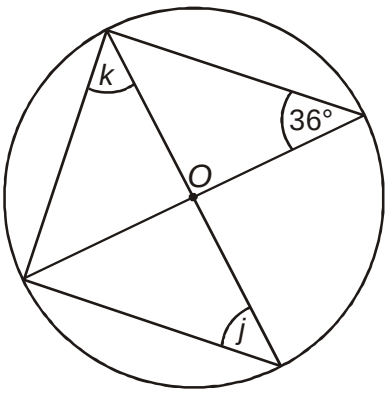
7) h = 90°



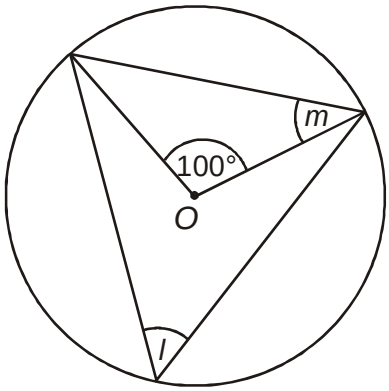
8) i = 90°



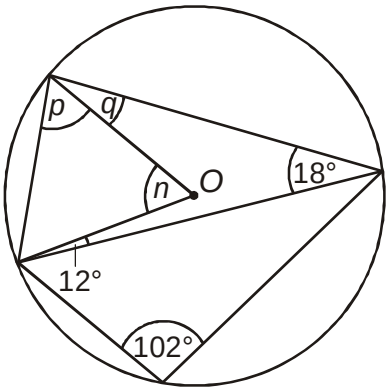
9) j = 36° k = 54°



10) l = 50° m = 40°

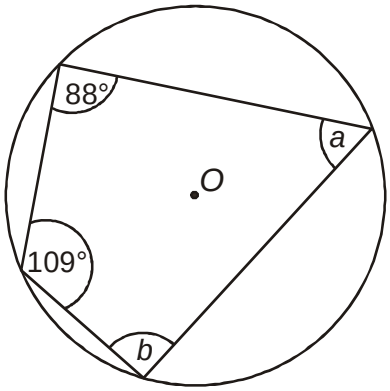


11) n = 36° p = 72° q = 6°

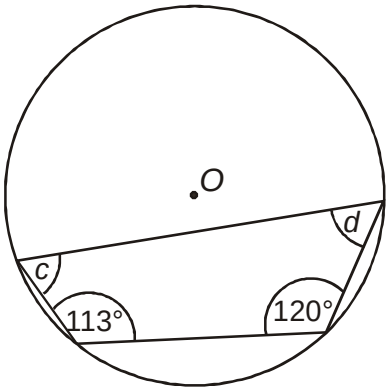


Circle Theorems

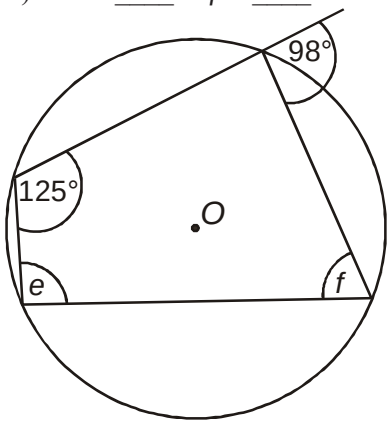
1) a = ____ b = ____



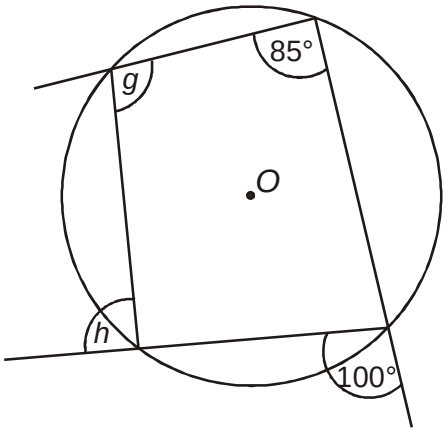
2) c = ____ d = ____



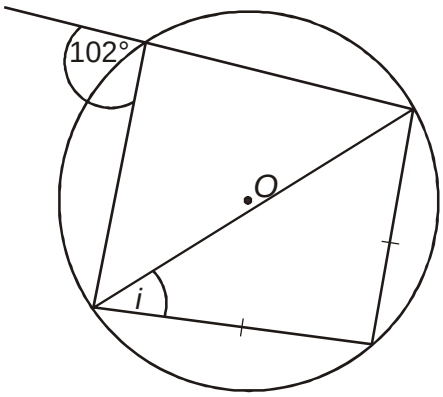
3) e = ____ f = ____



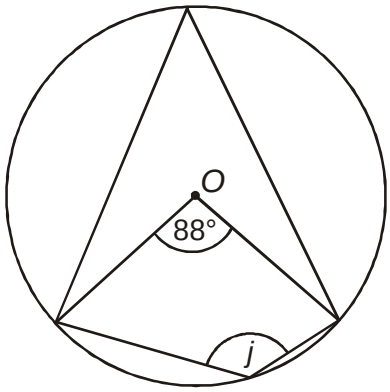
4) g = ____ h = ____



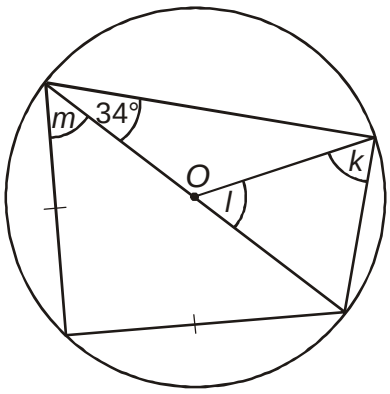
5) i = ____



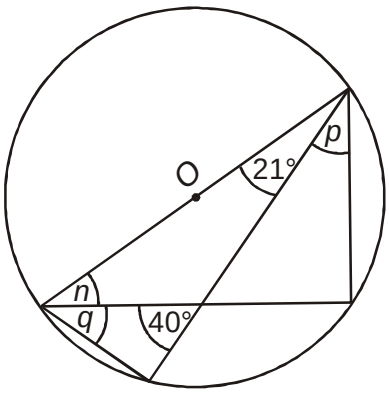
6) j = ____



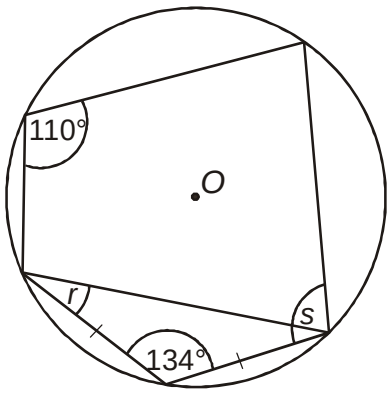
7) k = ____ l = ____ m = ____



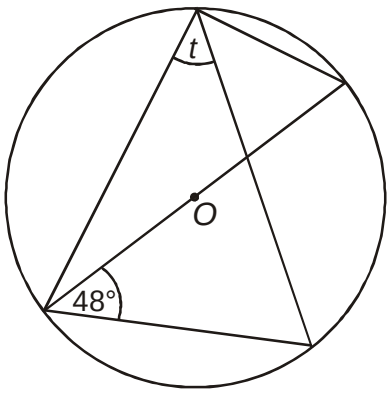
8) n = ____ p = ____ q = ____



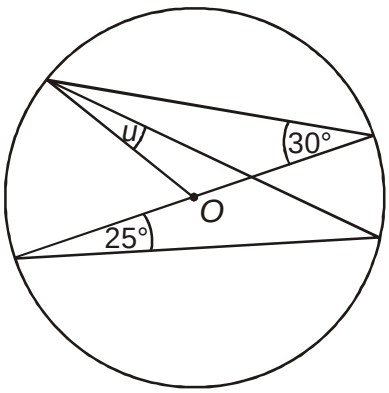
9) r = ____ s = ____



10) t = ____

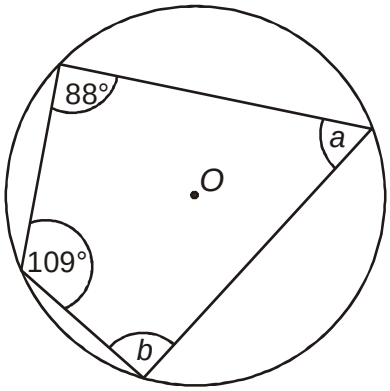


11) u = ____

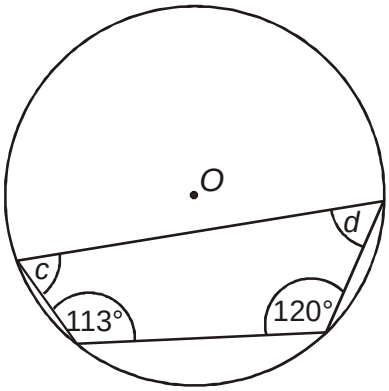


Circle Theorems

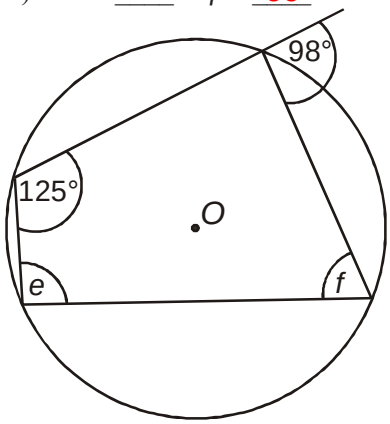
1) a = 71° b = 92°



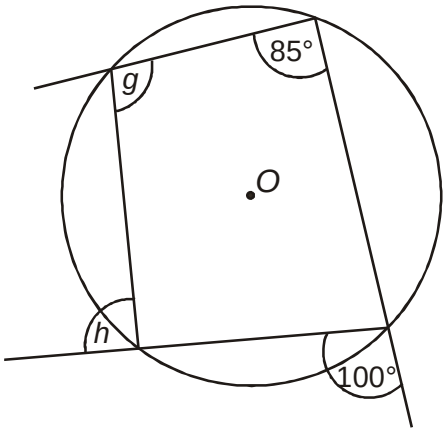
2) c = 60° d = 67°



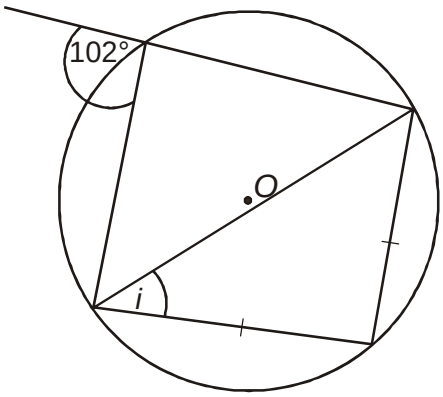
3) e = 98° f = 55°



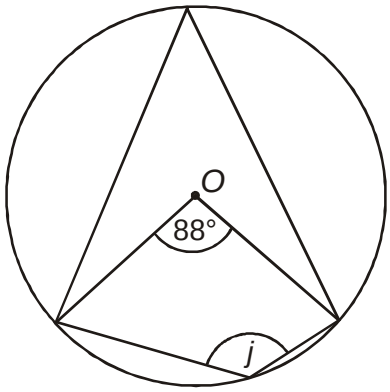
4) g = 100° h = 85°



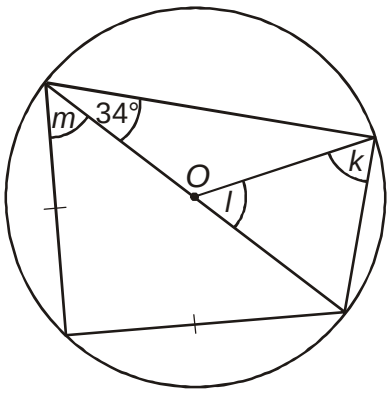
5) i = 39°



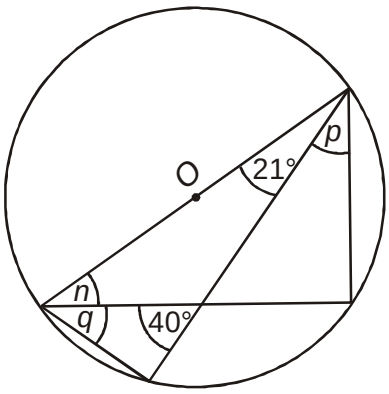
6) j = 136°



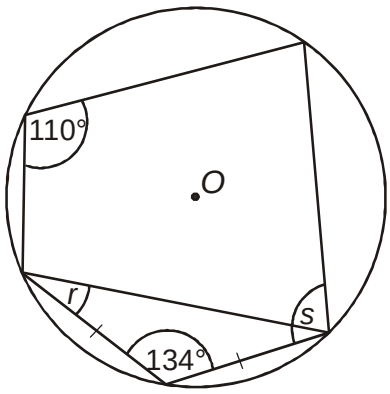
7) k = 56° l = 68° m = 45°



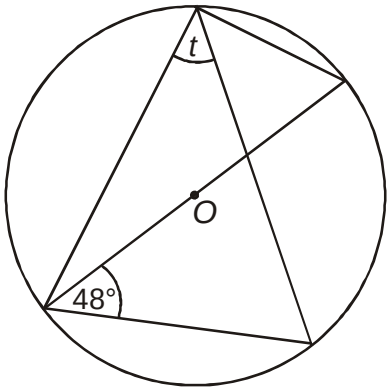
8) n = 19° p = 50° q = 50°



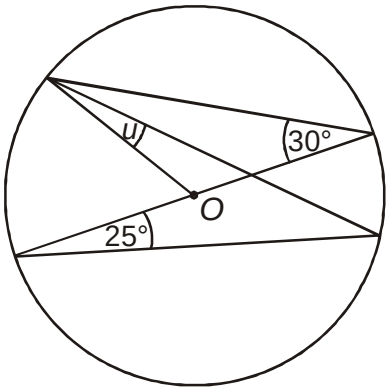
9) r = 23° s = 93°



10) t = 42°

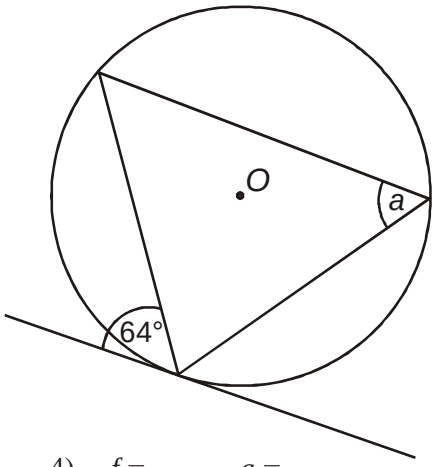


11) u = 5°

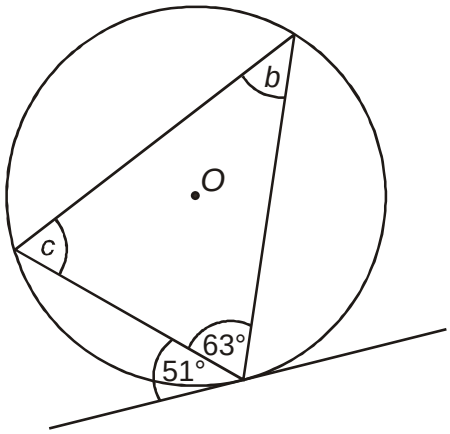


Circle Theorems

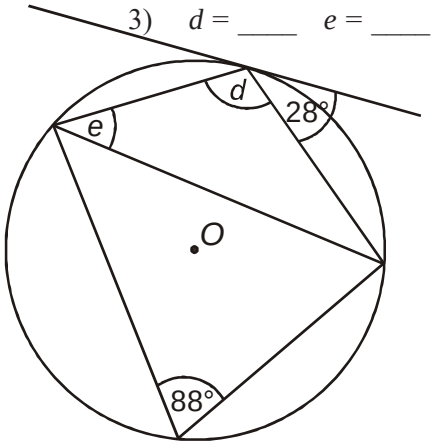
1) a = ____



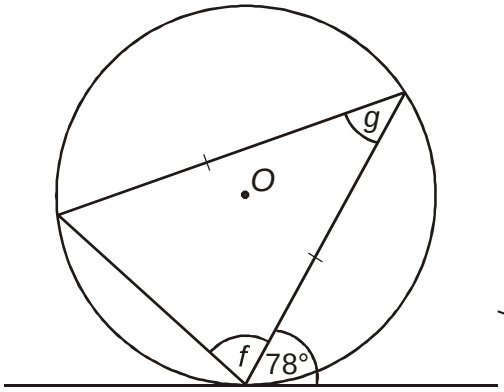
2) b = ____ c = ____



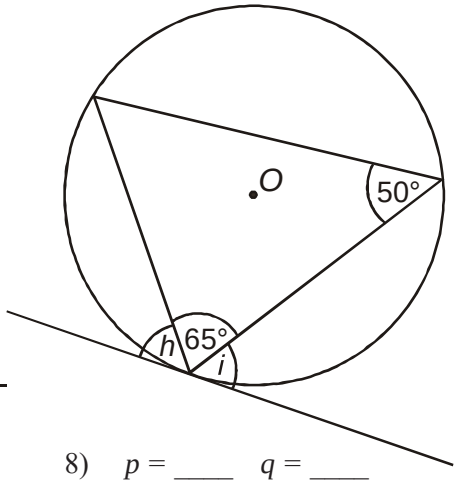
3) d = ____ e = ____



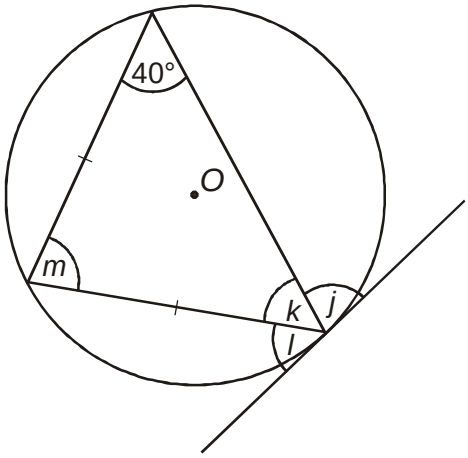
4) f = ____ g = ____



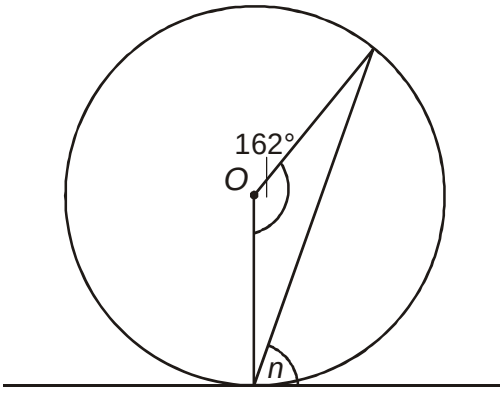
5) h = ____ i = ____



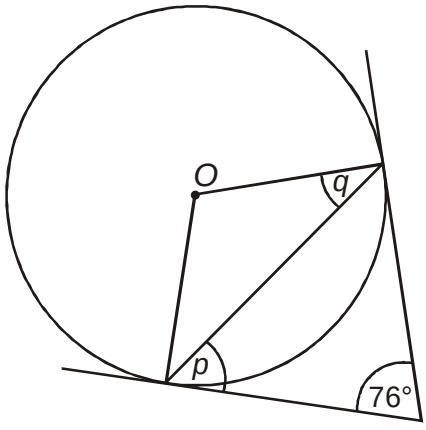
6) j = ____ k = ____ l = ____ m = ____



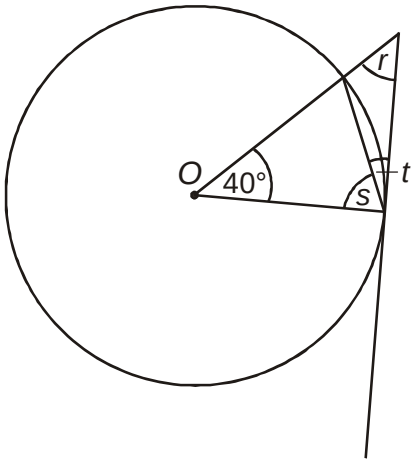
7) n = ____



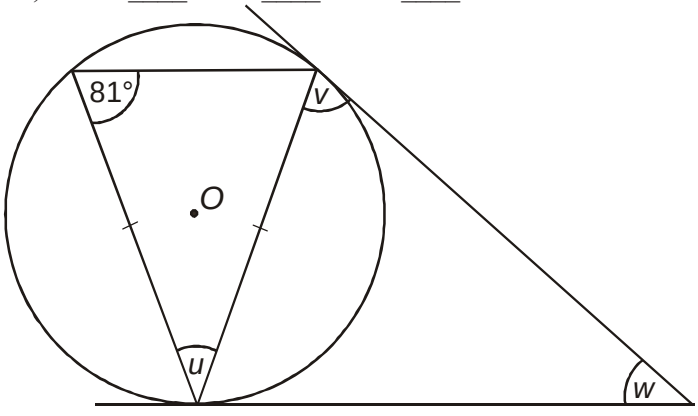
8) p = ____ q = ____



9) r = ____ s = ____ t = ____

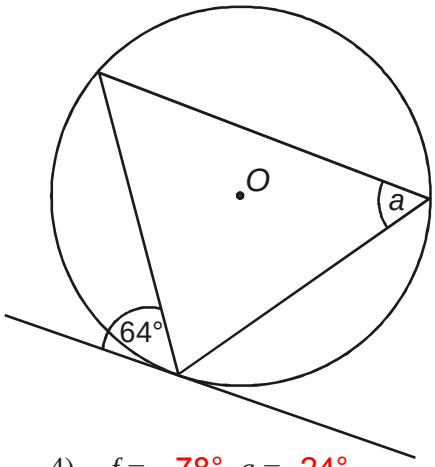


10) u = ____ v = ____ w = ____

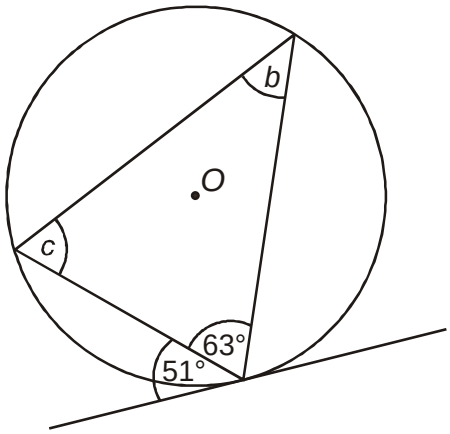


Circle Theorems

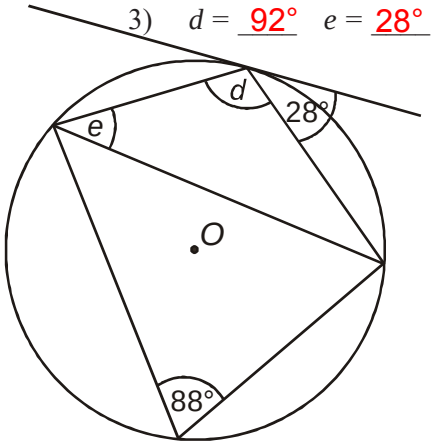
1) a = 64°



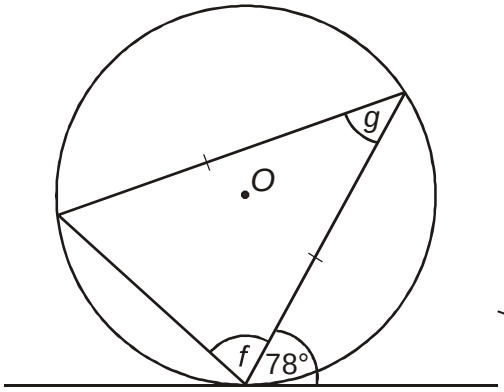
2) b = 51° c = 66°



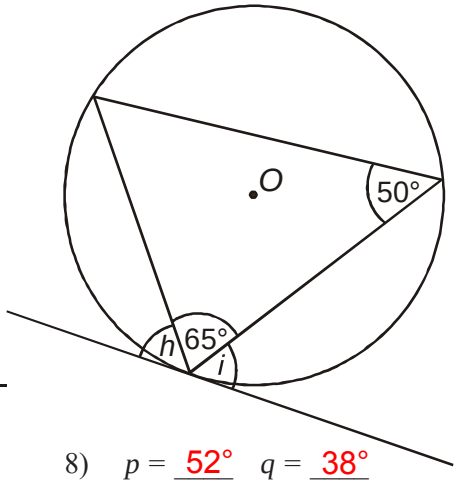
3) d = 92° e = 28°



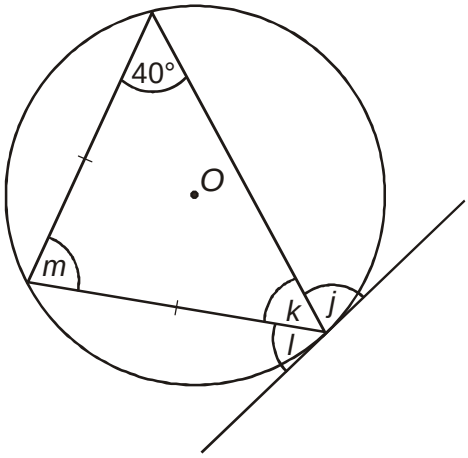
4) f = 78° g = 24°



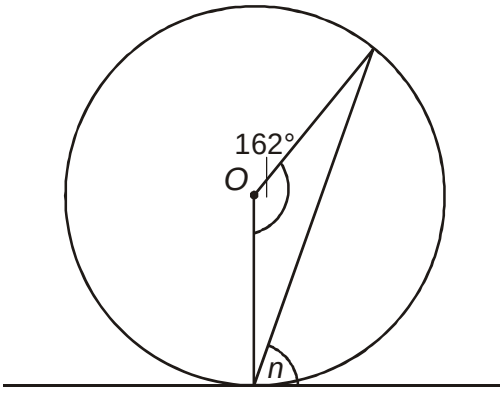
5) h = 50° i = 65°



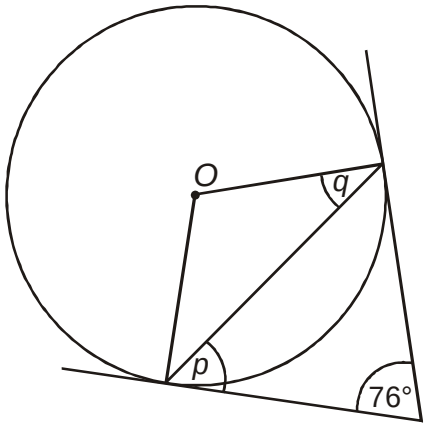
6) j = 100° k = 40° l = 40° m = 100°



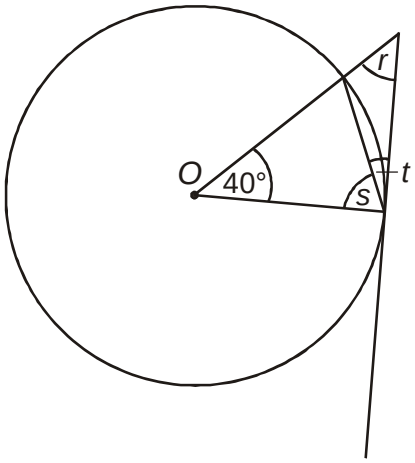
7) n = 81°



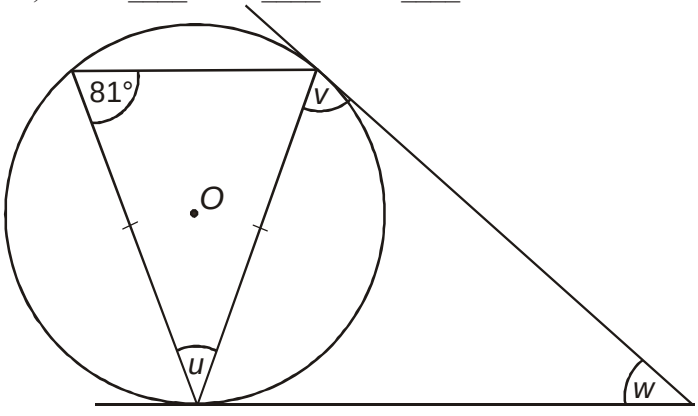
8) p = 52° q = 38°



9) r = 50° s = 70° t = 20°



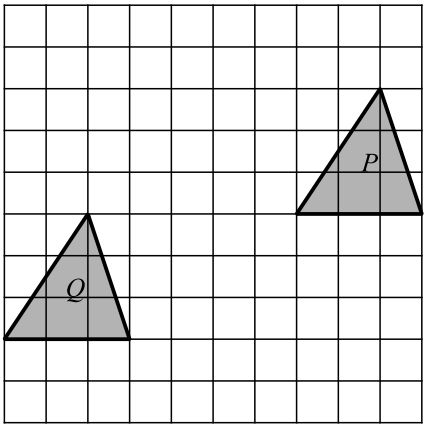
10) u = 18° v = 81° w = 18°



Introduction to Vectors

1) The translation of triangle *P* to triangle *Q* is described by column vector **v**.

Write down **v**.



2) Shape X is translated to shape Y using vector $\begin{bmatrix} 8 \\ -3 \end{bmatrix}$.

Circle the vector that translates shape Y to shape X.

A	B	C	D
$\begin{bmatrix} 8 \\ 3 \end{bmatrix}$	$\begin{bmatrix} -8 \\ -3 \end{bmatrix}$	$\begin{bmatrix} -3 \\ 8 \end{bmatrix}$	$\begin{bmatrix} -8 \\ 3 \end{bmatrix}$

3) Here are two column vectors: $\mathbf{f} = \begin{bmatrix} -2 \\ 5 \end{bmatrix}$ $\mathbf{g} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$

Work out

a) $2\mathbf{f}$

b) $-\mathbf{g}$

c) $\mathbf{f} + \mathbf{g}$

d) $\mathbf{f} - \mathbf{g}$

e) $2\mathbf{f} + 4\mathbf{g}$

f) $3\mathbf{g} - \mathbf{f}$

4) Here are two column vectors: $\mathbf{j} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ $\mathbf{k} = \begin{bmatrix} 5 \\ -12 \end{bmatrix}$

a) Find the magnitude of vector **j**.

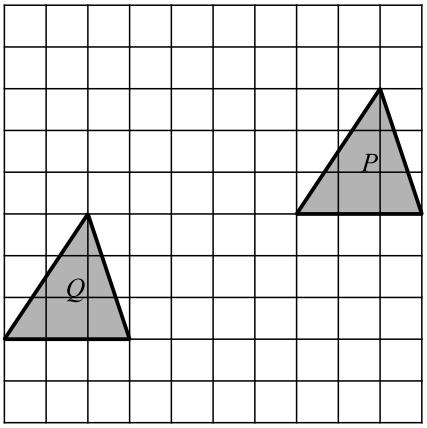
b) Find the magnitude of vector **k**.

5) *O* is the point (0, 0) and *P* is (6, 8).

Find the value of $|\overrightarrow{OP}|$.

Introduction to Vectors

1) The translation of triangle P to triangle Q is described by column vector **v**.



Write down **v**. $\begin{bmatrix} -7 \\ -3 \end{bmatrix}$

2) Shape X is translated to shape Y using vector $\begin{bmatrix} 8 \\ -3 \end{bmatrix}$.

Circle the vector that translates shape Y to shape X.

A $\begin{bmatrix} 8 \\ 3 \end{bmatrix}$ B $\begin{bmatrix} -8 \\ -3 \end{bmatrix}$ C $\begin{bmatrix} -3 \\ 8 \end{bmatrix}$ D $\begin{bmatrix} -8 \\ 3 \end{bmatrix}$

3) Here are two column vectors: $\mathbf{f} = \begin{bmatrix} -2 \\ 5 \end{bmatrix}$ $\mathbf{g} = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$

Work out

a) $2\mathbf{f}$ $\begin{bmatrix} -4 \\ 10 \end{bmatrix}$

b) $-\mathbf{g}$ $\begin{bmatrix} -3 \\ 1 \end{bmatrix}$

c) $\mathbf{f} + \mathbf{g}$ $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$

d) $\mathbf{f} - \mathbf{g}$ $\begin{bmatrix} -5 \\ 6 \end{bmatrix}$

e) $2\mathbf{f} + 4\mathbf{g}$ $\begin{bmatrix} 8 \\ 6 \end{bmatrix}$

f) $3\mathbf{g} - \mathbf{f}$ $\begin{bmatrix} 11 \\ -8 \end{bmatrix}$

4) Here are two column vectors: $\mathbf{j} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$ $\mathbf{k} = \begin{bmatrix} 5 \\ -12 \end{bmatrix}$

a) Find the magnitude of vector **j**. 5

b) Find the magnitude of vector **k**. 13

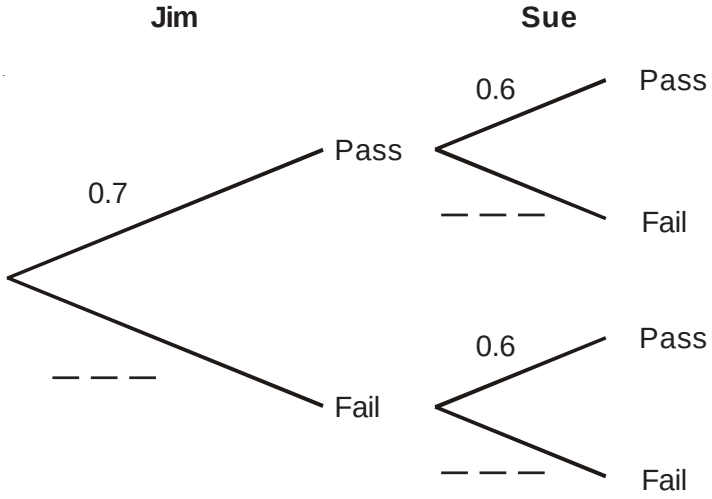
5) O is the point (0, 0) and P is (6, 8).

Find the value of $|\overrightarrow{OP}|$. 10

Simple Tree Diagrams

1) Jim and Sue each take a driving test.
The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.



b) Work out the probability that both Jim and Sue will pass the driving test.

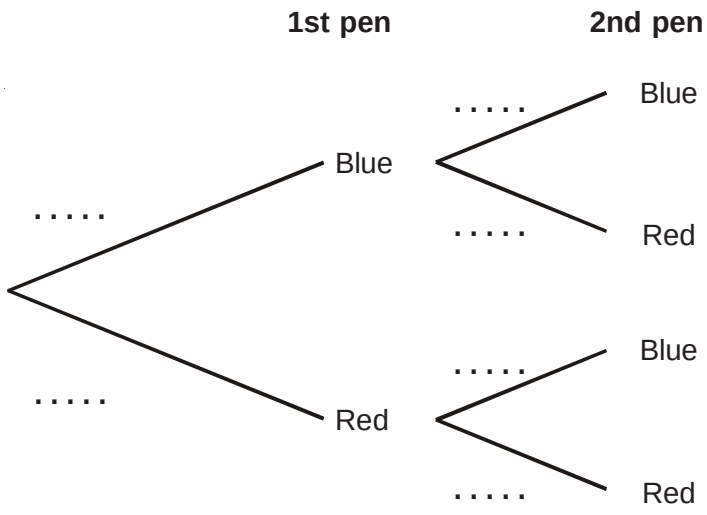
c) Work out the probability that only one of them will pass the driving test.

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.

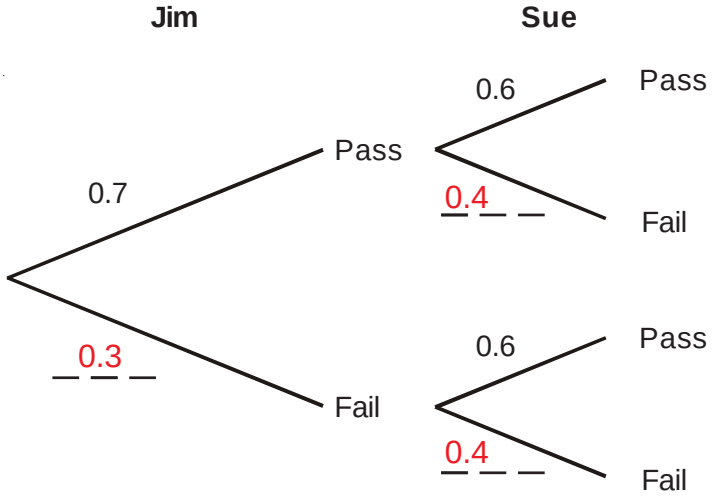


b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Simple Tree Diagrams

1) Jim and Sue each take a driving test.
The probability that Jim will pass the driving test is 0.7
The probability that Sue will pass the driving test is 0.6

a) Complete the probability tree diagram.



b) Work out the probability that both Jim and Sue will pass the driving test. 0.42

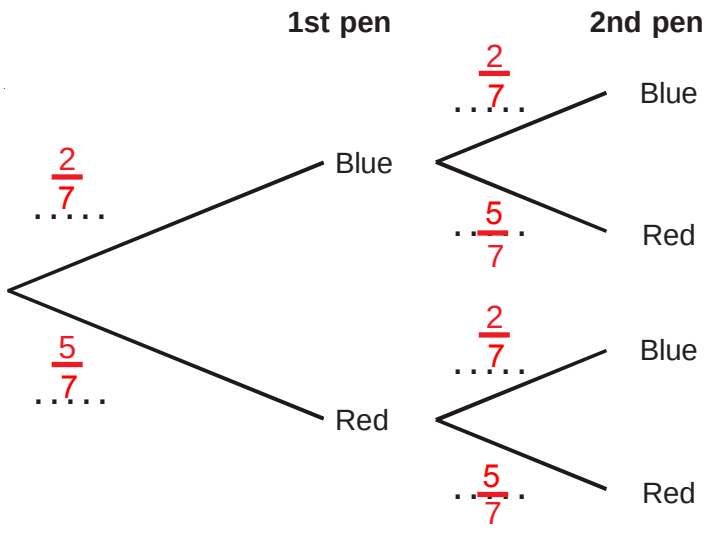
c) Work out the probability that only one of them will pass the driving test. 0.28 + 0.18 = 0.46

2) Terri has 7 pens in a box.
2 of the pens are blue.
5 of the pens are red.

Terri takes at random a pen from the box and writes down its colour.
Terri puts the pen back in the box.

Then Terri takes at random a second pen from the box and writes down its colour.

a) Complete the probability tree diagram.



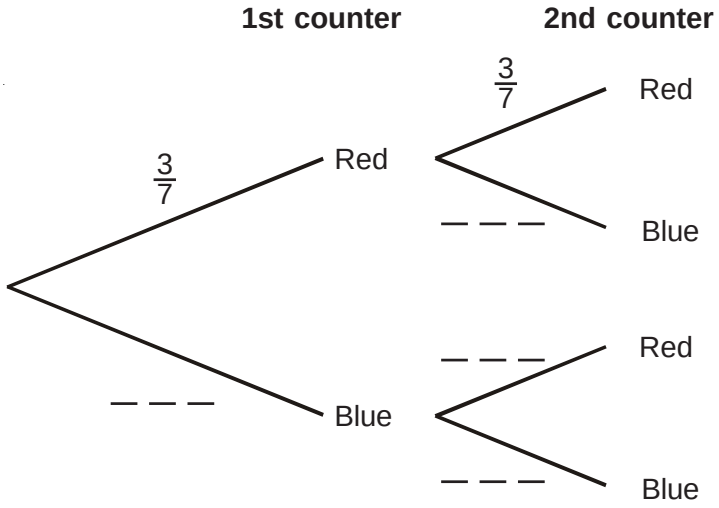
$\frac{10}{49} + \frac{10}{49} = \frac{20}{49}$

b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Simple Tree Diagrams

1) Tim puts 3 red counters and 4 blue counters in a bag.
He takes at random a counter from the bag.
He writes down the colour of the counter.
He puts the counter in the bag again.
He then takes at random a second counter from the bag.

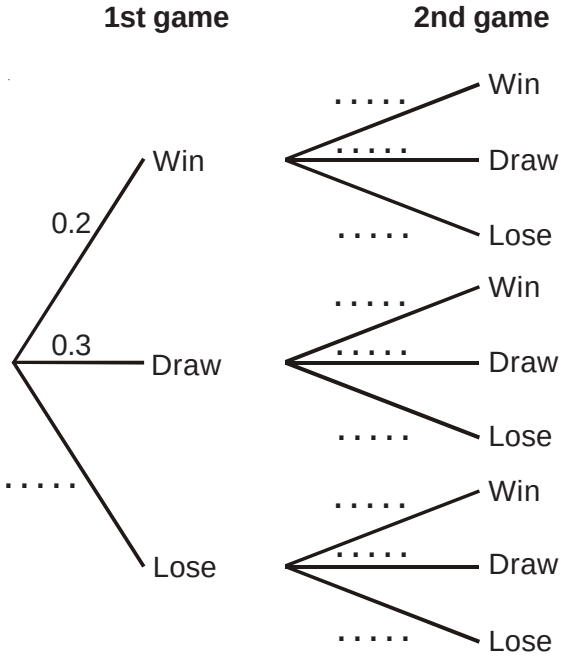
a) Complete the probability tree diagram.



b) Work out the probability that Tim takes two red counters.

2) In a game of chess, a player can either win, lose or draw.
The probability that Jane wins any game of chess is 0.2
The probability that Jane draws any game of chess is 0.3
Jane plays 2 games of chess.

a) Complete the probability tree diagram.

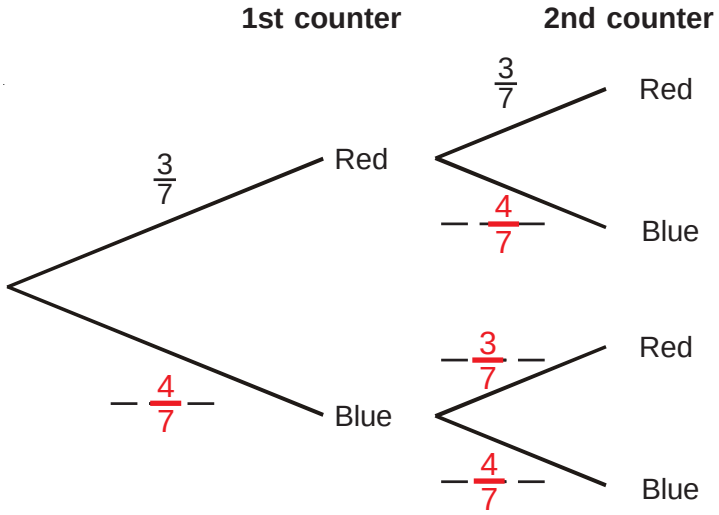


b) Work out the probability that Jane will win both games.

Simple Tree Diagrams

1) Tim puts 3 red counters and 4 blue counters in a bag.
He takes at random a counter from the bag.
He writes down the colour of the counter.
He puts the counter in the bag again.
He then takes at random a second counter from the bag.

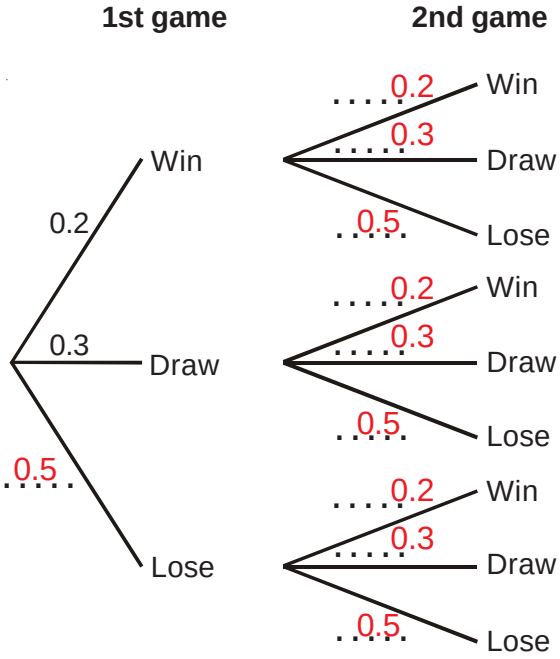
a) Complete the probability tree diagram.



b) Work out the probability that Tim takes two red counters. $\frac{9}{49}$

2) In a game of chess, a player can either win, lose or draw.
The probability that Jane wins any game of chess is 0.2
The probability that Jane draws any game of chess is 0.3
Jane plays 2 games of chess.

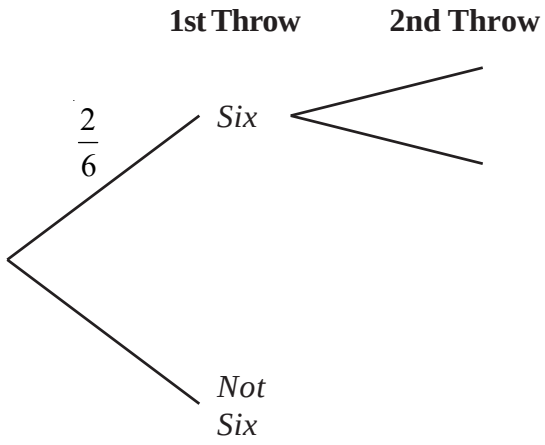
a) Complete the probability tree diagram.



b) Work out the probability that Jane will win both games. 0.04

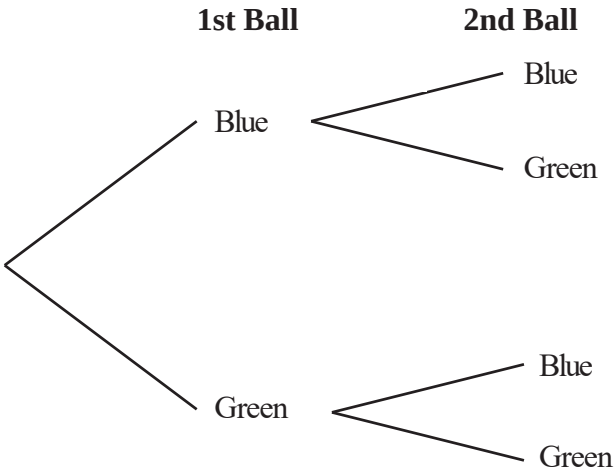
Simple Tree Diagrams

1) Lucy throws a biased dice twice.
Complete the probability tree diagram to show the outcomes.
Label clearly the branches of the tree diagram.



2) A bag contains 10 coloured balls.
7 of the balls are blue and 3 of the balls are green.
Nathan is going to take a ball, replace it, and then take a second ball.

a) Complete the tree diagram.



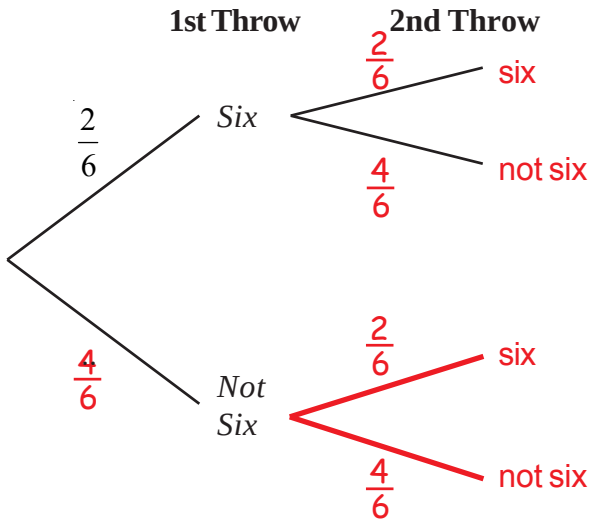
b) Work out the probability that Nathan will take two blue balls.

c) Work out the probability that Nathan will take one of each coloured balls.

d) Work out the probability that Nathan will take two balls of the same colour.

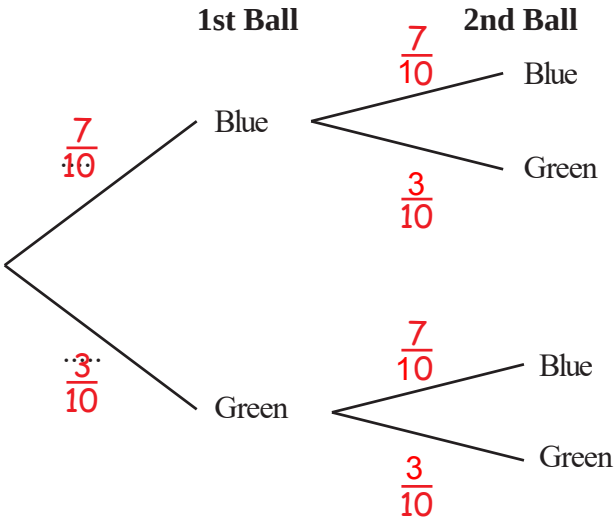
Simple Tree Diagrams

1) Lucy throws a biased dice twice.
Complete the probability tree diagram to show the outcomes.
Label clearly the branches of the tree diagram.



2) A bag contains 10 coloured balls.
7 of the balls are blue and 3 of the balls are green.
Nathan is going to take a ball, replace it, and then take a second ball.

a) Complete the tree diagram.



b) Work out the probability that Nathan will take two blue balls. $\frac{49}{100}$

c) Work out the probability that Nathan will take one of each coloured balls. $\frac{42}{100}$

d) Work out the probability that Nathan will take two balls of the same colour. $\frac{58}{100}$

Harder Tree Diagrams

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
Jerry takes at random a pen from the box and gives the pen to his friend.
Jerry then takes at random another pen from the box.
Work out the probability that both pens are the same colour.

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
Jack takes a sweet at random.
He eats the sweet.
He then takes another sweet at random.

Work out the probability that both sweets are the same colour.

3) There are 13 buttons in a bag.
9 buttons are white.
4 buttons are black.
Carol takes a button at random from the bag, and keeps it.
She now takes another button from the bag.

Work out the probability that Carol takes a button of each colour.

Harder Tree Diagrams

1) There are 5 red pens, 3 blue pens and 2 green pens in a box.
Jerry takes at random a pen from the box and gives the pen to his friend.
Jerry then takes at random another pen from the box.
Work out the probability that both pens are the same colour. $\frac{28}{90}$

2) There are 3 red sweets, 2 blue sweets and 4 green sweets in a bag.
Jack takes a sweet at random.
He eats the sweet.
He then takes another sweet at random.

Work out the probability that both sweets are the same colour. $\frac{20}{72}$

3) There are 13 buttons in a bag.
9 buttons are white.
4 buttons are black.
Carol takes a button at random from the bag, and keeps it.
She now takes another button from the bag.

Work out the probability that Carol takes a button of each colour. $\frac{72}{156}$

Harder Tree Diagrams

1) A bag contains 7 green and 3 yellow balls.
A ball is taken from the bag at random and not replaced.
Another ball is taken from the bag at random.

   a) Draw a tree diagram to show all the possibilities.
   b) What is the probability that both balls are different colours?

2) A box contains 5 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
Another counter is taken at random.

   a) Draw a tree diagram to show all the possibilities.
   b) What is the probability of choosing at least one blue counter?
   c) What is the probability of choosing two counters of the same colour?
   d) What is the probability of choosing two counters of different colours?

3) A box contains 4 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
A second counter is taken from the box at random and not replaced.
A third counter is taken from the box.

   a) Draw a tree diagram to show all the possibilities.
   b) What is the probability that all three counters are the same colour?
   c) What is the probability that exactly two of the counters are red?

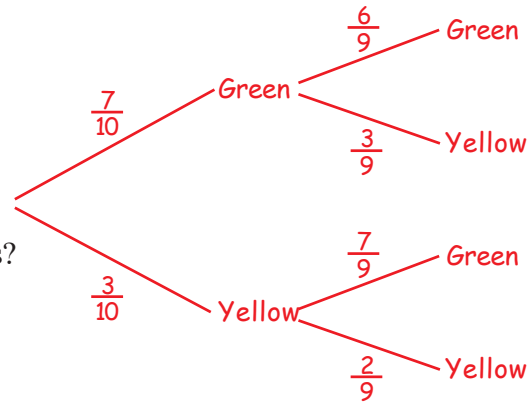
Harder Tree Diagrams

1) A bag contains 7 green and 3 yellow balls.
A ball is taken from the bag at random and not replaced.
Another ball is taken from the bag at random.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that both balls are different colours?
$\frac{42}{90}$

a)



2) A box contains 5 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
Another counter is taken at random.

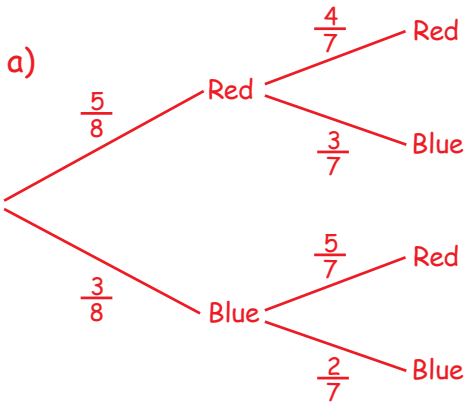
a) Draw a tree diagram to show all the possibilities.

b) What is the probability of choosing at least one blue counter? $\frac{36}{56}$

c) What is the probability of choosing two counters of the same colour? $\frac{26}{56}$

d) What is the probability of choosing two counters of different colours? $\frac{30}{56}$

a)



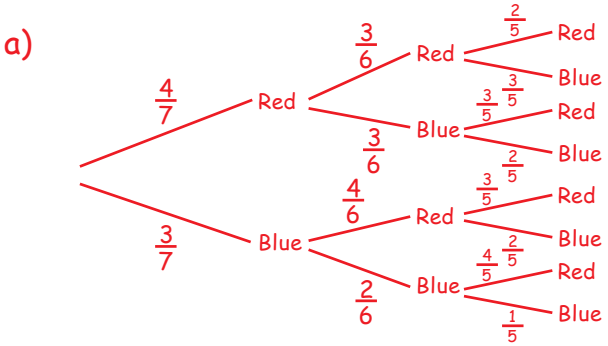
3) A box contains 4 red counters and 3 blue counters.
A counter is taken from the box at random and not replaced.
A second counter is taken from the box at random and not replaced.
A third counter is taken from the box.

a) Draw a tree diagram to show all the possibilities.

b) What is the probability that all three counters are the same colour? $\frac{30}{210}$

c) What is the probability that exactly two of the counters are red? $\frac{108}{210}$

a)

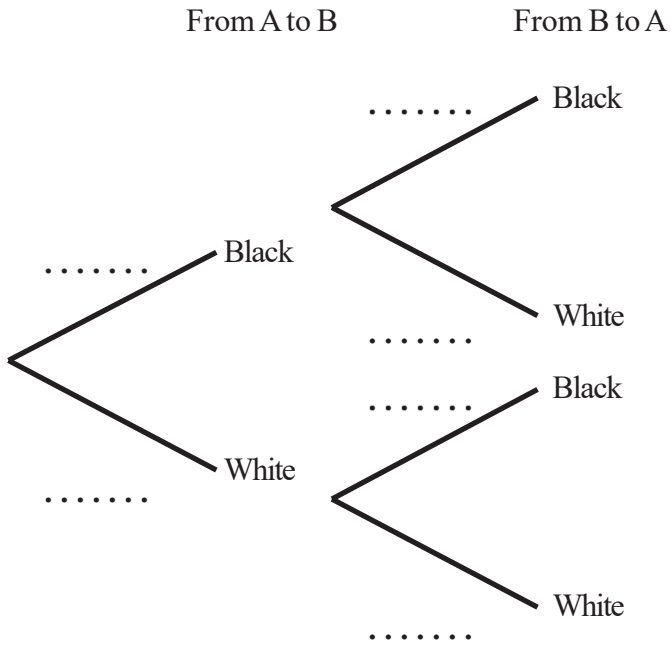


Harder Tree Diagrams

1) Sara has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Sara takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

a) Complete the probability tree diagram.



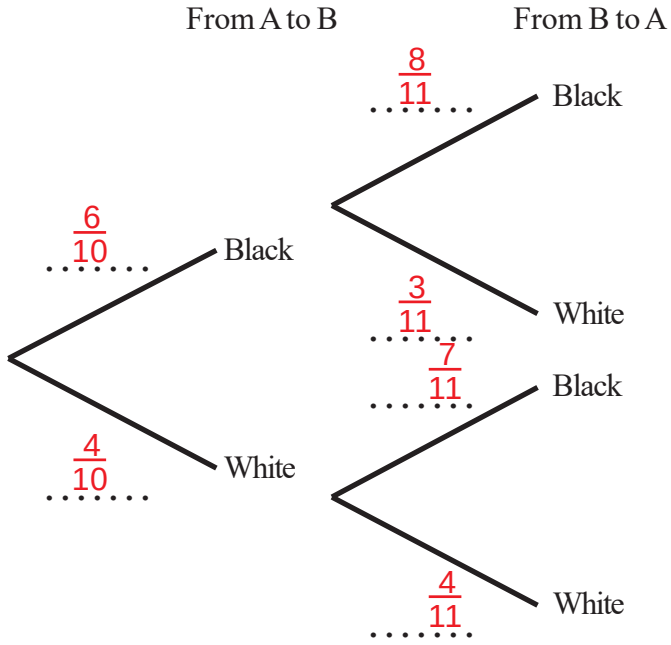
b) Find the probability that after Sara has put the counters from box B into box A there will still be 6 black counters and 4 white counters in box A.

Harder Tree Diagrams

1) Sara has two boxes.
There are 6 black and 4 white counters in box A.
There are 7 black and 3 white counters in box B.

Sara takes at random a counter from box A and puts it in box B.
She then takes at random a counter from box B and puts it in box A.

a) Complete the probability tree diagram.



b) Find the probability that after Sara has put the counters from box B into box A there will still be 6 black counters and 4 white counters in box A. $\frac{64}{110}$

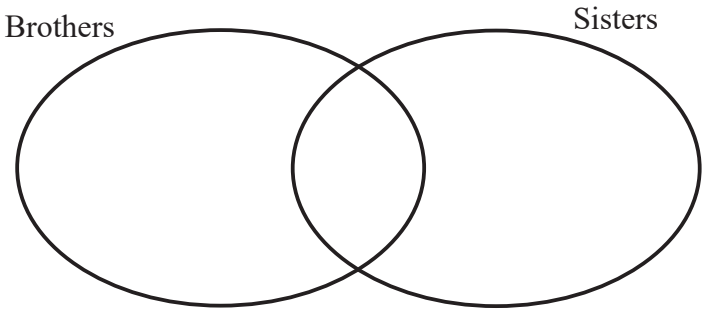
Probability Using Venn Diagrams

1) In a class of 30 students, all of them have brothers or sisters or both.

19 have a brother.

16 have a sister.

a) Complete the Venn diagram.



b) Find the probability that a student in the class has a brother and a sister.

c) If it is known that a student has a sister, what is the probability that they also have a brother?

2) A cafeteria serves only main courses and desserts. Some people just have a main, some have just a dessert and some have both.

One day, 65% of the customers had a main course and 90% had a dessert.

a) Show this information on a Venn diagram.

b) What is the probability that a customer had a main course and a dessert?

c) If it is known that a customer had a dessert, what is the probability that they also had a main course?

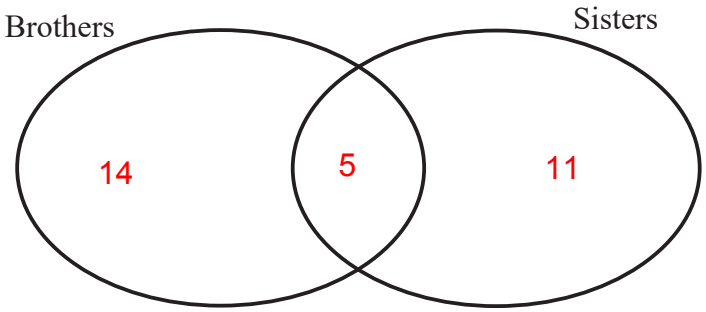
Probability Using Venn Diagrams

1) In a class of 30 students, all of them have brothers or sisters or both.

19 have a brother.

16 have a sister.

a) Complete the Venn diagram.



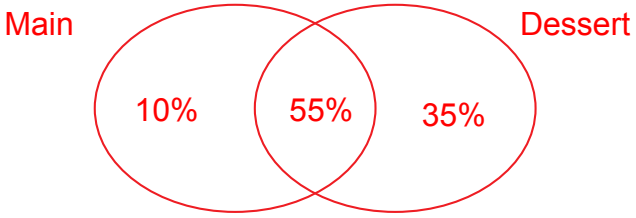
b) Find the probability that a student in the class has a brother and a sister. $\frac{5}{30}$

c) If it is known that a student has a sister, what is the probability that they also have a brother? $\frac{5}{16}$

2) A cafeteria serves only main courses and desserts. Some people just have a main, some have just a dessert and some have both.

One day, 65% of the customers had a main course and 90% had a dessert.

a) Show this information on a Venn diagram.



b) What is the probability that a customer had a main course and a dessert? $\frac{55}{100}$

c) If it is known that a customer had a dessert, what is the probability that they also had a main course? $\frac{55}{90}$

Interquartile Range

1) Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 6 7 7 9 10 10 10 M: LQ: UQ: IQR:

b) 7 8 8 8 9 9 11 14 15 16 18 M: LQ: UQ: IQR:

c) 11 11 15 18 19 23 24 M: LQ: UQ: IQR:

d) 1.1 1.2 1.3 1.5 1.5 1.6 1.9 M: LQ: UQ: IQR:

2) Find the median, quartiles and interquartile range for each data set.

a) 3 5 1 4 5 3 3 4 3 1 5

b) 4 13 8 8 5 8 7

c) 6 7 14 17 19 16 5 20 21 20 16 6 17 8 18

d) 4.1 1.4 6.1 3.3 1.5 5.2 4.5 7.2 5.8 3.9 4.8

3) Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 8 10

b) 13 11 9 12 13 14 9 15 10

c) 15 12 21 15 14 19 19 17

d) 2.6 1.9 2.2 2.7 2.4 2.3 2.1 1.8 2.7 2.1 2.4 2.1

4) The time, in minutes, taken by a group of students to complete a puzzle are shown.

Andy	Ella	Ty	Luke	Ollie	Chloe	Emma	Karen	Scott	Gareth
16	9	12	17	13	11	8	17	11	14

Find the interquartile range of the times.

5) The data in the table shows the tries scored by a rugby team at each game in a season.

Game	1	2	3	4	5	6	7	8
Tries	3	0	2	5	5	0	1	3

Calculate the interquartile range of the number of tries scored.

Interquartile Range

1) Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 6 7 7 9 10 10 10 M: 7 LQ: 5 UQ: 10 IQR: 5

b) 7 8 8 8 9 9 11 14 15 16 18 M: 9 LQ: 8 UQ: 15 IQR: 7

c) 11 11 15 18 19 23 24 M: 18 LQ: 11 UQ: 23 IQR: 12

d) 1.1 1.2 1.3 1.5 1.5 1.6 1.9 M: 1.5 LQ: 1.2 UQ: 1.6 IQR: 0.4

2) Find the median, quartiles and interquartile range for each data set.

a) 3 5 1 4 5 3 3 4 3 1 5 M = 3 LQ = 3 UQ = 5 IQR = 2

b) 4 13 8 8 5 8 7 M = 8 LQ = 5 UQ = 8 IQR = 3

c) 6 7 14 17 19 16 5 20 21 20 16 6 17 8 18
M = 16 LQ = 7 UQ = 19 IQR = 12

d) 4.1 1.4 6.1 3.3 1.5 5.2 4.5 7.2 5.8 3.9 4.8
M = 4.5 LQ = 3.3 UQ = 5.8 IQR = 2.5

3) Find the median, quartiles and interquartile range for each data set.

a) 2 5 5 6 8 10 M = 5.5 LQ = 5 UQ = 8 IQR = 3

b) 13 11 9 12 13 14 9 15 10 M = 12 LQ = 9.5 UQ = 13.5 IQR = 4

c) 15 12 21 15 14 19 19 17 M = 16 LQ = 14.5 UQ = 19 IQR = 4.5

d) 2.6 1.9 2.2 2.7 2.4 2.3 2.1 1.8 2.7 2.1 2.4 2.1
M = 2.25 LQ = 2.1 UQ = 2.5 IQR = 0.4

4) The time, in minutes, taken by a group of students to complete a puzzle are shown.

Andy	Ella	Ty	Luke	Ollie	Chloe	Emma	Karen	Scott	Gareth
16	9	12	17	13	11	8	17	11	14

Find the interquartile range of the times. IQR = 16 – 11 = 5

5) The data in the table shows the tries scored by a rugby team at each game in a season.

Game	1	2	3	4	5	6	7	8
Tries	3	0	2	5	5	0	1	3

Calculate the interquartile range of the number of tries scored. IQR = 4 – 0.5 = 3.5

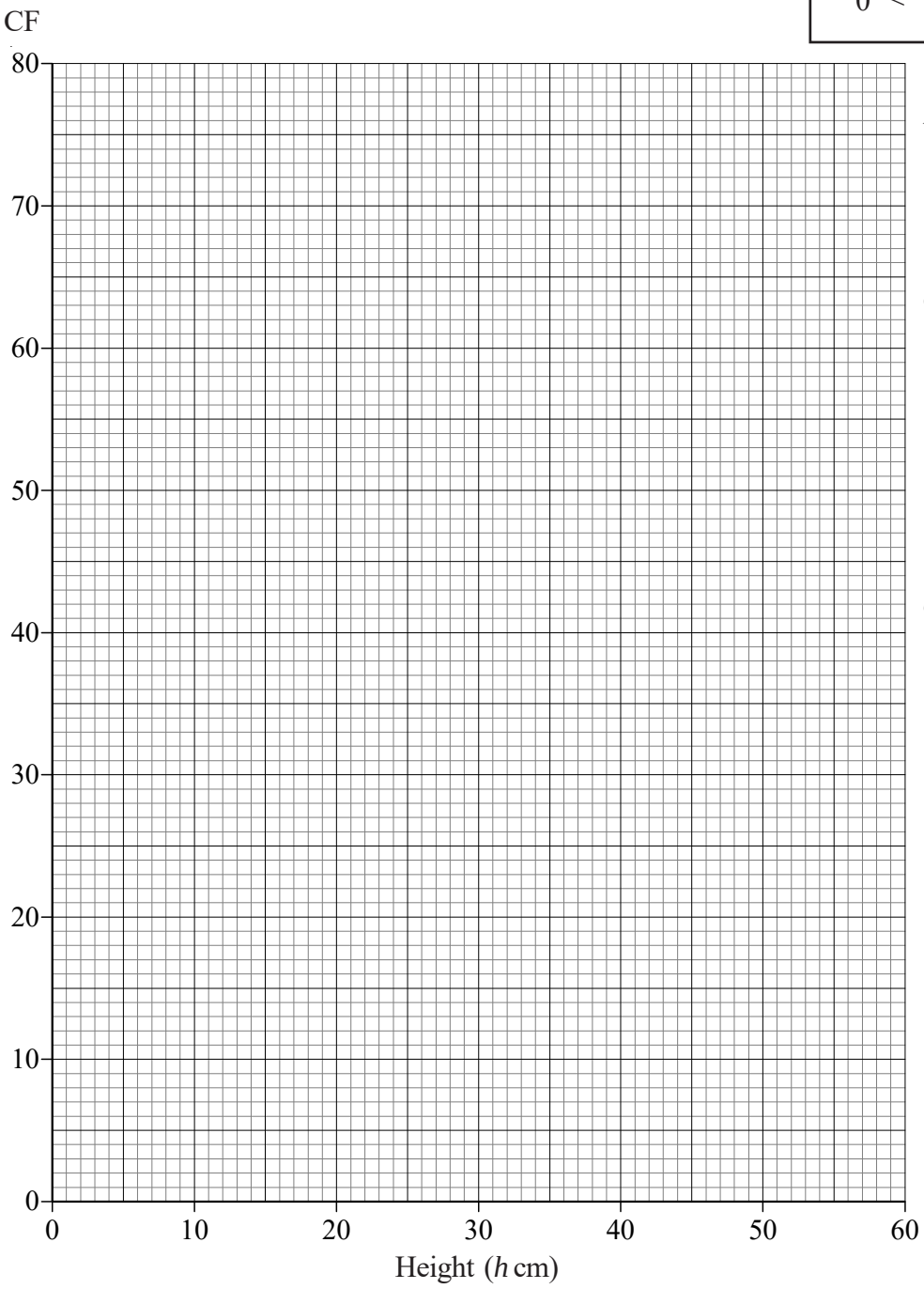
Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	
$0 < h \leqslant 30$	
$0 < h \leqslant 40$	
$0 < h \leqslant 50$	
$0 < h \leqslant 60$	



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.

(ii) the interquartile range of the heights of the plants.

d) Use your graph to estimate how many plants had a height that was greater than 45cm.

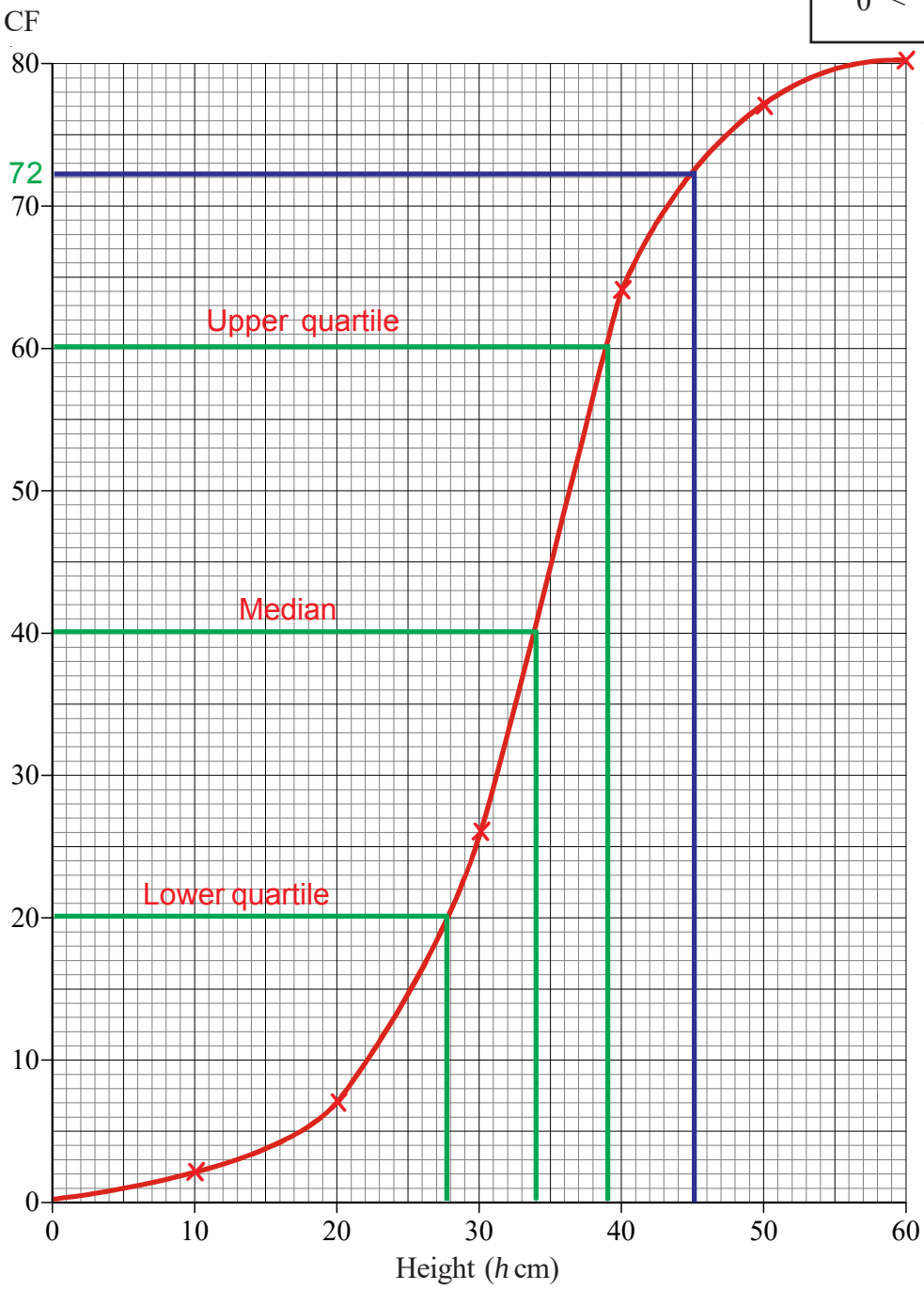
Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height (h cm)	Frequency
$0 < h \leqslant 10$	2
$10 < h \leqslant 20$	5
$20 < h \leqslant 30$	19
$30 < h \leqslant 40$	38
$40 < h \leqslant 50$	13
$50 < h \leqslant 60$	3

a) Complete the cumulative frequency table for the plants.

Height (h cm)	Cumulative Frequency
$0 < h \leqslant 10$	2
$0 < h \leqslant 20$	7
$0 < h \leqslant 30$	26
$0 < h \leqslant 40$	64
$0 < h \leqslant 50$	77
$0 < h \leqslant 60$	80



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.

34 cm

(ii) the interquartile range of the heights of the plants.

39 – 27.7 = 11.3 cm

d) Use your graph to estimate how many plants had a height that was greater than 45cm.

80 – 72 = 8 plants

Cumulative Frequency

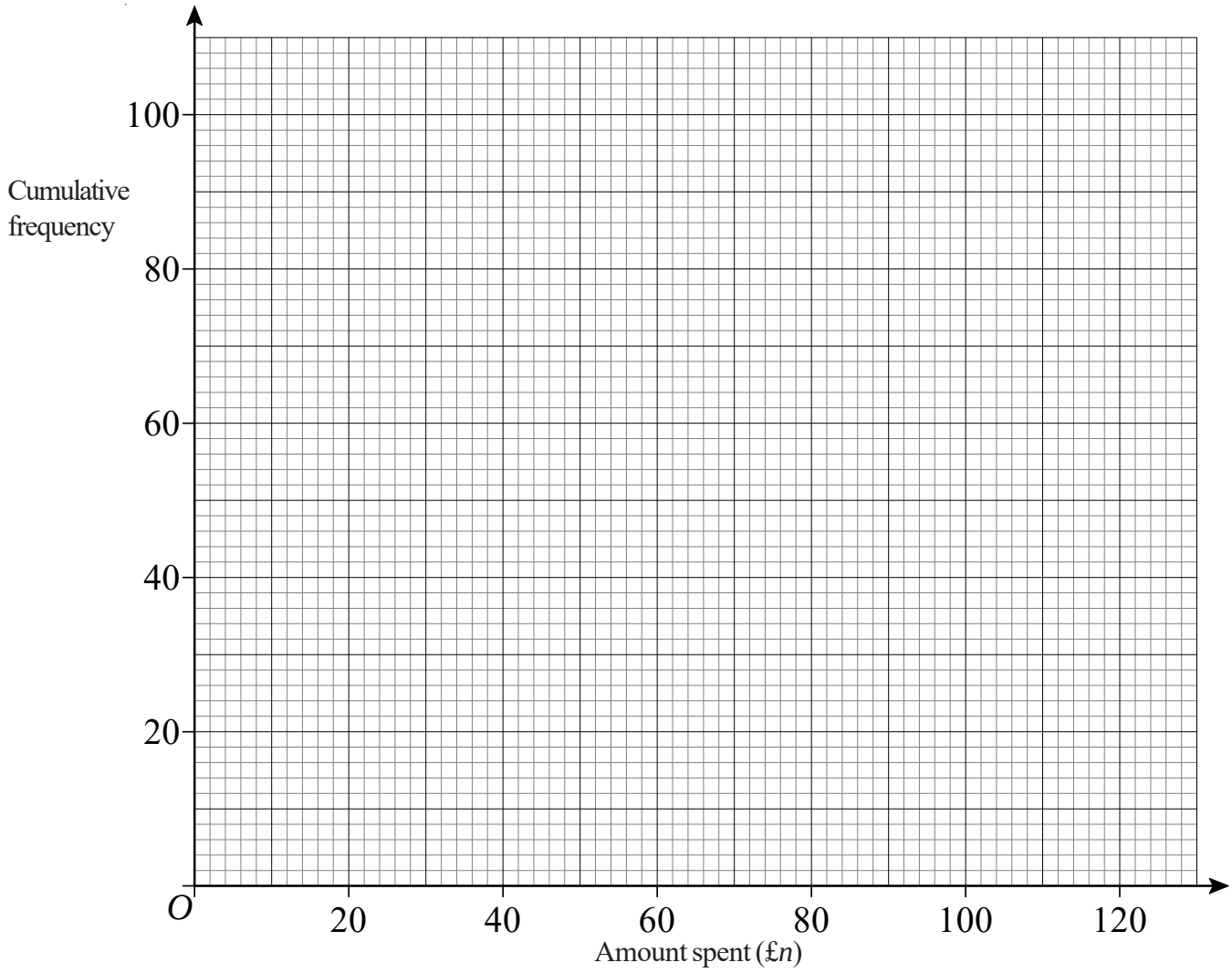
The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n \leqslant 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n \leqslant 40$	
$0 < n \leqslant 60$	
$0 < n \leqslant 80$	
$0 < n \leqslant 100$	
$0 < n \leqslant 120$	

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median amount spent.

d) Use your graph to find an estimate for the interquartile range of the amount of money spent.

Cumulative Frequency

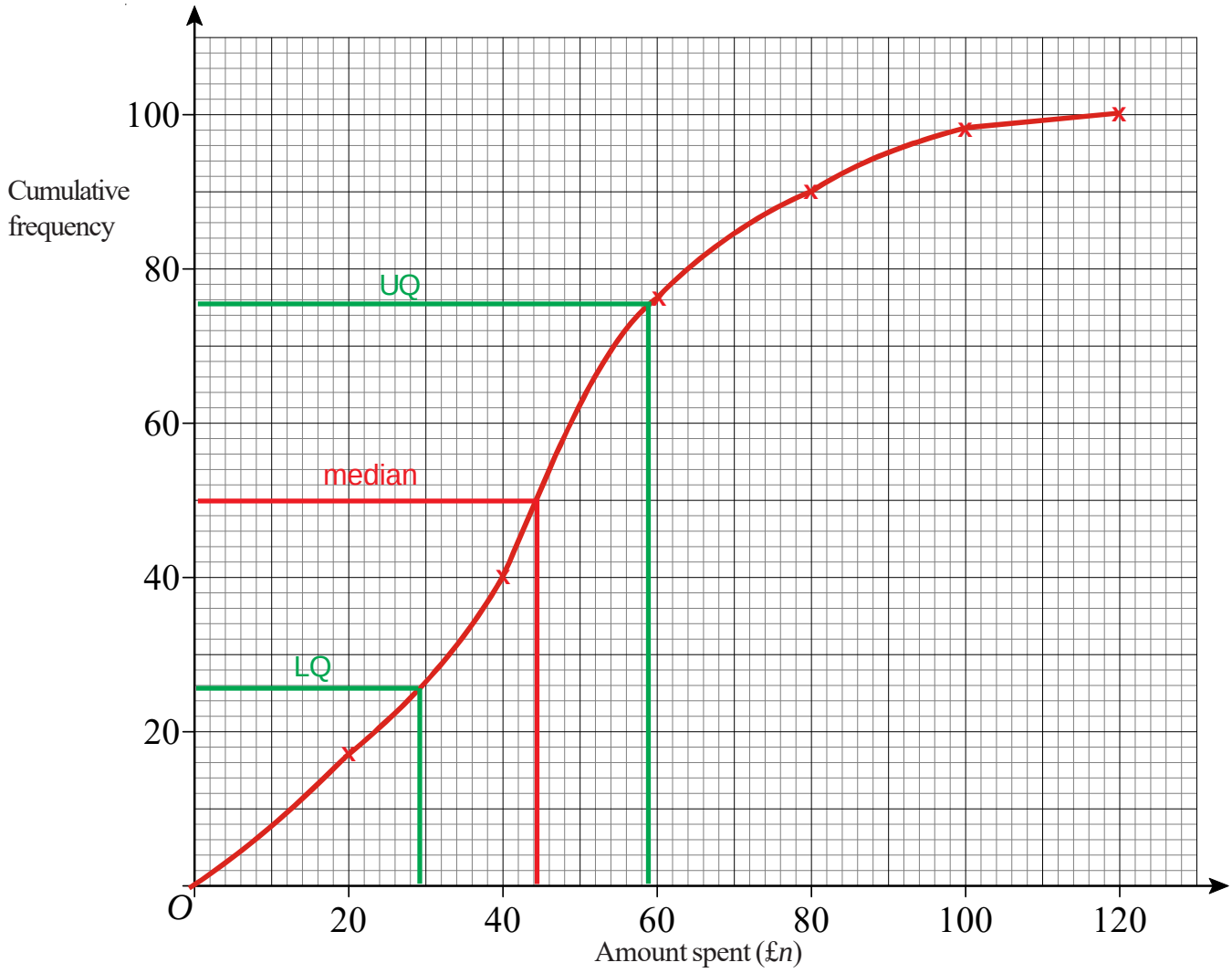
The table shows information about the amount spent by 100 customers in a supermarket.

Amount spent (£n)	Frequency
$0 < n \leqslant 20$	17
$20 < n \leqslant 40$	23
$40 < n \leqslant 60$	36
$60 < n \leqslant 80$	14
$80 < n \leqslant 100$	8
$100 < n \leqslant 120$	2

a) Complete the cumulative frequency table for this information.

Amount spent (£n)	Cumulative frequency
$0 < n \leqslant 20$	17
$0 < n \leqslant 40$	40
$0 < n \leqslant 60$	76
$0 < n \leqslant 80$	90
$0 < n \leqslant 100$	98
$0 < n \leqslant 120$	100

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median amount spent. £44

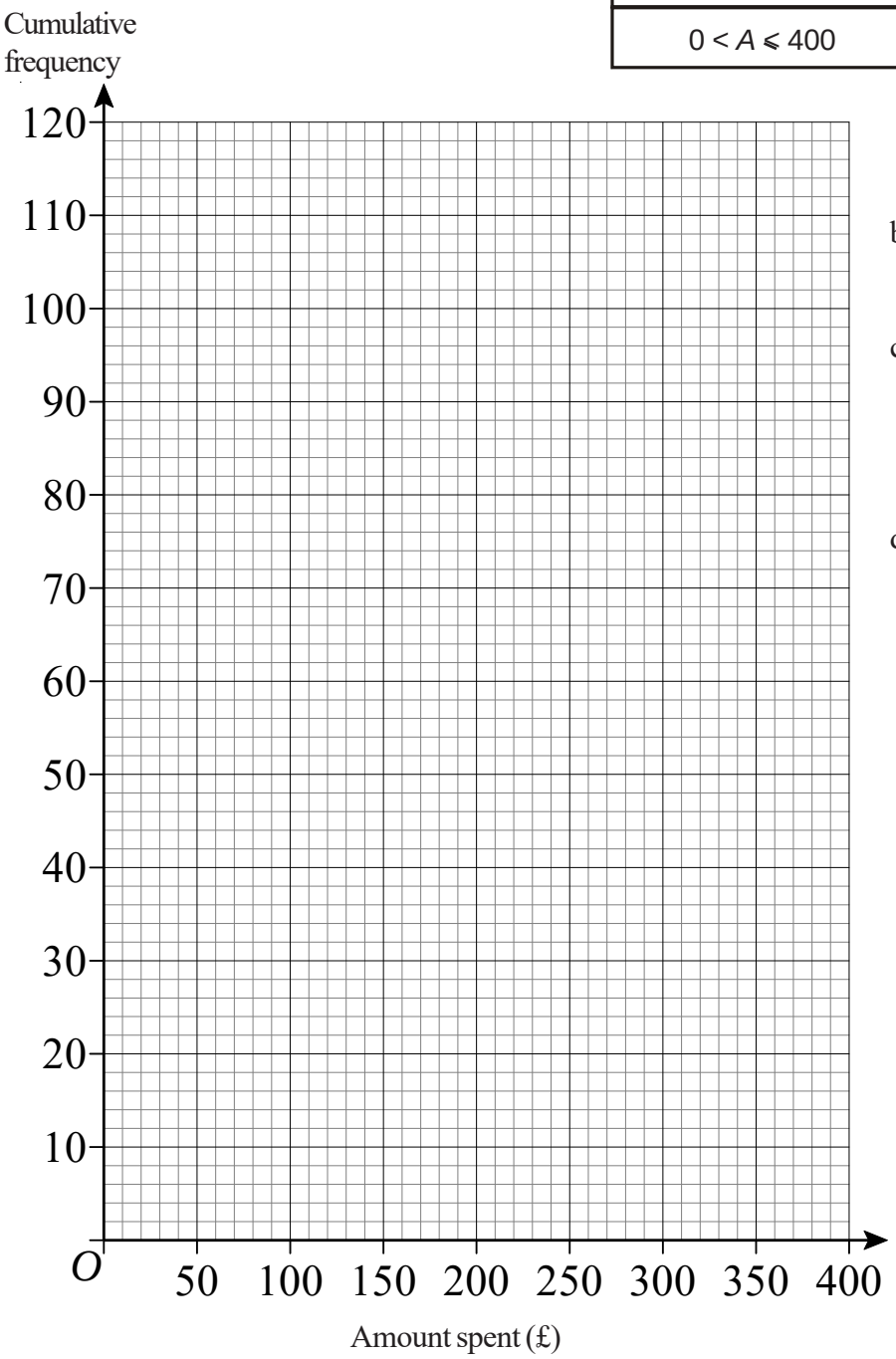
d) Use your graph to find an estimate for the interquartile range of the amount of money spent. £59 – £29 = £30

Cumulative Frequency

Fred did a survey about the amount of money spent by 120 men at Christmas.
The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
$0 < A \leqslant 100$	12
$0 < A \leqslant 150$	26
$0 < A \leqslant 200$	42
$0 < A \leqslant 250$	64
$0 < A \leqslant 300$	93
$0 < A \leqslant 350$	112
$0 < A \leqslant 400$	120

a) On the grid, draw a cumulative frequency diagram.



b) Use your cumulative frequency diagram to estimate the median.

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent.

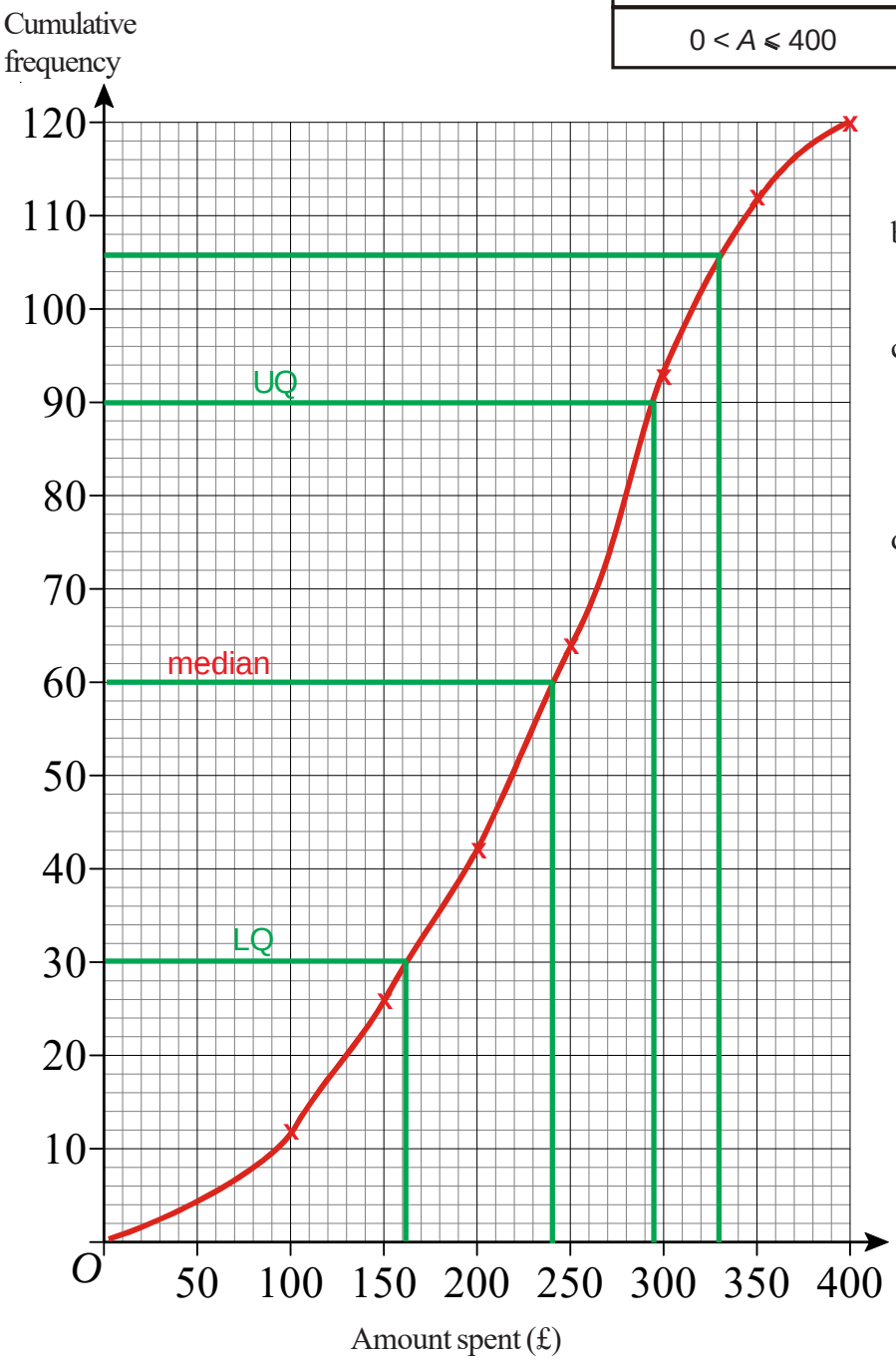
d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.

Cumulative Frequency

Fred did a survey about the amount of money spent by 120 men at Christmas.
The cumulative frequency table gives some information about the amounts of money spent by the 120 men.

Amount (£A) spent	Cumulative frequency
$0 < A \leqslant 100$	12
$0 < A \leqslant 150$	26
$0 < A \leqslant 200$	42
$0 < A \leqslant 250$	64
$0 < A \leqslant 300$	93
$0 < A \leqslant 350$	112
$0 < A \leqslant 400$	120

a) On the grid, draw a cumulative frequency diagram.



b) Use your cumulative frequency diagram to estimate the median.
£240

c) Use your cumulative frequency diagram to estimate the interquartile range of the amount of money spent. £295 – £160 = £135

d) Use your cumulative frequency diagram to estimate the number of men who spent more than £330.
14

Cumulative Frequency

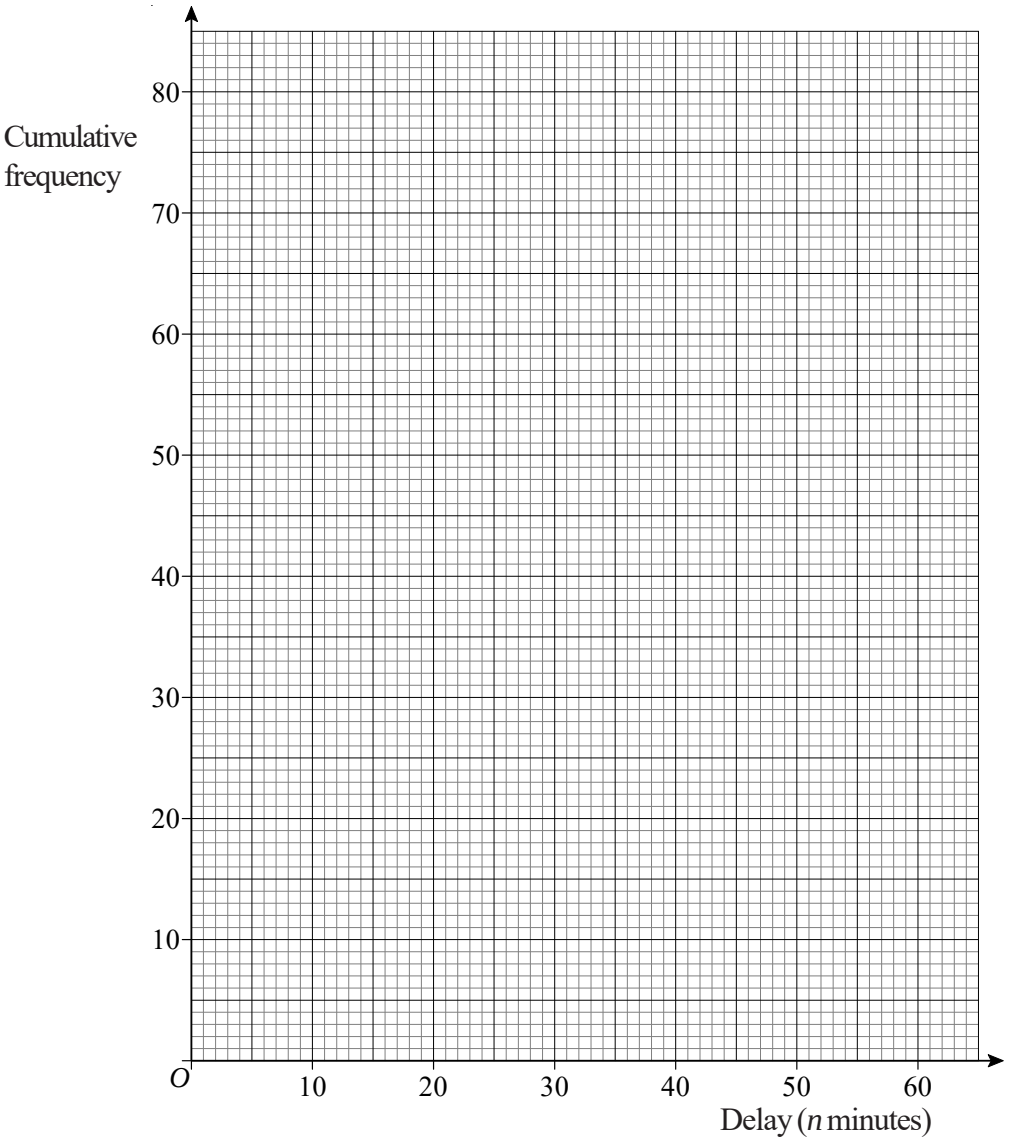
The table gives some information about the delay, in minutes, of 80 trains.

a) Complete the cumulative frequency table.

Delay (n minutes)	Frequency
$0 < n \leqslant 20$	16
$20 < n \leqslant 30$	27
$30 < n \leqslant 40$	22
$40 < n \leqslant 50$	10
$50 < n \leqslant 60$	5

Delay (n minutes)	Cumulative Frequency
$0 < n \leqslant 20$	
$0 < n \leqslant 30$	
$0 < n \leqslant 40$	
$0 < n \leqslant 50$	
$0 < n \leqslant 60$	

b) On the grid below, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for

(i) the median delay.

(ii) the interquartile range of the delays.

(iii) the number of trains delayed for more than 53 minutes.

Cumulative Frequency

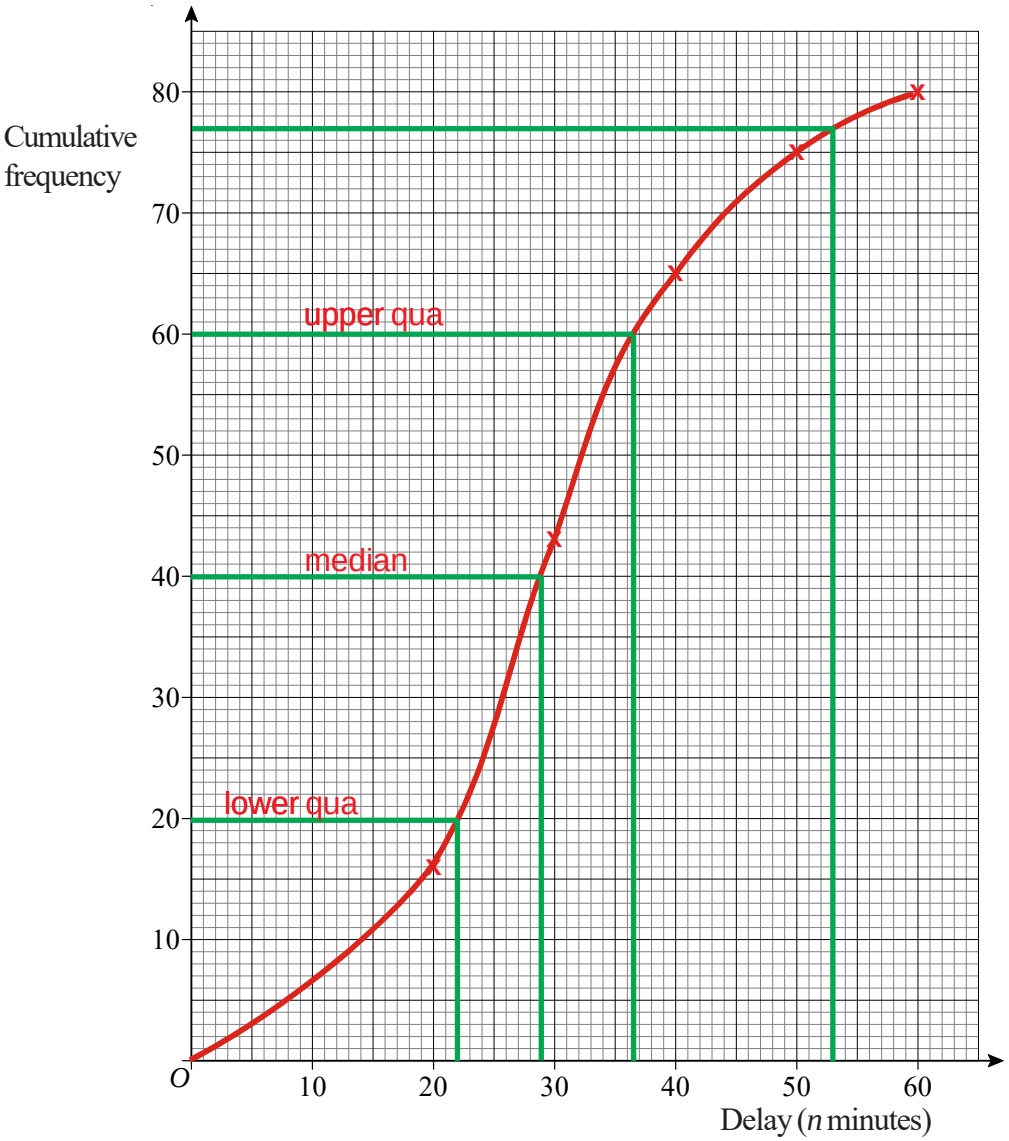
The table gives some information about the delay, in minutes, of 80 trains.

a) Complete the cumulative frequency table.

Delay (n minutes)	Frequency
$0 < n \leqslant 20$	16
$20 < n \leqslant 30$	27
$30 < n \leqslant 40$	22
$40 < n \leqslant 50$	10
$50 < n \leqslant 60$	5

Delay (n minutes)	Cumulative Frequency
$0 < n \leqslant 20$	16
$0 < n \leqslant 30$	43
$0 < n \leqslant 40$	65
$0 < n \leqslant 50$	75
$0 < n \leqslant 60$	80

b) On the grid below, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for

(i) the median delay. 29 minutes

(ii) the interquartile range of the delays. 36.5 – 22 = 14.5 minutes

(iii) the number of trains delayed for more than 53 minutes. 3

Cumulative Frequency

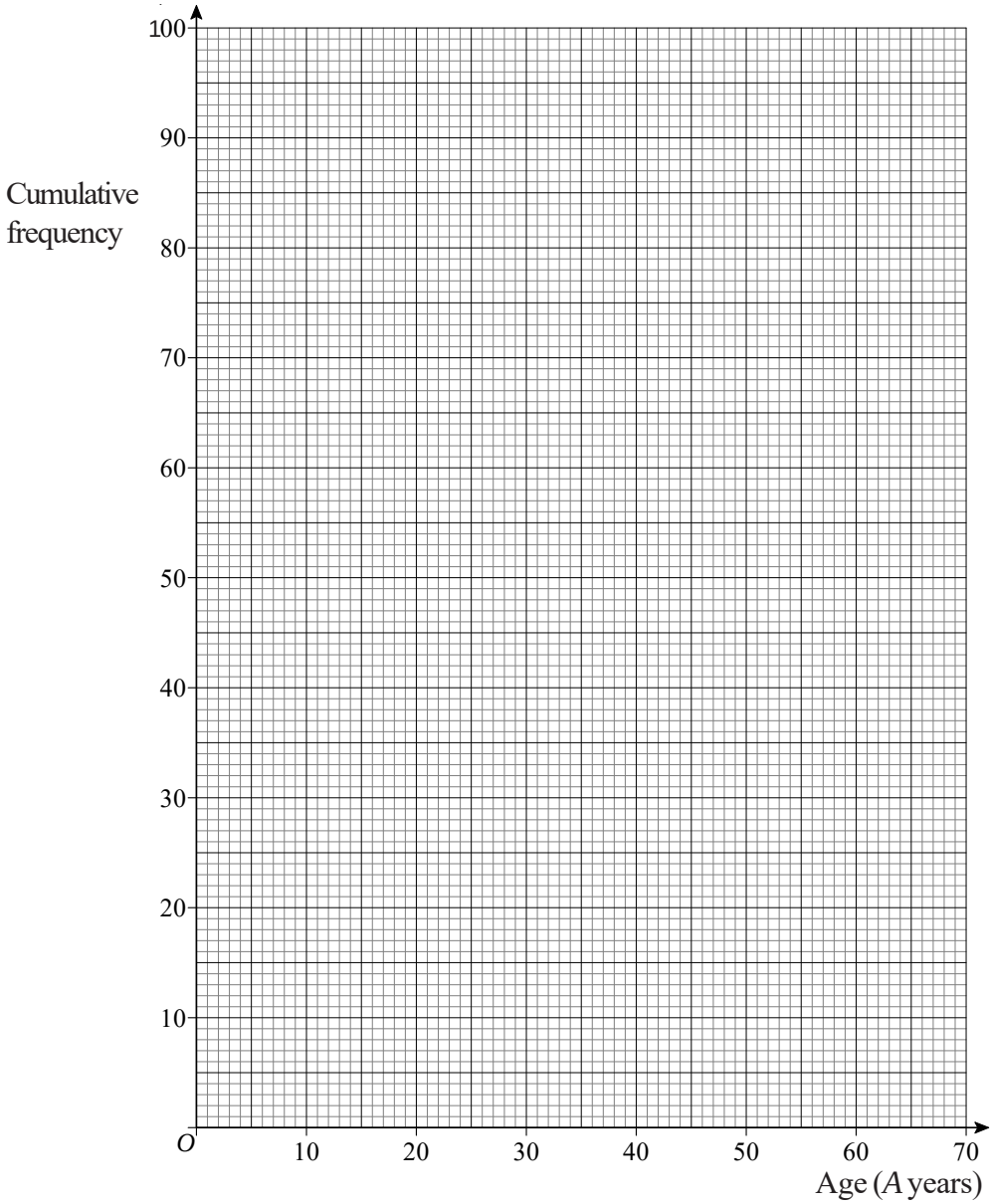
There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results.

Age (A years)	Frequency
$20 < A \leqslant 30$	25
$30 < A \leqslant 40$	36
$40 < A \leqslant 50$	22
$50 < A \leqslant 60$	11
$60 < A \leqslant 70$	6

a) Complete the cumulative frequency table

Age (A years)	Cumulative Frequency
$20 < A \leqslant 30$	25
$20 < A \leqslant 40$	
$20 < A \leqslant 50$	
$20 < A \leqslant 60$	
$20 < A \leqslant 70$	

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median age.

d) Use your graph to find an estimate for the number of these teachers who are **older** than 56 years old.

Cumulative Frequency

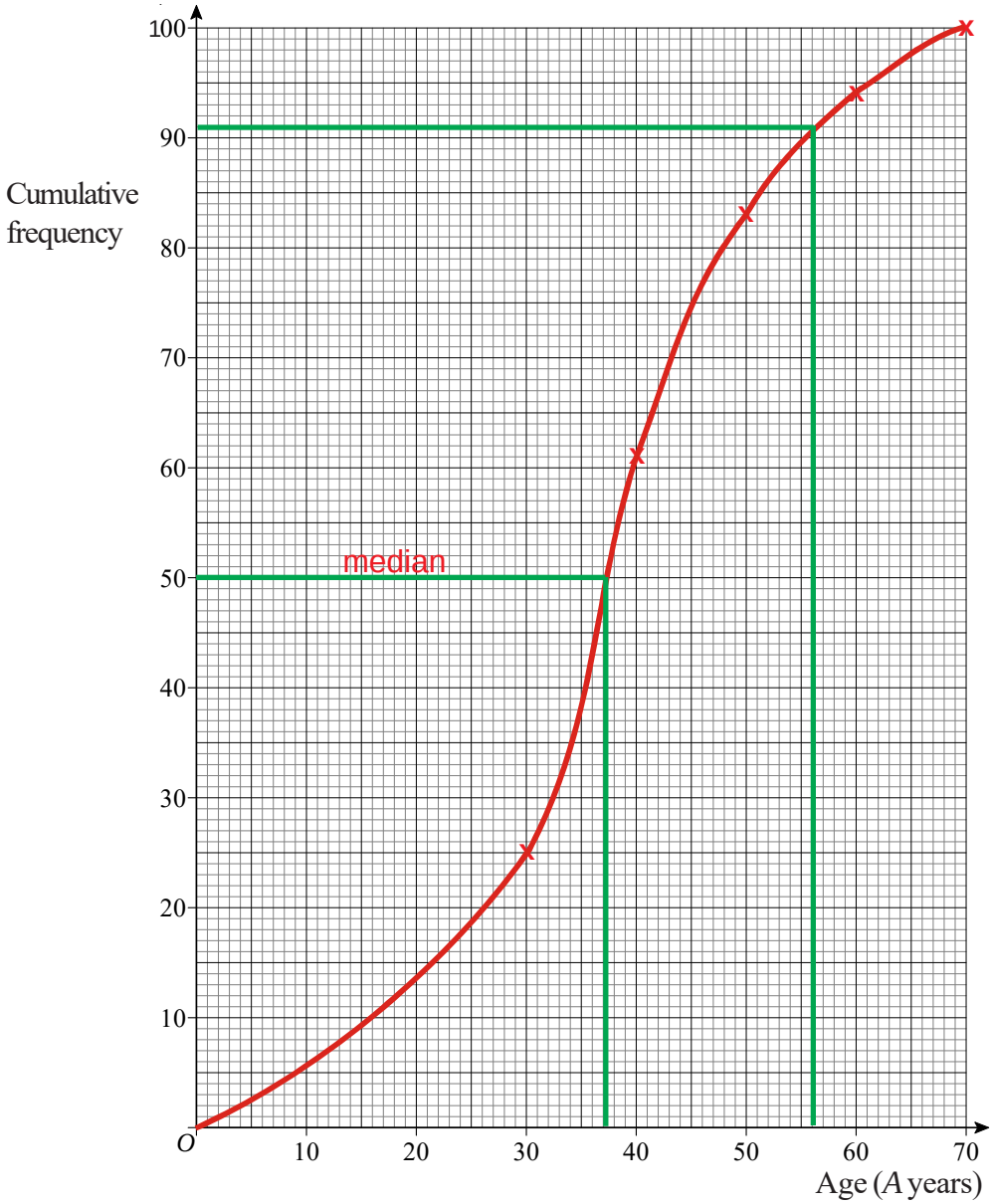
There are 100 teachers at Sam's school.
Sam found out the age of each teacher.
The table gives information about her results.

Age (A years)	Frequency
$20 < A \leqslant 30$	25
$30 < A \leqslant 40$	36
$40 < A \leqslant 50$	22
$50 < A \leqslant 60$	11
$60 < A \leqslant 70$	6

a) Complete the cumulative frequency table

Age (A years)	Cumulative Frequency
$20 < A \leqslant 30$	25
$20 < A \leqslant 40$	61
$20 < A \leqslant 50$	83
$20 < A \leqslant 60$	94
$20 < A \leqslant 70$	100

b) On the grid, draw a cumulative frequency graph for your table.



c) Use your graph to find an estimate for the median age. 37 years

d) Use your graph to find an estimate for the number of these teachers who are **older** than 56 years old. 9

Cumulative Frequency

This table shows information about the time, m minutes, it takes to show each of 120 films.

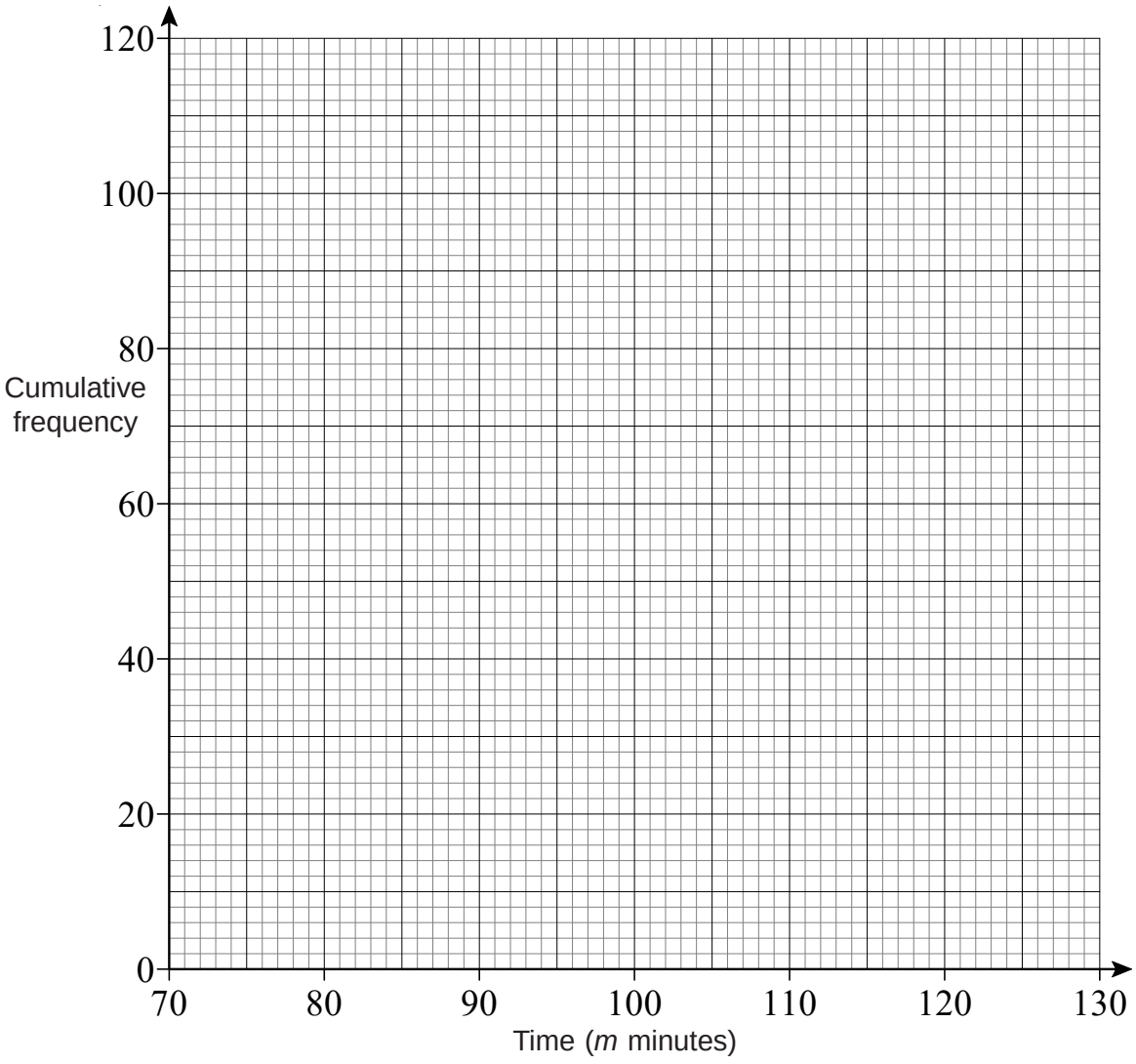
Time (m minutes)	Frequency
$70 < m \leqslant 80$	3
$80 < m \leqslant 90$	13
$90 < m \leqslant 100$	34
$100 < m \leqslant 110$	32
$110 < m \leqslant 120$	26
$120 < m \leqslant 130$	12

a) Write down the modal class interval.

b) Complete this cumulative frequency table.

Time (m minutes)	Cumulative frequency
$70 < m \leqslant 80$	3
$70 < m \leqslant 90$	
$70 < m \leqslant 100$	
$70 < m \leqslant 110$	
$70 < m \leqslant 120$	
$70 < m \leqslant 130$	

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.



d) Use your graph to find an estimate for the median.

e) Use your graph to find an estimate for the interquartile range of times.

f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show.

Cumulative Frequency

This table shows information about the time, m minutes, it takes to show each of 120 films.

Time (m minutes)	Frequency
$70 < m \leqslant 80$	3
$80 < m \leqslant 90$	13
$90 < m \leqslant 100$	34
$100 < m \leqslant 110$	32
$110 < m \leqslant 120$	26
$120 < m \leqslant 130$	12

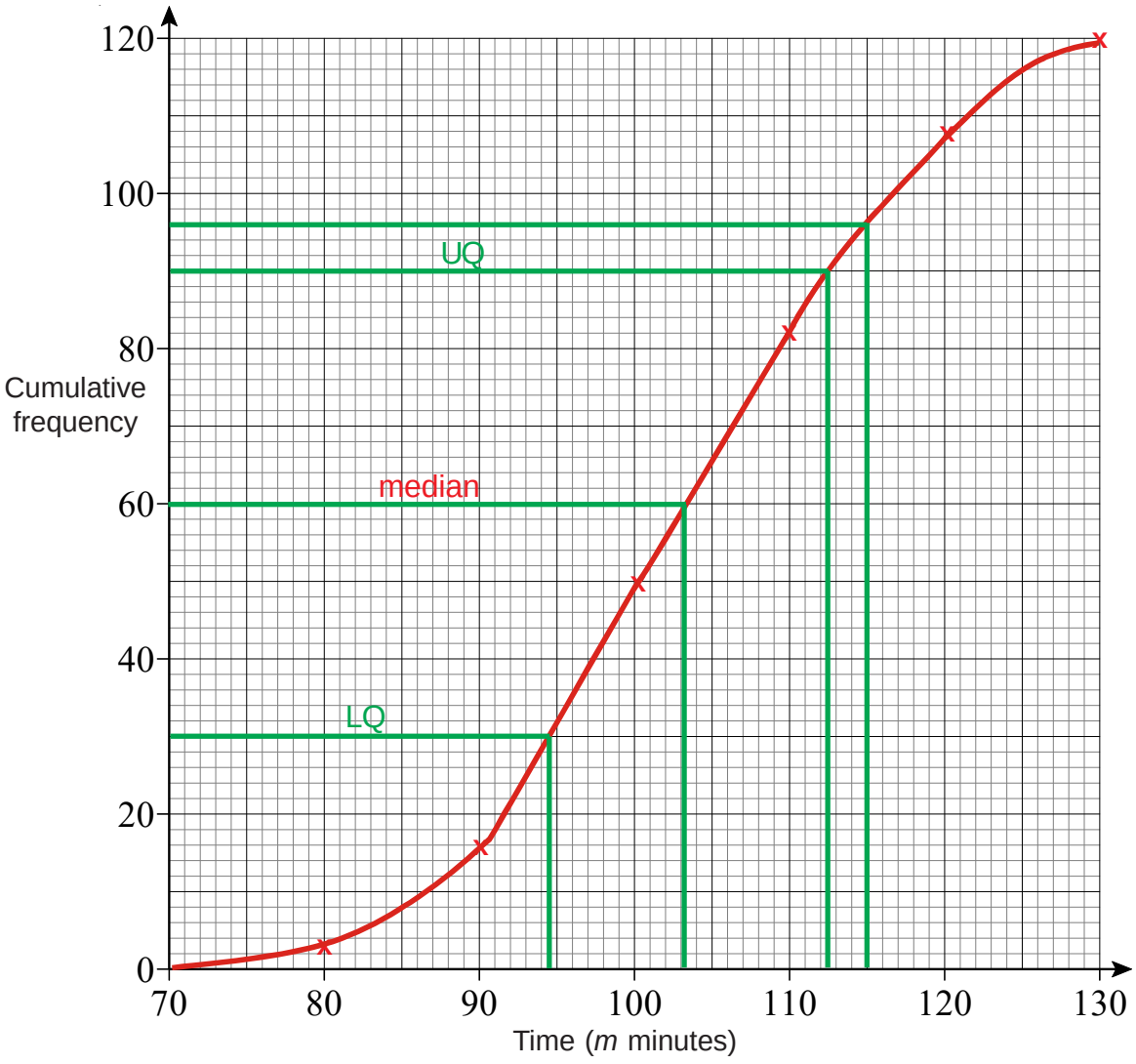
a) Write down the modal class interval.

$90 < m \leqslant 100$

b) Complete this cumulative frequency table.

Time (m minutes)	Cumulative frequency
$70 < m \leqslant 80$	3
$70 < m \leqslant 90$	16
$70 < m \leqslant 100$	50
$70 < m \leqslant 110$	82
$70 < m \leqslant 120$	108
$70 < m \leqslant 130$	120

c) On the grid, draw a cumulative frequency graph for your cumulative frequency table.



d) Use your graph to find an estimate for the median. 103 minutes

e) Use your graph to find an estimate for the interquartile range of times. 112.5 – 94.5 = 18 minutes

f) Use your graph to find an estimate for the number of films which take longer than 115 minutes to show. 24 films

Fractional Indices

1) Simplify the following:

a) $y^4 \times y^5$

b) $x^2 \times x^6$

c) $(p^4)^5$

d) $(x^3)^2$

e) $(x^4)^{-2}$

f) $(x^{-3})^{-5}$

g) $x^7 \div x^2$

h) $\dfrac{t^5}{t^3}$

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0

b) 4^{-2}

c) 5^{-3}

d) $49^{\frac{1}{2}}$

e) $8^{\frac{1}{3}}$

f) $32^{\frac{2}{5}}$

g) $16^{-\frac{1}{2}}$

h) $27^{-\frac{1}{3}}$

i) $64^{-\frac{2}{3}}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n.

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n.

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y}

(ii) 2^{2x}

(iii) 2^{x+2y}

Fractional Indices

1) Simplify the following:

a) $y^4 \times y^5$ y^9

b) $x^2 \times x^6$ x^8

c) $(p^4)^5$ p^{20}

d) $(x^3)^2$ x^6

e) $(x^4)^{-2}$ x^{-8}

f) $(x^{-3})^{-5}$ x^{15}

g) $x^7 \div x^2$ x^5

h) $\frac{t^5}{t^3}$ t^2

2) Work out the value of the following, leaving your answer in fraction form when necessary

a) 5^0 1

b) 4^{-2} $\frac{1}{16}$

c) 5^{-3} $\frac{1}{125}$

d) $49^{\frac{1}{2}}$ 7

e) $8^{\frac{1}{3}}$ 2

f) $32^{\frac{2}{5}}$ 4

g) $16^{-\frac{1}{2}}$ $\frac{1}{4}$

h) $27^{-\frac{1}{3}}$ $\frac{1}{3}$

i) $64^{-\frac{2}{3}}$ $\frac{1}{16}$

3) $5\sqrt{5}$ can be written in the form 5^n.

Calculate the value of n. $1\frac{1}{2}$

4) $2\sqrt{8}$ can be written in the form 2^n.

Calculate the value of n. $2\frac{1}{2}$

5) $a = 2^x$, $b = 2^y$

Express in terms of a and b

(i) 2^{x+y} ab

(ii) 2^{2x} a^2

(iii) 2^{x+2y} ab^2

Recurring Decimals - Proof

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal.

b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

Recurring Decimals - Proof

1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form. $\frac{4}{11}$

b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$

$0.\dot{7}\dot{2} = 2 \times 0.\dot{3}\dot{6}$

$0.\dot{7}\dot{2} = 2 \times \frac{4}{11}$

$0.\dot{7}\dot{2} = \frac{8}{11}$

2) a) Change $\frac{4}{9}$ to a decimal. $0.\dot{4}$

b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$

$x = 0.5757...$

$100x = 57.5757...$

$99x = 57$

$x = \frac{57}{99} = \frac{19}{33}$

3) a) Change $\frac{3}{11}$ to a decimal. $0.\dot{2}\dot{7}$

b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$

$x = 0.4545...$

$100x = 45.4545...$

$99x = 45$

$x = \frac{45}{99} = \frac{15}{33}$

4) a) Change $\frac{1}{6}$ to a decimal. $0.1\dot{6}$

b) Prove that the recurring decimal $0.\dot{1}3\dot{5} = \frac{5}{37}$

$x = 0.135135...$

$1000x = 135.135135...$

$999x = 135$

$x = \frac{135}{999} = \frac{5}{37}$

5) a) Convert the recurring decimal $0.\dot{2}6\dot{1}$ to a fraction in its simplest form. $\frac{29}{111}$

b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$

$x = 0.2777...$

$100x = 27.777...$

$99x = 27.5$

$x = \frac{27.5}{99} = \frac{55}{198} = \frac{5}{18}$

6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.

$x = 5.222...$

$10x = 52.222...$

$9x = 47$

$x = \frac{47}{9} = 5\frac{2}{9}$

b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

$x = 0.13636...$

$100x = 13.63636...$

$99x = 13.5$

$x = \frac{13.5}{99} = \frac{27}{198} = \frac{3}{22}$

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x.

b) Calculate the value of y when $x = 350$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V.

b) Calculate the value of P when $V = 2$

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$.
Give your answer correct to 3 significant figures.

Direct and Inverse Proportion

1) M is directly proportional to L^3.

When $L = 2$, $M = 160$

Find the value of M when $L = 3$ $M = 540$

2) y is directly proportional to x.

When $x = 500$, $y = 10$

a) Find a formula for y in terms of x. $y = \frac{x}{50}$ or $y = 0.02x$

b) Calculate the value of y when $x = 350$ $y = 7$

3) D is proportional to S^2.

$D = 900$ when $S = 20$

Calculate the value of D when $S = 25$ $D = 1406.25$

4) P is inversely proportional to V.

When $V = 8$, $P = 6$

a) Find a formula for P in terms of V. $P = \frac{48}{V}$

b) Calculate the value of P when $V = 2$ 24

5) The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m^2, of the sphere.

When $A = 100$, $T = 30$.

Find the value of T when $A = 60$. $T = 23.2$ secs
Give your answer correct to 3 significant figures.

Direct and Inverse Proportion

1) x is directly proportional to y.
When $x = 21$, then $y = 3$.

a) Express x in terms of y.

b) Find the value of x when y is equal to 10.

2) a is inversely proportional to b.
When $a = 12$, then $b = 4$.

a) Find a formula for a in terms of b.

b) Find the value of a when b is equal to 8.

c) Find the value of b when a is equal to 4.

3) The variables u and v are in inverse proportion to one another.
When $u = 3$, then $v = 8$.

Find the value of u when $v = 12$.

4) p is directly proportional to the square of q.
$p = 75$ when $q = 5$

a) Express p in terms of q.

b) Work out the value of p when $q = 7$.

c) Work out the positive value of q when $p = 27$.

5) y is directly proportional to x^2.
When $x = 3$, then $y = 36$.

a) Express y in terms of x.

z is inversely proportional to x.
When $x = 4$, $z = 2$.

b) Show that $z = c\,y^n$, where c and n are numbers and $c > 0$.
You must find the values of c and n.

Direct and Inverse Proportion

1) x is directly proportional to y.
When $x = 21$, then $y = 3$.

a) Express x in terms of y. $x = 7y$

b) Find the value of x when y is equal to 10. 70

2) a is inversely proportional to b.
When $a = 12$, then $b = 4$.

a) Find a formula for a in terms of b. $a = \frac{48}{b}$

b) Find the value of a when b is equal to 8. 6

c) Find the value of b when a is equal to 4. 12

3) The variables u and v are in inverse proportion to one another.
When $u = 3$, then $v = 8$.

Find the value of u when $v = 12$.

4) p is directly proportional to the square of q.
$p = 75$ when $q = 5$

a) Express p in terms of q. $p = 3q^2$

b) Work out the value of p when $q = 7$. $p = 147$

c) Work out the positive value of q when $p = 27$. $q = 3$

5) y is directly proportional to x^2.
When $x = 3$, then $y = 36$.

a) Express y in terms of x. $y = 4x^2$

z is inversely proportional to x.
When $x = 4$, $z = 2$.

b) Show that $z = c\,y^n$, where c and n are numbers and $c > 0$. $z = 16y^{-0.5}$
You must find the values of c and n.

$c = 16$
$n = -0.5$

Rearranging Difficult Formulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$

2) Make t the subject of the formula.

$A = \pi t + 5t$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula.

b) Make m the subject of the formula.

5) $A = \dfrac{k(x + 5)}{3}$

Make x the subject of the formula.

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula.

7) $\dfrac{3x + 2}{5} = \dfrac{y}{10 + y}$

Make y the subject of the formula.

8) $\sqrt{\dfrac{a - 3}{5}} = 4b$

Rearrange this formula to give a in terms of b.

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject.

Rearranging Difficult Formulae

1) Make c the subject of the formula.

$v = 2a + 3b + c$ $c = v - 2a - 3b$

2) Make t the subject of the formula.

$A = \pi t + 5t$ $t = \dfrac{A}{\pi + 5}$

3) Make s the subject of the formula.

$R = 3s + \pi s + 2t$ $s = \dfrac{R - 2t}{3 + \pi}$

4) $k = \dfrac{l}{m - l}$

a) Make l the subject of the formula. $l = \dfrac{km}{1 + k}$

b) Make m the subject of the formula. $m = \dfrac{l + kl}{k}$

5) $A = \dfrac{k(x+5)}{3}$

Make x the subject of the formula. $x = \dfrac{3A - 5k}{k}$

6) $R = \dfrac{u + v^2}{u + v}$

Make u the subject of the formula. $u = \dfrac{v^2 - Rv}{R - 1}$

7) $\dfrac{3x+2}{5} = \dfrac{y}{10+y}$

Make y the subject of the formula. $y = \dfrac{30x + 20}{3 - 3x}$

8) $\sqrt{\dfrac{a-3}{5}} = 4b$

Rearrange this formula to give a in terms of b. $a = 80b^2 + 3$

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject. $h = \sqrt{\dfrac{S^2}{4\pi^2 d^2} - d^2}$

Factorising Hard Quadratics

1) Factorise the following:

a) $2x^2 + 7x + 3$

b) $3x^2 + 5x - 2$

c) $6x^2 - 11x + 3$

d) $8x^2 + 10x + 3$

e) $6x^2 - 7x - 20$

f) $4x^2 - 4x - 15$

2) Solve the following:

a) $5x^2 + 9x - 2 = 0$

b) $6x^2 + 5x - 6 = 0$

c) $12x^2 + 25x + 7 = 0$

d) $8x^2 - 14x - 15 = 0$

e) $10x^2 - 43x - 30 = 5$

f) $4x^2 - 8x + 2 = 7$

Factorising Hard Quadratics

1) Factorise the following:

a) $2x^2 + 7x + 3$ $(2x + 1)(x + 3)$

b) $3x^2 + 5x - 2$ $(x + 2)(3x - 1)$

c) $6x^2 - 11x + 3$ $(2x - 3)(3x - 1)$

d) $8x^2 + 10x + 3$ $(2x + 1)(4x + 3)$

e) $6x^2 - 7x - 20$ $(2x - 5)(3x + 4)$

f) $4x^2 - 4x - 15$ $(2x - 5)(2x + 3)$

2) Solve the following:

a) $5x^2 + 9x - 2 = 0$ $x = -2,\ x = \frac{1}{5}$

b) $6x^2 + 5x - 6 = 0$ $x = -\frac{3}{2},\ x = \frac{2}{3}$

c) $12x^2 + 25x + 7 = 0$ $x = -\frac{1}{3},\ x = -\frac{7}{4}$

d) $8x^2 - 14x - 15 = 0$ $x = \frac{5}{2},\ x = -\frac{3}{4}$

e) $10x^2 - 43x - 30 = 5$ $x = 5,\ x = -\frac{7}{10}$

f) $4x^2 - 8x + 2 = 7$ $x = \frac{5}{2},\ x = -\frac{1}{2}$

Algebraic Proof

1) Show algebraically that the sum of two consecutive numbers is always odd.

2) Show algebraically that the product of two even numbers is always a multiple of four.

3) Show algebraically that the square of an odd number is always odd.

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.

5) n is an integer.

Prove that $(2n + 1)(n + 3) + (2n + 1)(n - 2)$ is not a multiple of 2.

6) Prove that $(4n + 1)^2 - (4n - 1)^2$ is a multiple of eight for all positive integer values of n.

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of 4.

Algebraic Proof

1) Show algebraically that the sum of two consecutive numbers is always odd.

$n + n + 1$
$2n + 1$

$2n$ is always even, so $2n + 1$ must always be odd.

2) Show algebraically that the product of two even numbers is always a multiple of four.

$2n \times 2m$
$4nm$

$4nm$ is always a multiple of 4.

3) Show algebraically that the square of an odd number is always odd.

$(2n + 1)^2$
$4n^2 + 4n + 1$
$2(2n^2 + 2n) + 1$
$2(2n^2 + 2n)$ is always even, so $2(2n^2 + 2n) + 1$ must always be odd.

4) Prove, using algebra, that the difference between the squares of any two consecutive even numbers is always a multiple of four.

$(2n + 2)^2 - (2n)^2$
$4n^2 + 8n + 4 - 4n^2$
$8n + 4$
$4(2n + 1)$ which is always a multiple of 4.

5) n is an integer.

Prove that $(2n + 1)(n + 3) + (2n + 1)(n - 2)$ is not a multiple of 2.

$2n^2 + 7n + 3 + 2n^2 - 3n - 2$
$4n^2 + 4n + 1$
$2(2n^2 + 2n) + 1$
$2(2n^2 + 2n)$ is even, so $2(2n^2 + 2n) + 1$ must be odd (not a multiple of 2).

6) Prove that $(4n + 1)^2 - (4n - 1)^2$ is a multiple of eight for all positive integer values of n.

$(16n^2 + 8n + 1) - (16n^2 - 8n + 1)$
$16n^2 + 8n + 1 - 16n^2 + 8n - 1$
$16n$
$8(2n)$ which is always a multiple of 8.

7) Prove algebraically that the sum of the squares of any three consecutive even numbers is always a multiple of 4.

$(2n)^2 + (2n + 2)^2 + (2n + 4)^2$
$4n^2 + 4n^2 + 8n + 4 + 4n^2 + 16n + 16$
$12n^2 + 24n + 20$
$4(3n^2 + 6n + 5)$ which is always a multiple of 4.

Function Notation

1) Given that $f(x) = 3x - 1$, find the value of:

a) f(5) b) f(10) c) f(0)

2) Given that $f(x) = x^2 + 4$, find the value of:

a) f(1) b) f(5) c) f(–2)

3) Given that $f(x) = 2x + 7$ and $g(x) = x^2 - 1$, find the value of:

a) f(3) b) f(–1) c) g(2) d) g(7)

4) Given that $f(x) = \frac{x + 5}{2}$ and $g(x) = 7 - x$, find the value of:

a) f(2) b) g(4) c) f(–3) d) g(–1)

5) $f(x) = 2x + 7$

The domain of f(x) is {–2, –1, 0, 1}.

Find the range of f(x).

6) $f(x) = 5(x + 1)$

The domain of f(x) is {1, 3, 5}.

Find the range of f(x).

7) $f(x) = x^2 - 1$ for all values of x.

Find the range of f(x).

8) $f(x) = \frac{10}{x + 4}$

State the value of x that must be excluded in any domain of f.

9) $f(x) = \frac{1}{x - 3}$

a) State the value of x that cannot be included in any domain of f.

b) Find the range of f.

10) $f(x) = \sqrt{4x - 1}$

Determine the domain of f.

Function Notation

1) Given that $f(x) = 3x - 1$, find the value of:

a) f(5) 14 b) f(10) 29 c) f(0) –1

2) Given that $f(x) = x^2 + 4$, find the value of:

a) f(1) 5 b) f(5) 29 c) f(–2) 8

3) Given that $f(x) = 2x + 7$ and $g(x) = x^2 - 1$, find the value of:

a) f(3) 13 b) f(–1) 5 c) g(2) 3 d) g(7) 48

4) Given that $f(x) = \frac{x+5}{2}$ and $g(x) = 7 - x$, find the value of:

a) f(2) 3.5 b) g(4) 3 c) f(–3) 1 d) g(–1) 8

5) $f(x) = 2x + 7$

The domain of f(x) is {–2, –1, 0, 1}.

Find the range of f(x). {3, 5, 7, 9}

6) $f(x) = 5(x + 1)$

The domain of f(x) is {1, 3, 5}.

Find the range of f(x). {10, 20, 30}

7) $f(x) = x^2 - 1$ for all values of x.

Find the range of f(x). $\{y : y \geq -1\}$

8) $f(x) = \frac{10}{x+4}$

State the value of x that must be excluded in any domain of f. $x = -4$

9) $f(x) = \frac{1}{x-3}$

a) State the value of x that cannot be included in any domain of f. $x = 3$

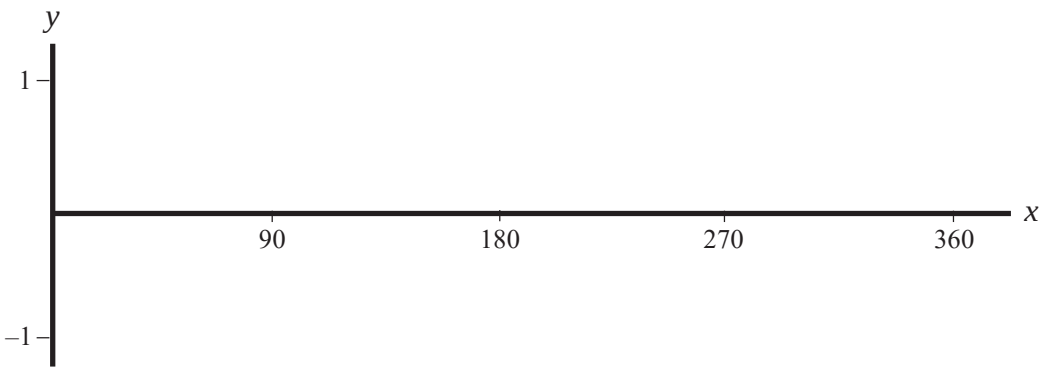
b) Find the range of f. $\{y : y \neq 0\}$

10) $f(x) = \sqrt{4x - 1}$

Determine the domain of f. $\{x : x \geq \frac{1}{4}\}$

Trigonometric Graphs

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

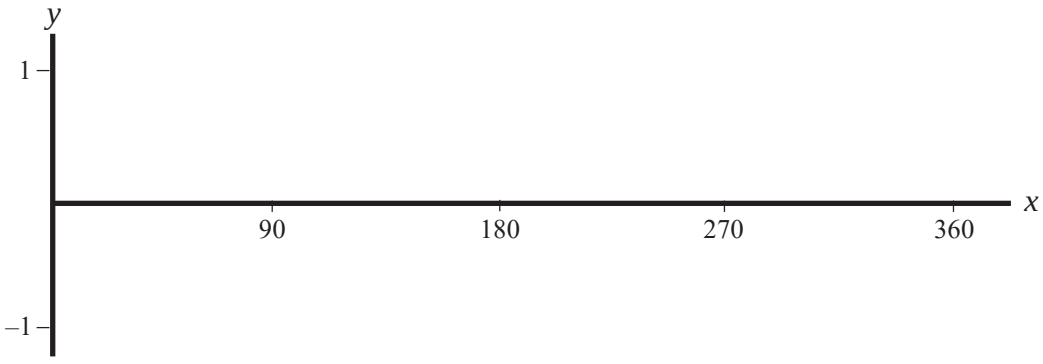


Given that sin 30° = 0.5, write down the value of:

(i) sin 150°

(ii) sin 330°

2) On the axes below, draw a sketch-graph to show $y = \cos x$



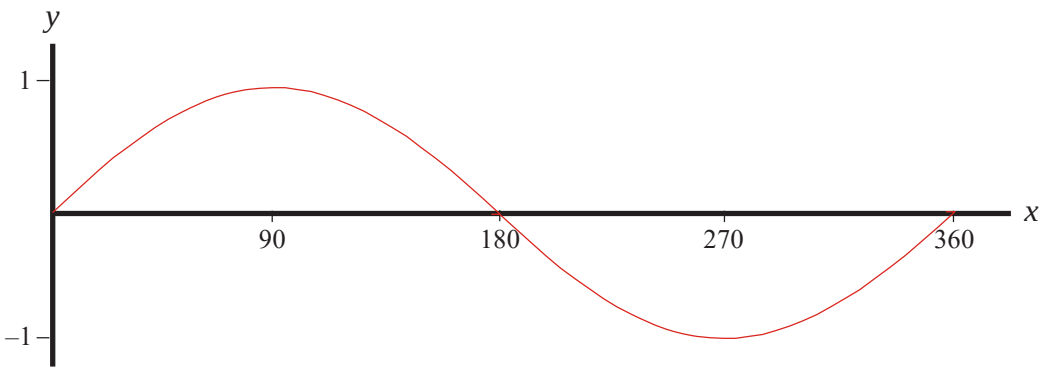
Given that cos 60° = 0.5, write down the value of:

(i) cos 120°

(ii) cos 240°

Trigonometric Graphs

1) On the axes below below, draw a sketch-graph to show $y = \sin x$

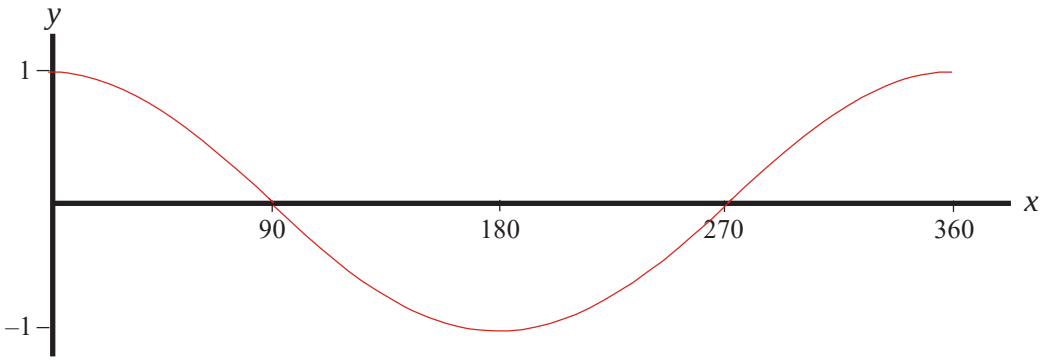


Given that sin 30° = 0.5, write down the value of:

(i) sin 150° 0.5

(ii) sin 330° -0.5

2) On the axes below, draw a sketch-graph to show $y = \cos x$



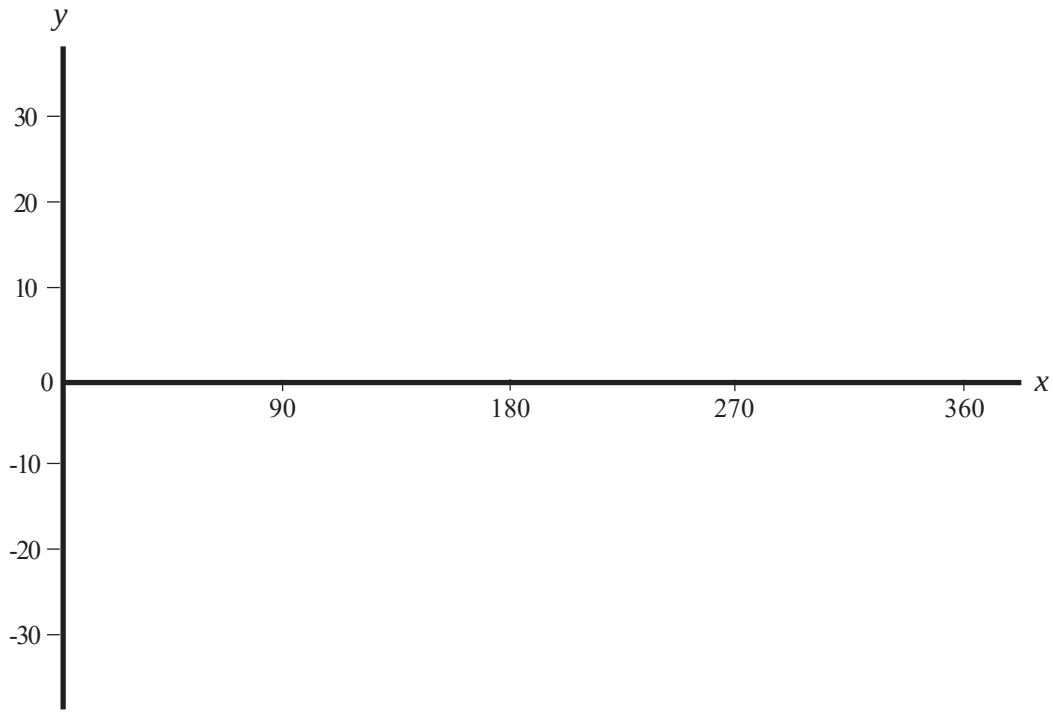
Given that cos 60° = 0.5, write down the value of:

(i) cos 120° -0.5

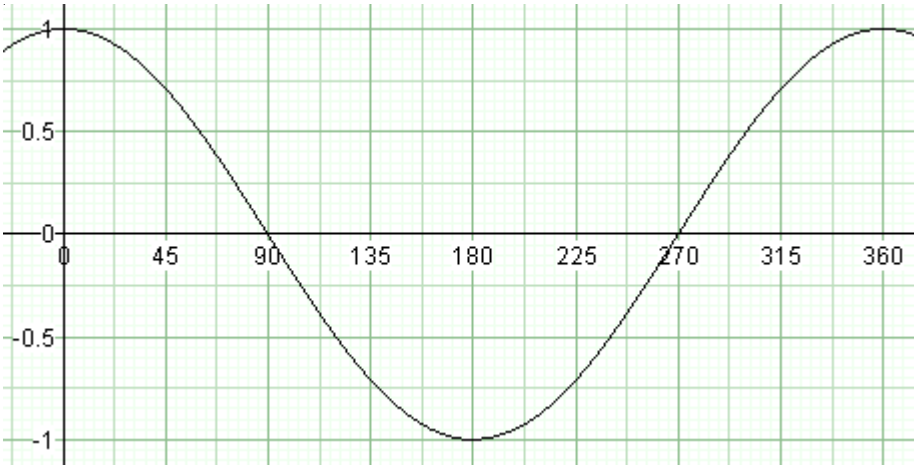
(ii) cos 240° -0.5

Trigonometric Graphs

1) On the axes below, draw a sketch-graph to show $y = \tan x$



2) Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360^\circ$.

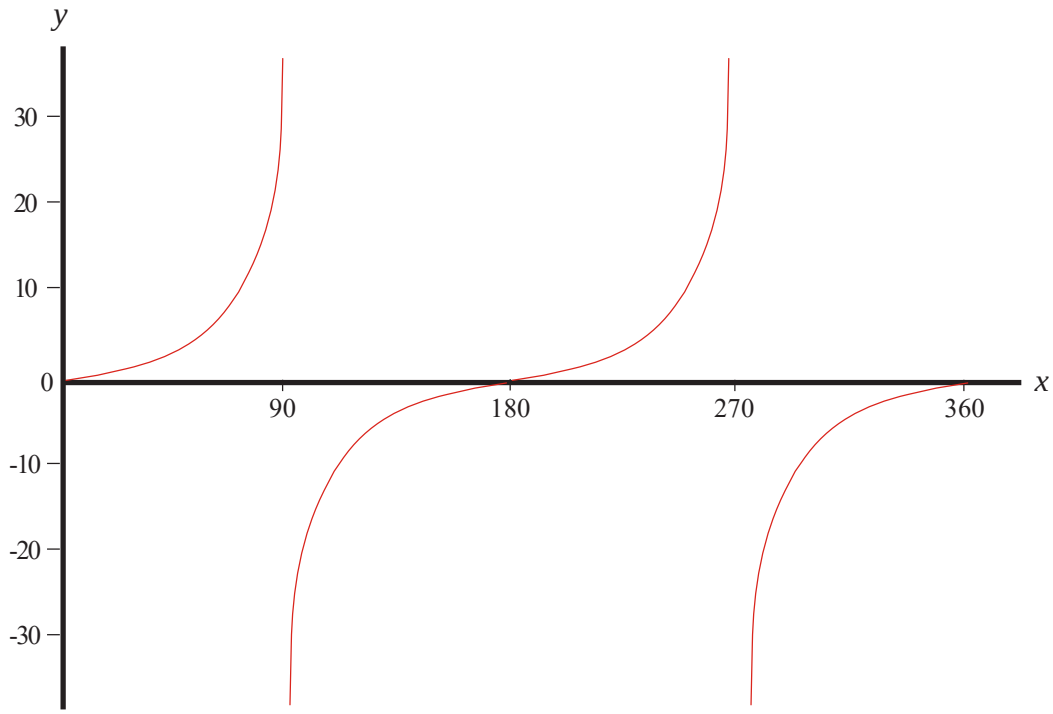


a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360^\circ$

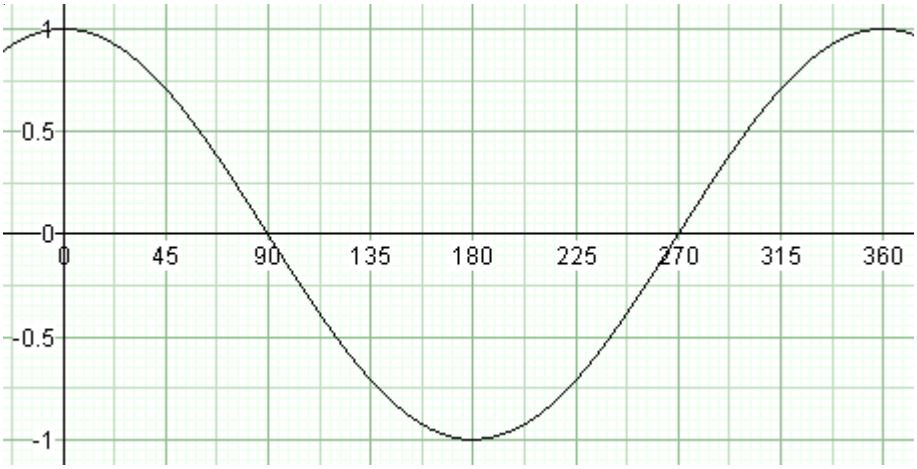
b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360^\circ$

Trigonometric Graphs

1) On the axes below, draw a sketch-graph to show $y = \tan x$



2) Here is the graph of the curve $y = \cos x$ for $0 \leqslant x \leqslant 360^\circ$.



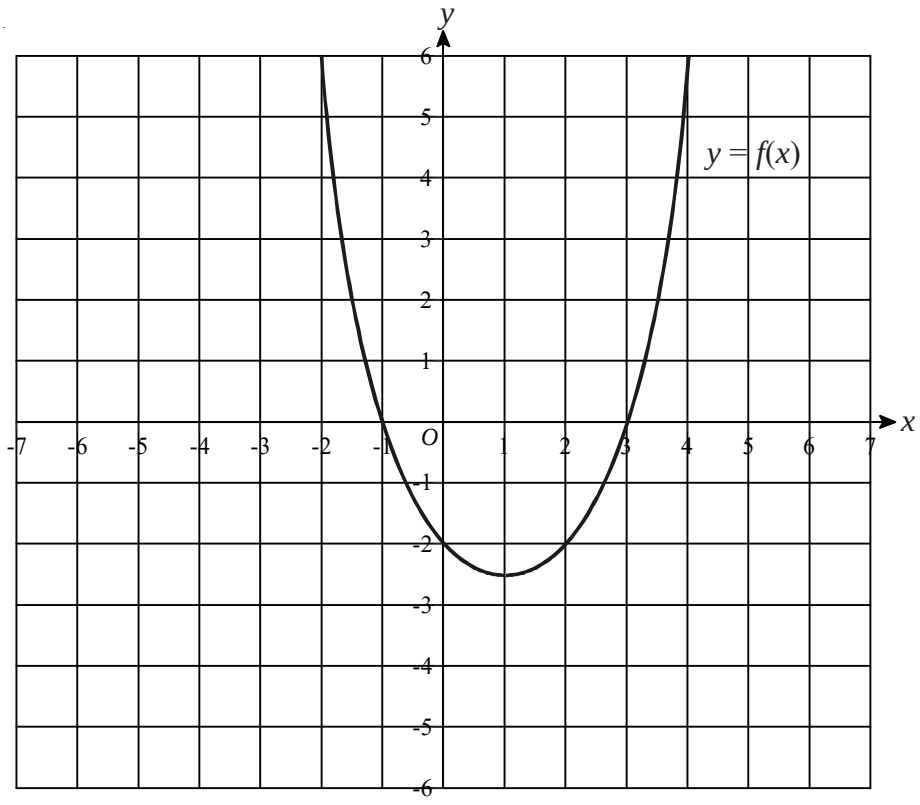
a) Use the graph to solve $\cos x = 0.75$ for $0 \leqslant x \leqslant 360^\circ$ $x = 42^\circ$ and 318°

b) Use the graph to solve $\cos x = -0.75$ for $0 \leqslant x \leqslant 360^\circ$ $x = 138^\circ$ and 222°

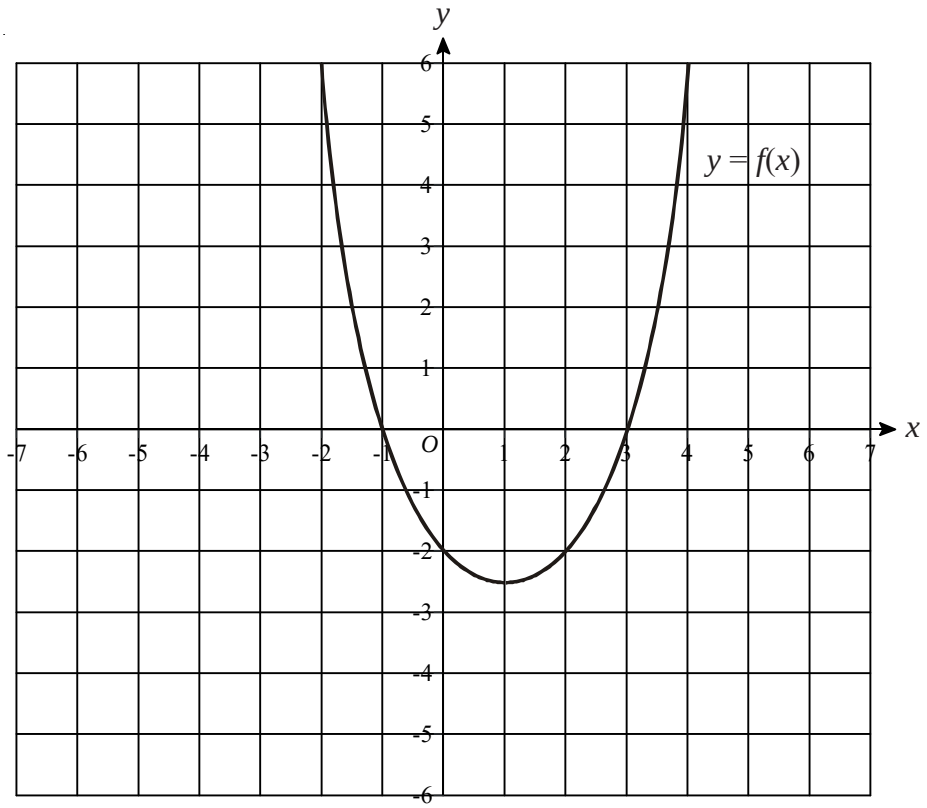
Transformation of Functions

1) The graph of $y = f(x)$ is shown on the grids.

a) On this grid, sketch the graph of $y = f(x - 3)$



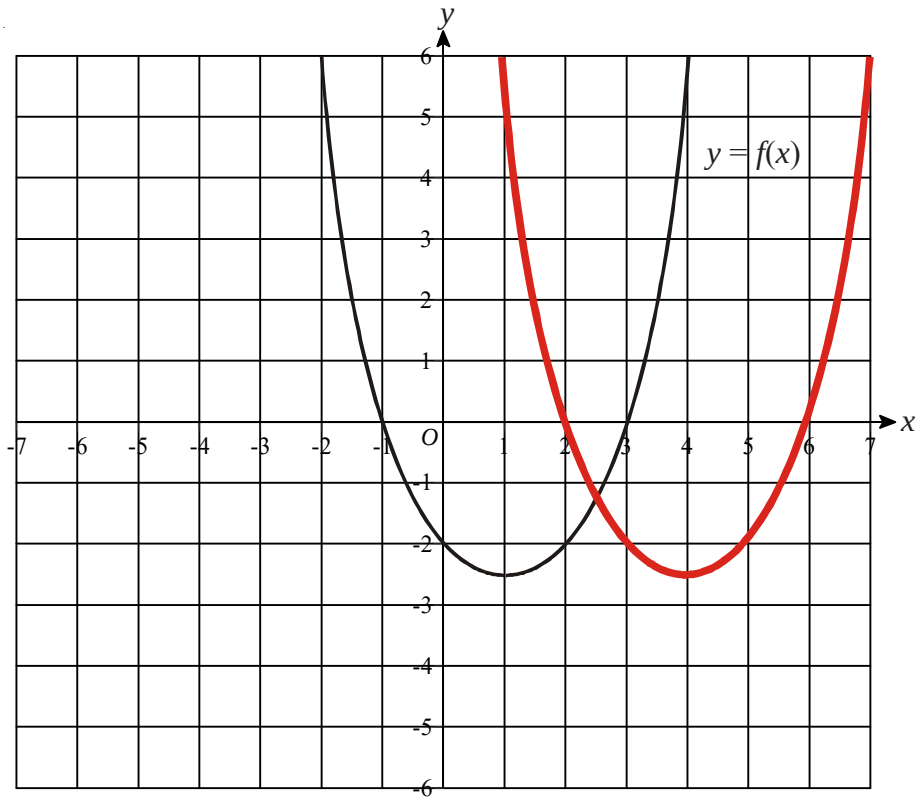
b) On this grid sketch the graph of $y = -f(x)$



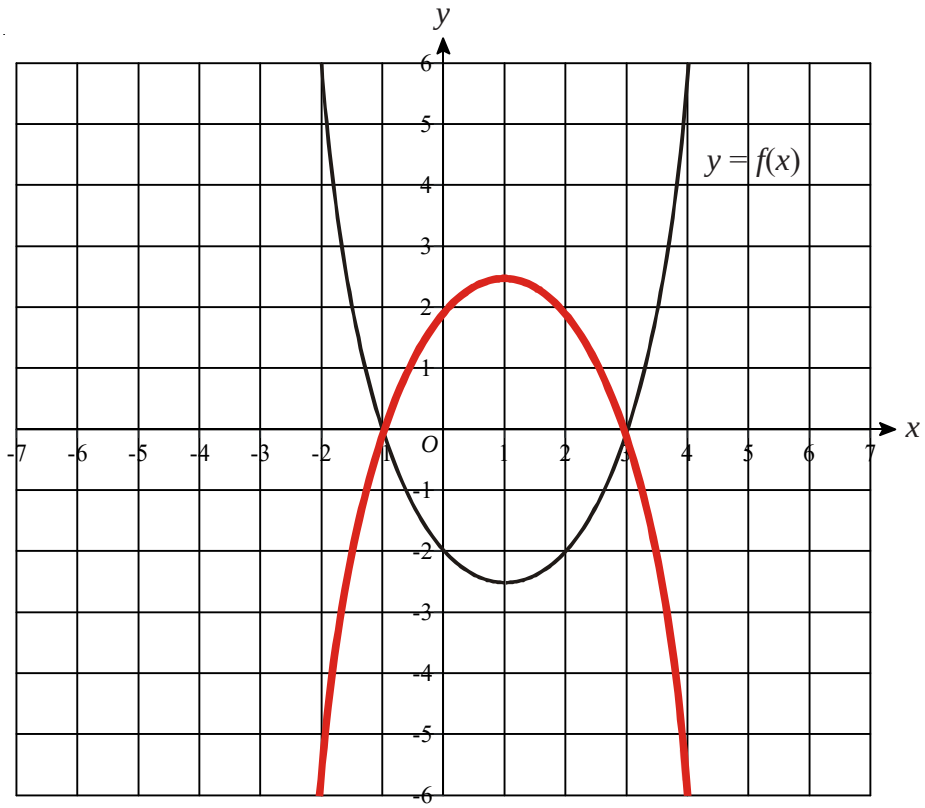
Transformation of Functions

1) The graph of $y = f(x)$ is shown on the grids.

a) On this grid, sketch the graph of $y = f(x - 3)$

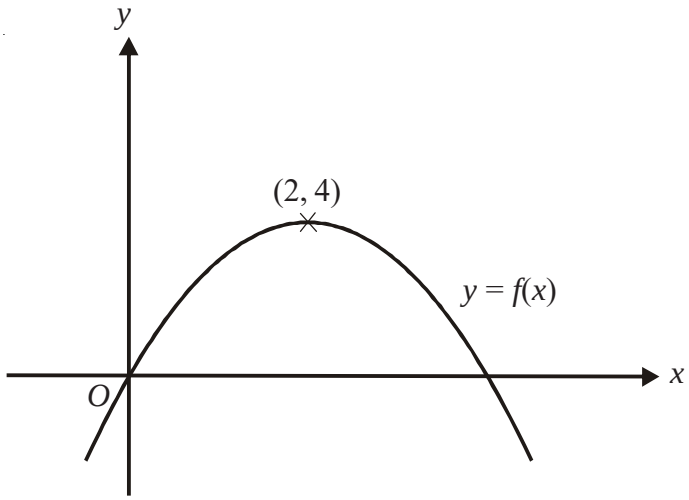


b) On this grid sketch the graph of $y = -f(x)$



Transformation of Functions

1)

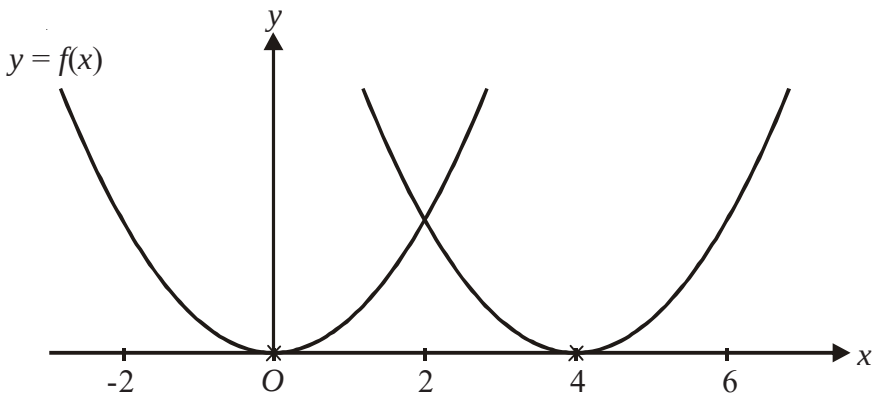


The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the maximum point of this curve are (2, 4).

Write down the coordinates of the maximum point of the curve with equation

$y = f(x - 2)$

2)

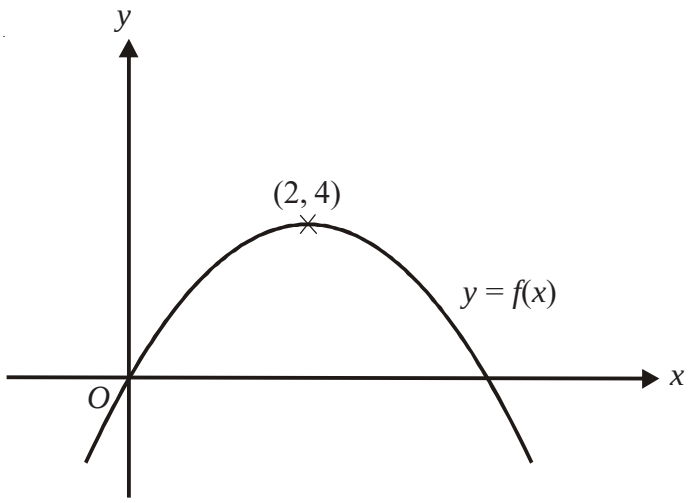


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

Find the equation of the translated curve.

Transformation of Functions

1)

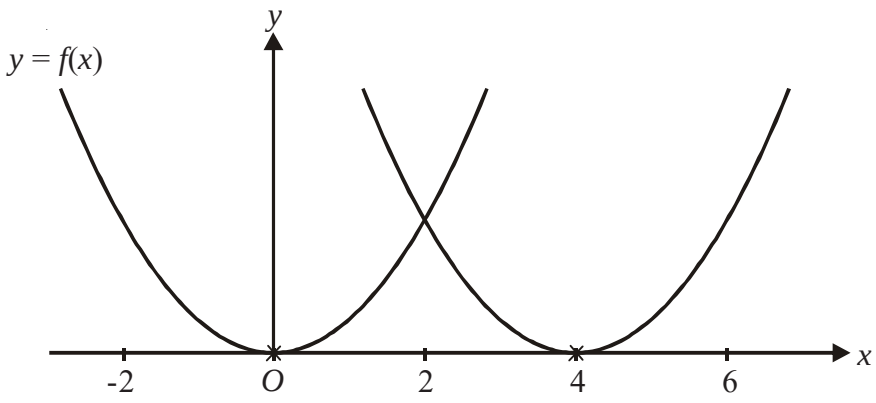


The diagram shows part of the curve with equation $y = f(x)$.
The coordinates of the maximum point of this curve are (2, 4).

Write down the coordinates of the maximum point of the curve with equation

$y = f(x - 2)$ (4, 4)

2)

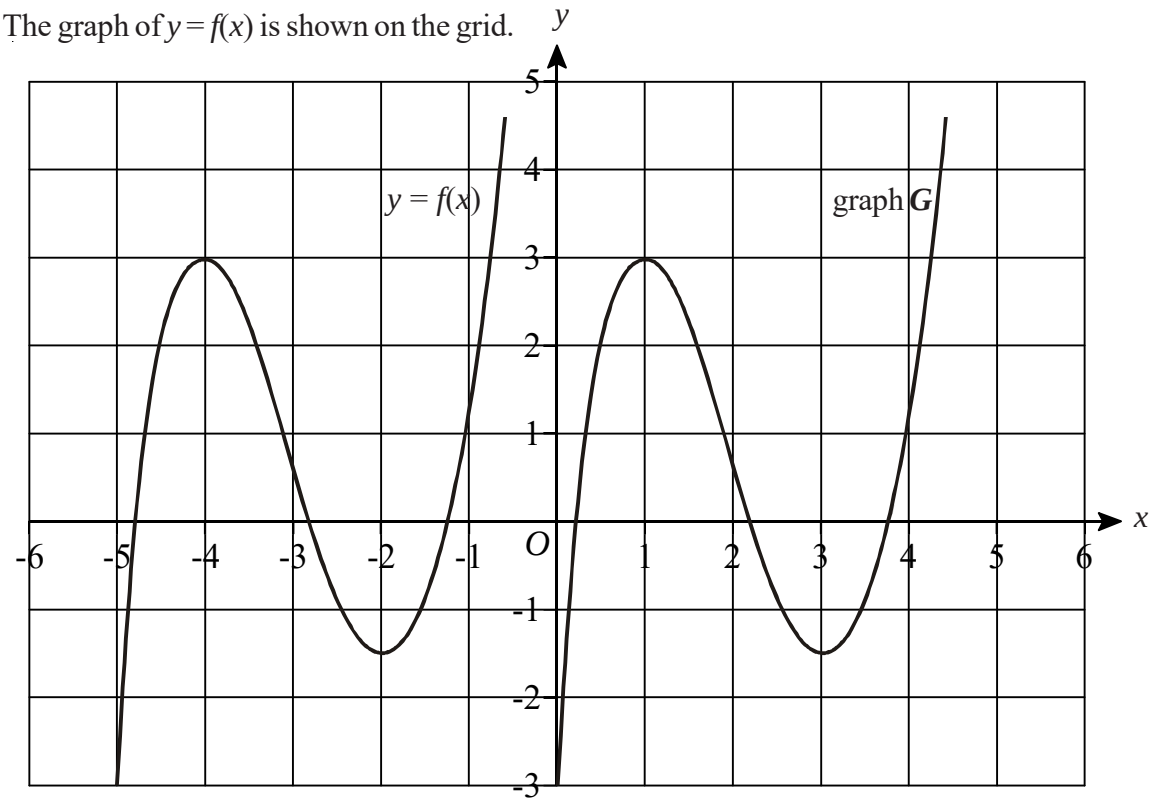


The curve with equation $y = f(x)$ is translated so that the point at (0, 0) is mapped onto the point (4, 0).

Find the equation of the translated curve. $y = f(x - 4)$

Transformation of Functions

1) The graph of $y = f(x)$ is shown on the grid.



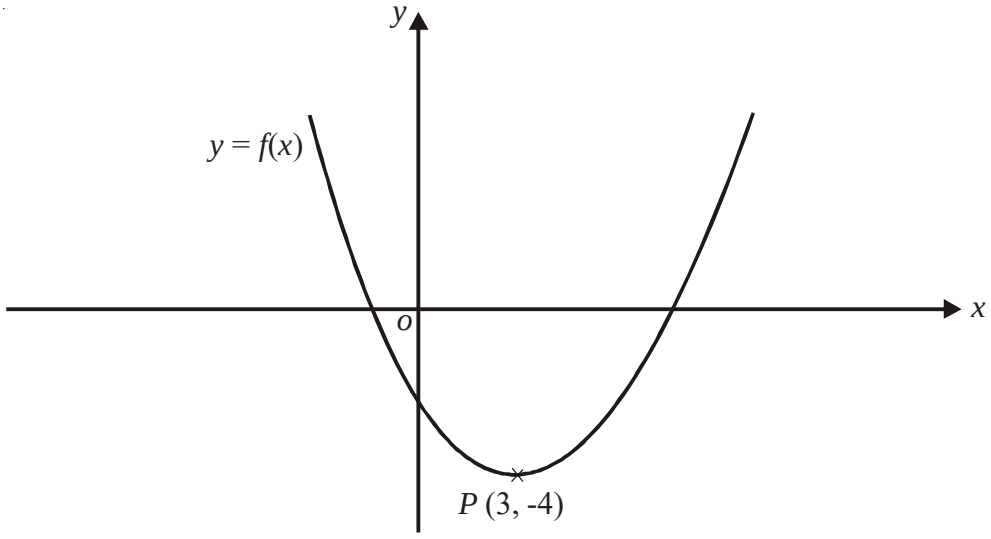
The graph ***G*** is a translation of the graph of $y = f(x)$.

a) Write down, in terms of f, the equation of graph ***G***.

The graph of $y = f(x)$ has a maximum point at (-4, 3).

b) Write down the coordinates of the maximum point of the graph $y = f(-x)$.

2) This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at P (3, -4).

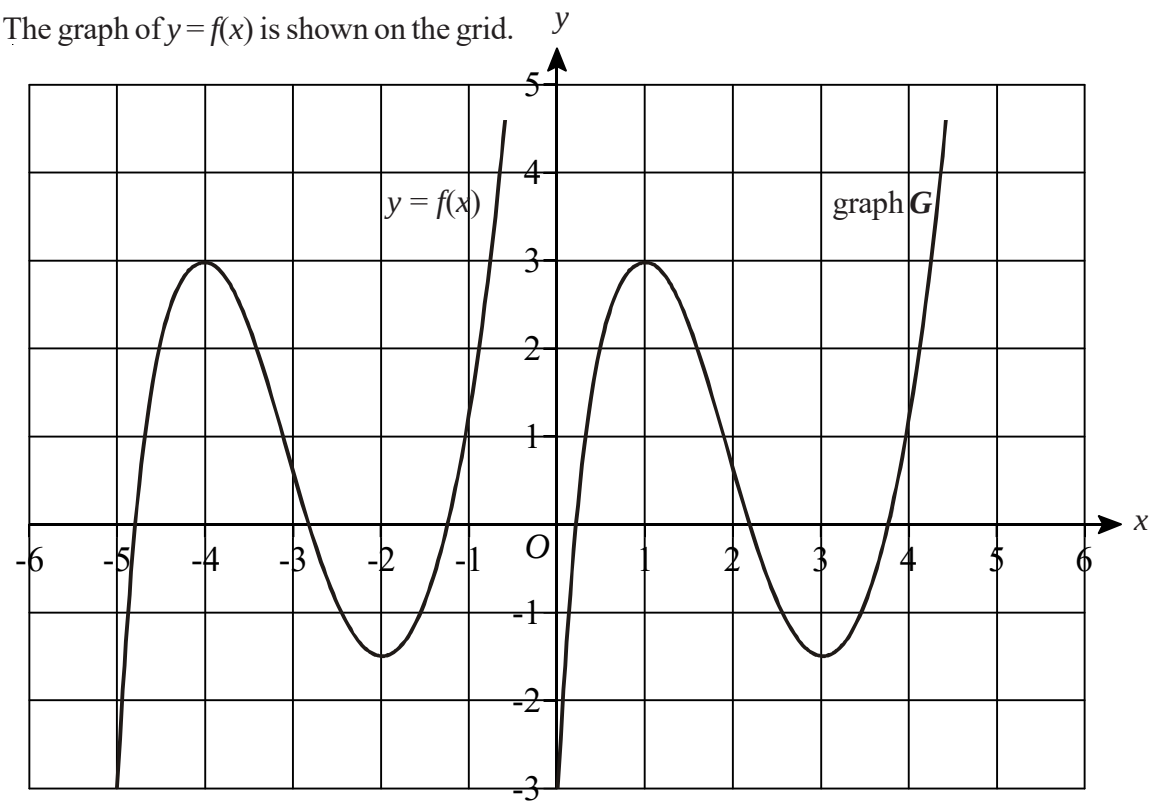


a) Write down the coordinates of the minimum point of the curve with the equation $y = f(x - 2)$

b) Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$

Transformation of Functions

1) The graph of $y = f(x)$ is shown on the grid.



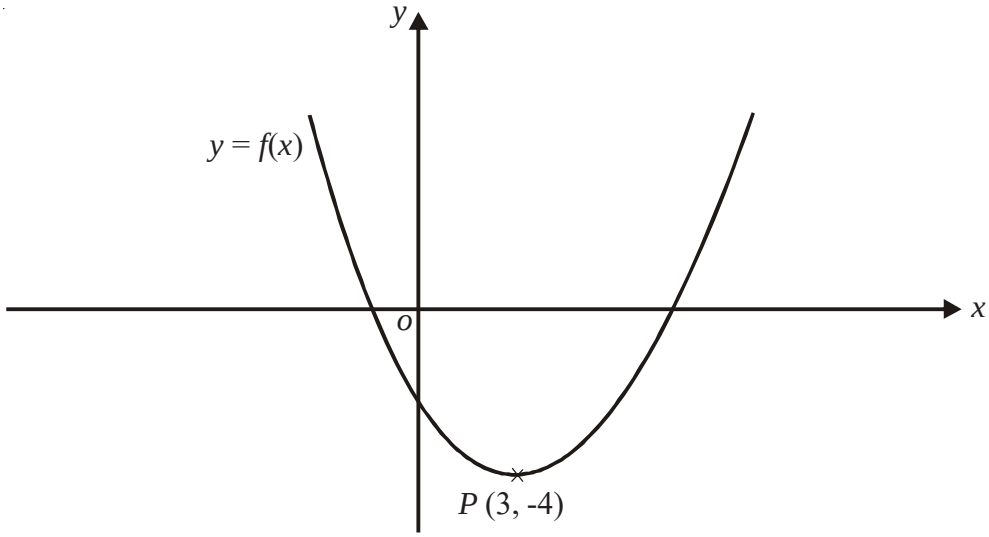
The graph **G** is a translation of the graph of $y = f(x)$.

a) Write down, in terms of f, the equation of graph **G**. $y = f(x - 5)$

The graph of $y = f(x)$ has a maximum point at (-4, 3).

b) Write down the coordinates of the maximum point of the graph $y = f(-x)$. (4, 3)

2) This is a sketch of the curve with the equation $y = f(x)$.
The only minimum point of the curve is at P (3, -4).

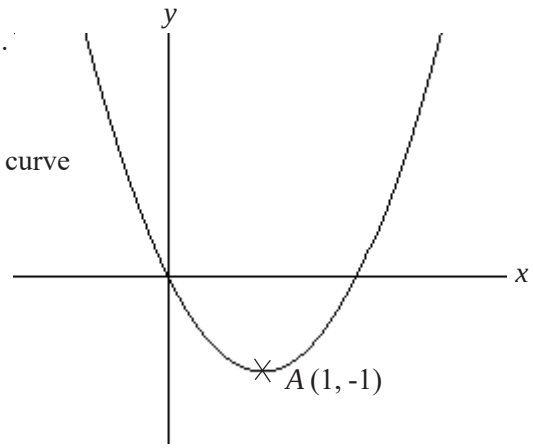


a) Write down the coordinates of the minimum point of the curve with the equation $y = f(x - 2)$ (5, -4)

b) Write down the coordinates of the minimum point of the curve with the equation $y = f(x + 5) + 6$ (-2, 2)

Transformation of Functions

1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.
The only vertex of the curve is at A (1, -1)

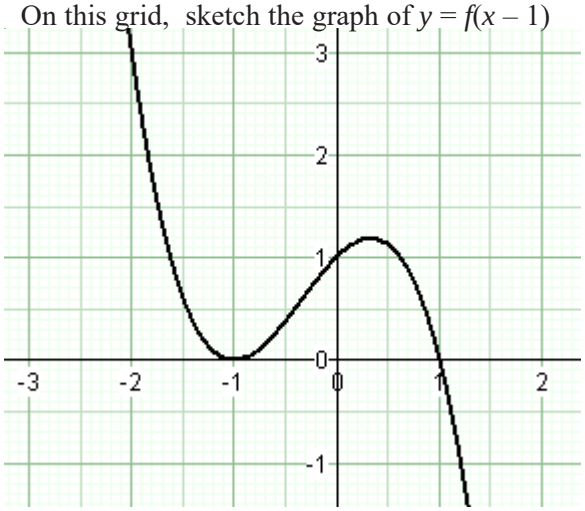


a) Write down the coordinates of the vertex of the curve with equation
(i) $y = f(x - 3)$
(ii) $y = f(x) - 5$
(iii) $y = -f(x)$

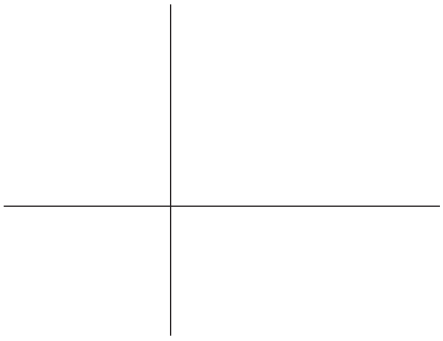
b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.
Find $f(x)$ in terms of x.

2) The graph of $y = f(x)$ is shown on the grids.

On this grid, sketch the graph of $y = f(x - 1)$

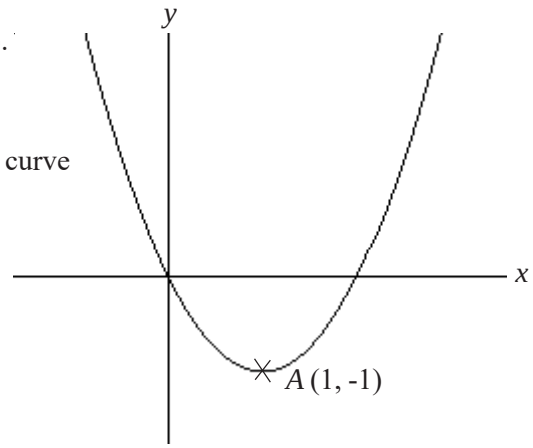


3) Sketch the graph of $y = (x - 2)^2 + 3$
State the coordinates of the vertex.



Transformation of Functions

1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.
The only vertex of the curve is at A (1, -1)



a) Write down the coordinates of the vertex of the curve with equation

(i) $y = f(x - 3)$ (4, -1)

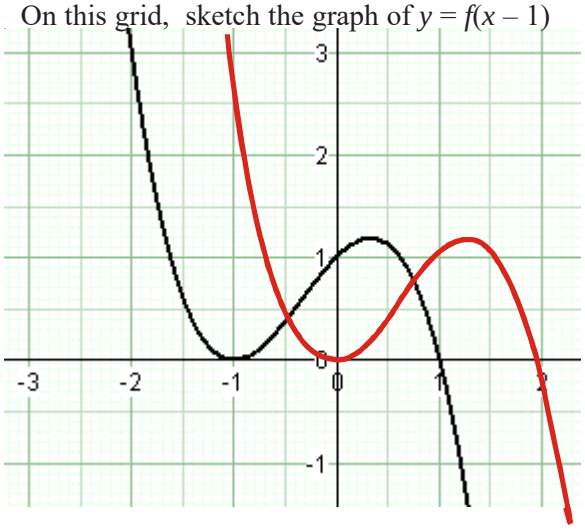
(ii) $y = f(x) - 5$ (1, -6)

(iii) $y = -f(x)$ (1, 1)

b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.
Find $f(x)$ in terms of x. $y = x^2 - 2x$

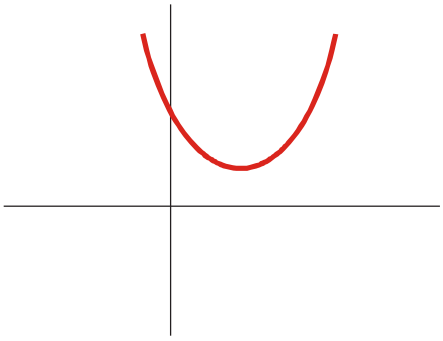
2) The graph of $y = f(x)$ is shown on the grids.

On this grid, sketch the graph of $y = f(x - 1)$



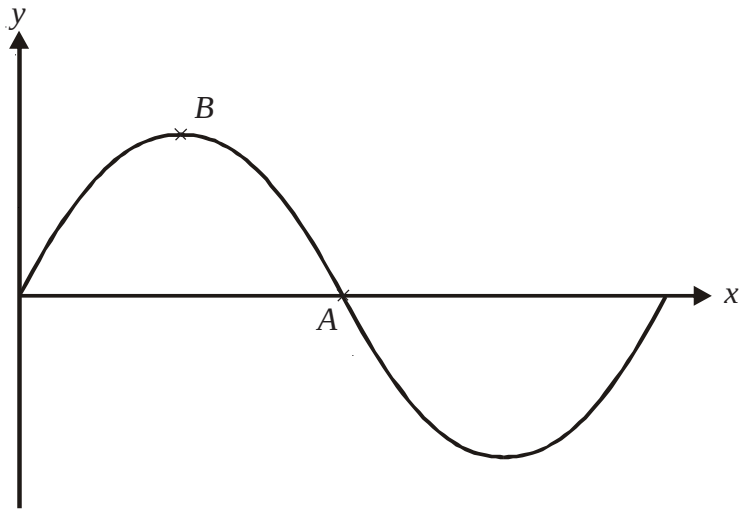
3) Sketch the graph of $y = (x - 2)^2 + 3$
State the coordinates of the vertex.

vertex is at (2, 3)



Transformation of Functions

1) The diagram below shows the graph of $y = 2\sin x$, for values of x between 0 and 360°.



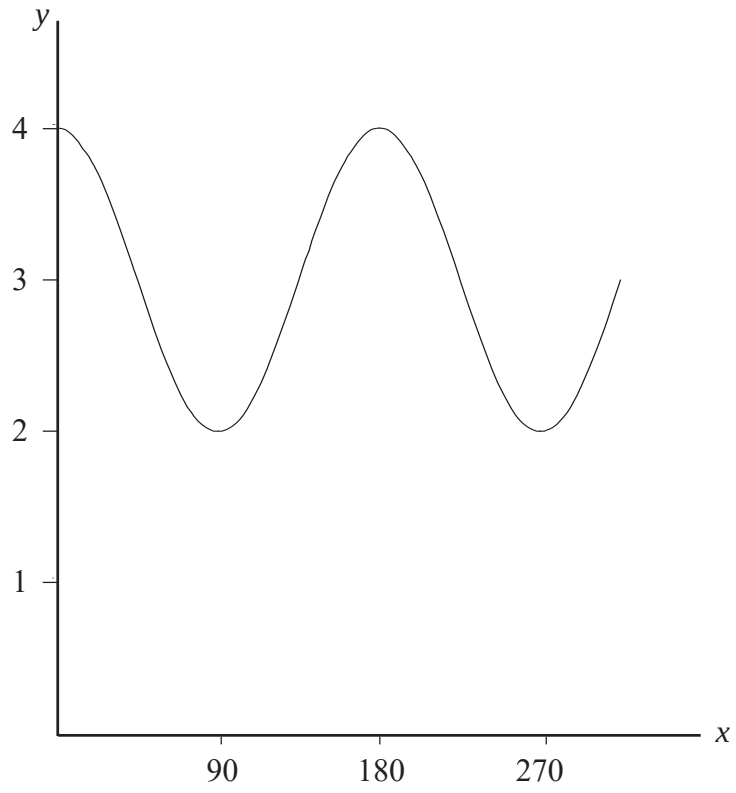
The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

a) (i) Write down the coordinates of A.
(ii) Write down the coordinates of B.

b) On the same diagram, sketch the graph of $y = 2\sin x + 1$ for values of x between 0° and 360°.

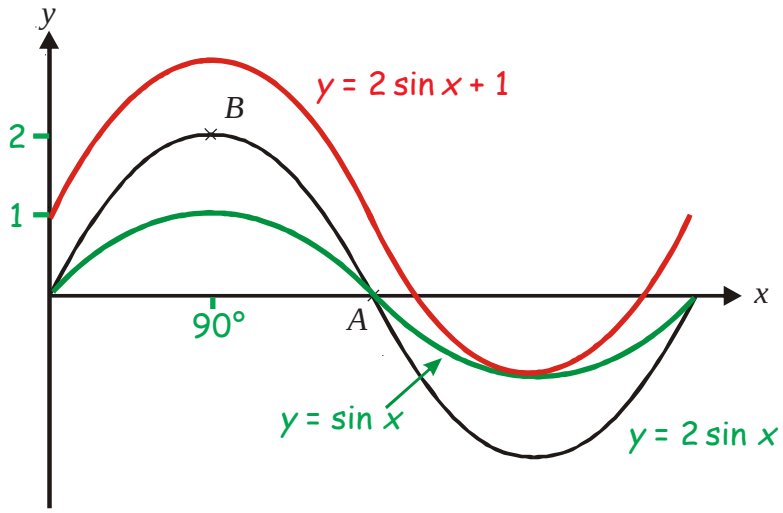
2) The diagram below shows the graph of $y = \cos \boldsymbol{a}x + \boldsymbol{b}$, for values of x between 0° and 300°.

Work out the values of $\boldsymbol{a}$ and $\boldsymbol{b}$.



Transformation of Functions

1) The diagram below shows the graph of $y = 2\sin x$, for values of x between 0 and 360°.



The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

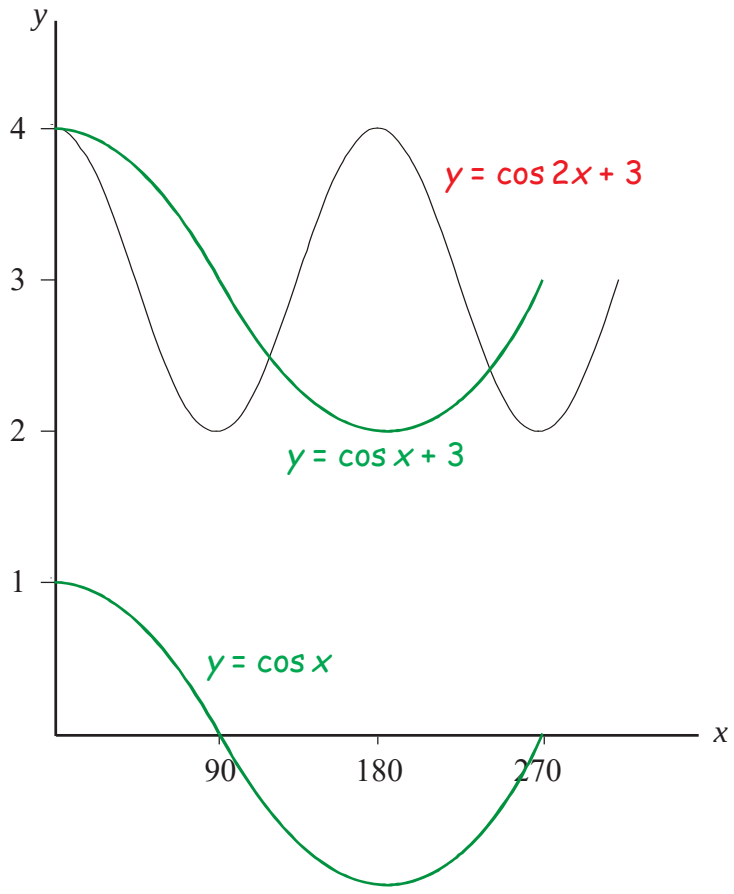
a) (i) Write down the coordinates of A. (180°, 0)

(ii) Write down the coordinates of B. (90°, 2)

b) On the same diagram, sketch the graph of $y = 2\sin x + 1$ for values of x between 0° and 360°.

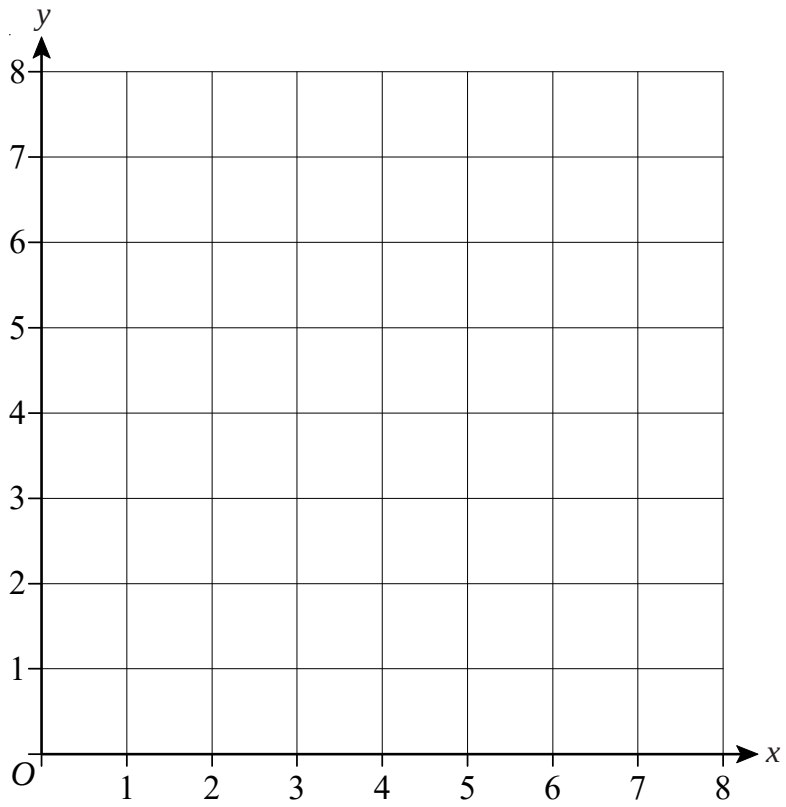
2) The diagram below shows the graph of $y = \cos \boldsymbol{a}x + \boldsymbol{b}$, for values of x between 0° and 300°.

Work out the values of $\boldsymbol{a}$ and $\boldsymbol{b}$. $a = 2$ $b = 3$

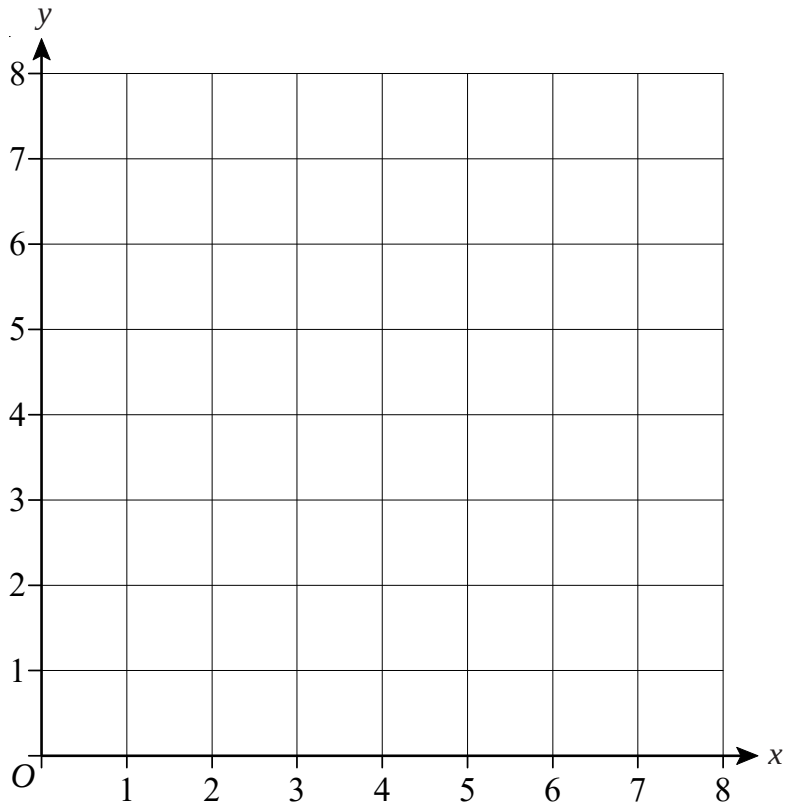


Regions

1) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $x \geqslant 1$ $y \geqslant x$ $x + y \leqslant 7$

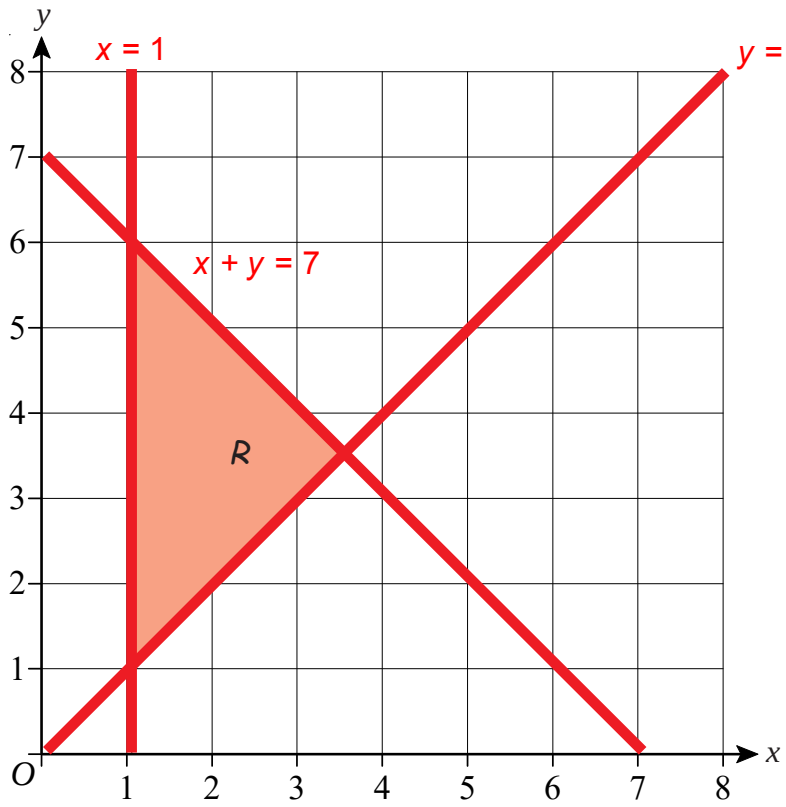


2) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $y \geqslant x + 1$ $y \leqslant 5$ $x \geqslant 1$

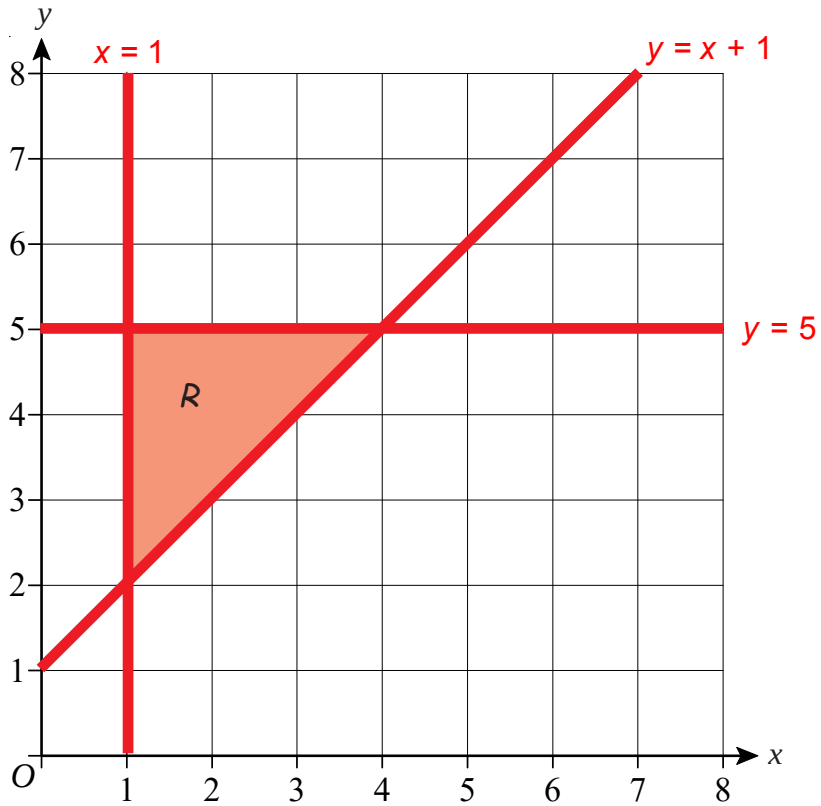


Regions

1) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $x \geqslant 1$ $y \geqslant x$ $x + y \leqslant 7$



2) On the grid below, draw straight lines and use shading to show the region ***R*** that satisfies the inequalities $y \geqslant x + 1$ $y \leqslant 5$ $x \geqslant 1$



Arithmetic Series

$u_n = a + (n-1)d$

$S_n = \frac{n}{2}[2a + (n-1)d]$

1) Here are the first five terms of an arithmetic sequence.

3 7 11 15 19

a) Find u_6

b) Find u_{21}

2) Here are the first five terms of an arithmetic sequence.

–1 5 11 17 23

a) Find u_6

b) Find u_{13}

3) Find the sum of the first 20 terms of each series below.

a) First term = 4 and common difference = 2

b) First term = 1 and common difference = 5

c) First term = –3 and common difference = 4

4) Here are the first five terms of an arithmetic sequence.

8 11 14 17 20

Work out the sum of the first 100 terms.

5) The first term of an arithmetic series is –3
The sum of the first 40 terms of the series is 6120

Find the 10th term of this series.

6) The third term of an arithmetic series is 5
The ninth term of the series is 17

Find the sum of the first 30 terms of this series.

7) The first term of an arithmetic series is 5
The sum of the fourth term and the fifth term is 52

a) Find the common difference.

b) Given that the last term of the series is 359, work out the number of terms in the series.

c) Find the sum of all the terms in the series.

Arithmetic Series

$u_n = a + (n-1)d$

$S_n = \frac{n}{2}[2a + (n-1)d]$

1) Here are the first five terms of an arithmetic sequence.

3 7 11 15 19

a) Find u_6 23

b) Find u_{21} 83

2) Here are the first five terms of an arithmetic sequence.

–1 5 11 17 23

a) Find u_6 29

b) Find u_{13} 71

3) Find the sum of the first 20 terms of each series below.

a) First term = 4 and common difference = 2 460

b) First term = 1 and common difference = 5 970

c) First term = –3 and common difference = 4 700

4) Here are the first five terms of an arithmetic sequence.

8 11 14 17 20

Work out the sum of the first 100 terms. 15650

5) The first term of an arithmetic series is –3
The sum of the first 40 terms of the series is 6120

Find the 10th term of this series. 69

6) The third term of an arithmetic series is 5
The ninth term of the series is 17

Find the sum of the first 30 terms of this series. 900

7) The first term of an arithmetic series is 5
The sum of the fourth term and the fifth term is 52

a) Find the common difference. 6

b) Given that the last term of the series is 359, work out the number of terms in the series. 60

c) Find the sum of all the terms in the series. 10920

Differentiation - Introduction

1) Differentiate.

a) $y = 2x$ b) $y = x^3$ c) $y = 6$ d) $y = x^5$

2) For each of the following, find $\frac{dy}{dx}$.

a) $y = 7x^2$ b) $y = 2x^3$ c) $y = 0.5x^4$ d) $y = \frac{1}{4}x^8$

3) Differentiate the following with respect to x.

a) $y = 2x^9$ b) $y = -3x^5$ c) $y = 0.2x^{10}$ d) $y = -\frac{1}{2}x^{12}$

4) Find $\frac{dy}{dx}$ for each of the following.

a) $y = x^3 + x^2 - x$ b) $y = 5x^2 - 2x$ c) $y = 4x^2 + 3x - 2$

d) $y = 4x^3 + 6$ e) $y = x^4 - 3x^2$ f) $y = x^3 - 4x^5$

5) Find $\frac{dy}{dx}$ for each of the following.

a) $y = \frac{1}{2}x^4 + 3x^2$ b) $y = \frac{1}{2}x^6 + x^5 - \frac{1}{4}x^4$

c) $y = \frac{2}{3}x^3 + 5x^2 - 6x + 1$ d) $y = \frac{x^3 + 6x^2 + x}{3}$

6) Differentiate the following with respect to x.

a) $y = (x + 3)(x + 2)$ b) $y = (x - 1)(x - 4)$

c) $y = 4x^3(x^2 + 5)$ d) $y = (2x - 3)^2$

Differentiation - Introduction

1) Differentiate.

a) $y = 2x$ $\frac{dy}{dx} = 2$ b) $y = x^3$ $\frac{dy}{dx} = 3x^2$ c) $y = 6$ $\frac{dy}{dx} = 0$ d) $y = x^5$ $\frac{dy}{dx} = 5x^4$

2) For each of the following, find $\frac{dy}{dx}$.

a) $y = 7x^2$ $\frac{dy}{dx} = 14x$ b) $y = 2x^3$ $\frac{dy}{dx} = 6x^2$ c) $y = 0.5x^4$ $\frac{dy}{dx} = 2x^3$ d) $y = \frac{1}{4}x^8$ $\frac{dy}{dx} = 2x^7$

3) Differentiate the following with respect to x.

a) $y = 2x^9$ $\frac{dy}{dx} = 18x^8$ b) $y = -3x^5$ $\frac{dy}{dx} = -15x^4$ c) $y = 0.2x^{10}$ $\frac{dy}{dx} = 5x^9$ d) $y = -\frac{1}{2}x^{12}$ $\frac{dy}{dx} = -6x^{11}$

4) Find $\frac{dy}{dx}$ for each of the following.

a) $y = x^3 + x^2 - x$ $\frac{dy}{dx} = 3x^2 + 2x - 1$

b) $y = 5x^2 - 2x$ $\frac{dy}{dx} = 10x - 2$

c) $y = 4x^2 + 3x - 2$ $\frac{dy}{dx} = 8x + 3$

d) $y = 4x^3 + 6$ $\frac{dy}{dx} = 12x^2$

e) $y = x^4 - 3x^2$ $\frac{dy}{dx} = 4x^3 - 6x$

f) $y = x^3 - 4x^5$ $\frac{dy}{dx} = 3x^2 - 20x^4$

5) Find $\frac{dy}{dx}$ for each of the following.

a) $y = \frac{1}{2}x^4 + 3x^2$ $\frac{dy}{dx} = 2x^3 + 6x$

b) $y = \frac{1}{2}x^6 + x^5 - \frac{1}{4}x^4$ $\frac{dy}{dx} = 3x^5 + 5x^4 - x^3$

c) $y = \frac{2}{3}x^3 + 5x^2 - 6x + 1$ $\frac{dy}{dx} = 2x^2 + 10x - 6$

d) $y = \frac{x^3 + 6x^2 + x}{3}$ $\frac{dy}{dx} = x^2 + 4x + \frac{1}{3}$

6) Differentiate the following with respect to x.

a) $y = (x + 3)(x + 2)$ $\frac{dy}{dx} = 2x + 5$

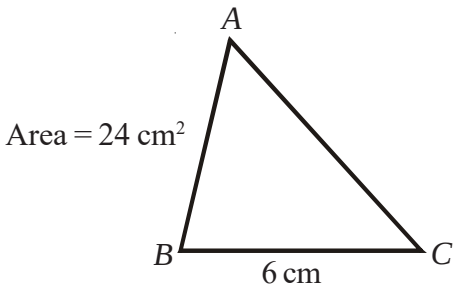
b) $y = (x - 1)(x - 4)$ $\frac{dy}{dx} = 2x - 5$

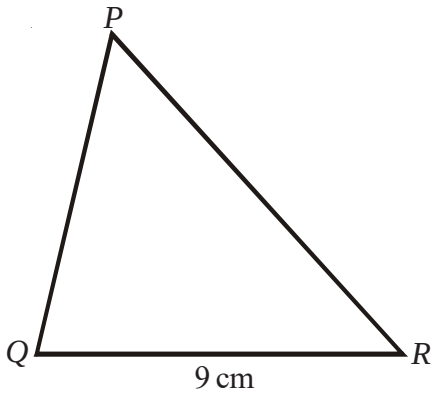
c) $y = 4x^3(x^2 + 5)$ $\frac{dy}{dx} = 20x^4 + 60x^2$

d) $y = (2x - 3)^2$ $\frac{dy}{dx} = 8x - 12$

Similarity - Area and Volume

1) Triangle *ABC* is similar to triangle *PQR*.

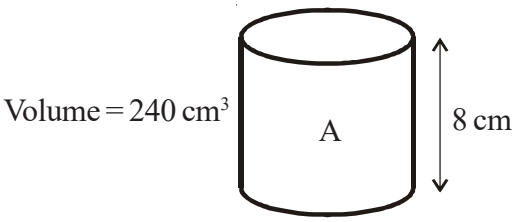


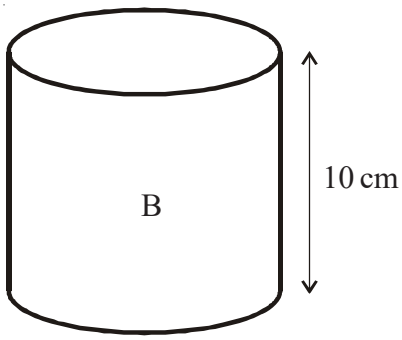


The area of triangle *ABC* is 24 cm².

Calculate the area of triangle *PQR*.

2) Cylinder A is mathematically similar to cylinder B.





The volume of cylinder A is 240 cm³

Calculate the volume of cylinder B.

3) P and Q are two geometrically similar solid shapes.

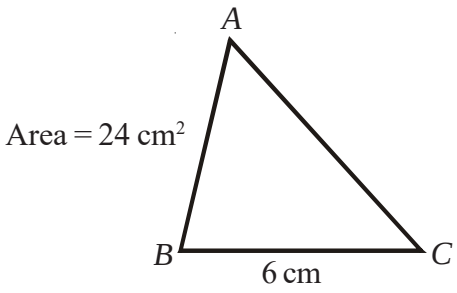
The total surface area of shape P is 540 cm².
The total surface area of shape Q is 2160 cm².

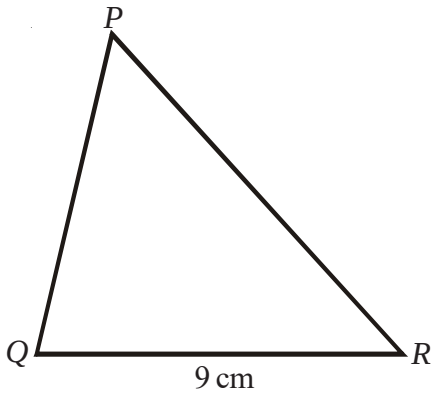
The volume of shape P is 2700 cm³.

Calculate the volume of shape Q.

Similarity - Area and Volume

1) Triangle *ABC* is similar to triangle *PQR*.

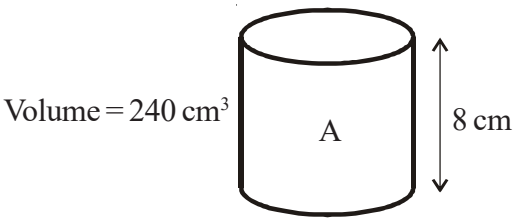


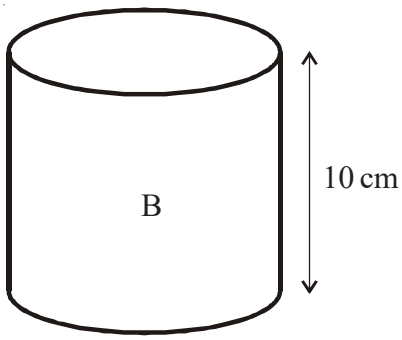


The area of triangle *ABC* is 24 cm².

Calculate the area of triangle *PQR*. 54 cm²

2) Cylinder A is mathematically similar to cylinder B.





The volume of cylinder A is 240 cm³

Calculate the volume of cylinder B. 468.75 cm³

3) P and Q are two geometrically similar solid shapes.

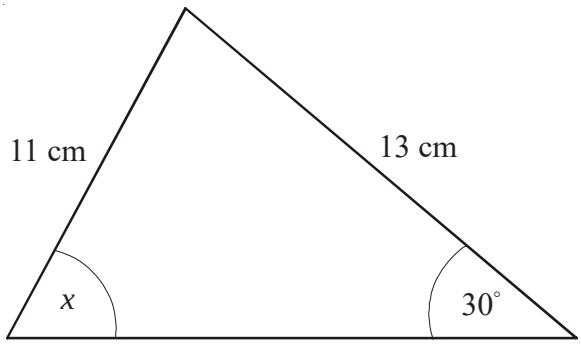
The total surface area of shape P is 540 cm².
The total surface area of shape Q is 2160 cm².

The volume of shape P is 2700 cm³.

Calculate the volume of shape Q. 21600 cm³

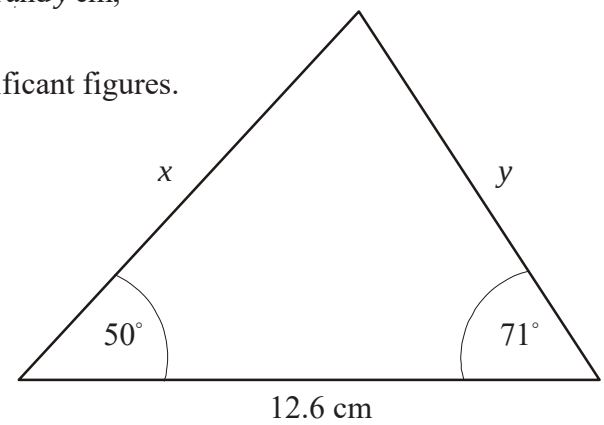
The Sine Rule

1) Work out the size of the angle marked x.
Give your answer correct to one decimal place.



2) Find the missing lengths, x cm and y cm, in this triangle.

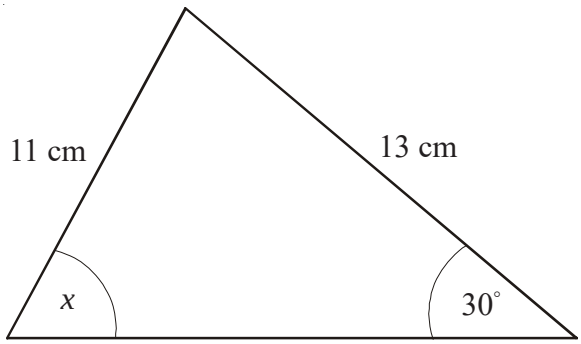
Give your answers to 3 significant figures.



The Sine Rule

1) Work out the size of the angle marked x.
Give your answer correct to one decimal place.

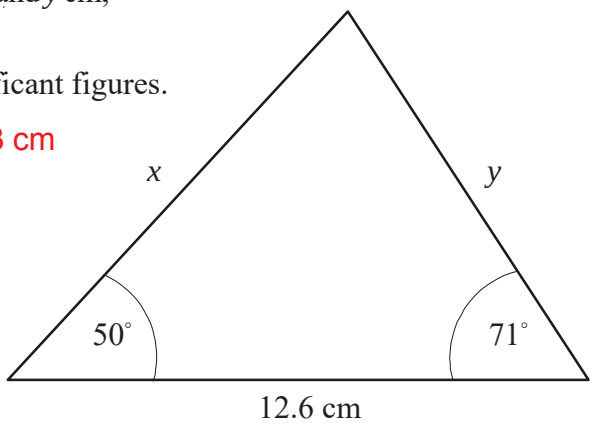
36.2°



2) Find the missing lengths, x cm and y cm, in this triangle.

Give your answers to 3 significant figures.

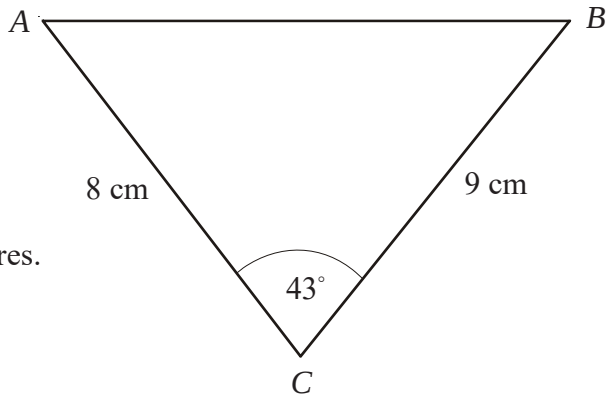
x = 13.9 cm y = 11.3 cm



The Cosine Rule

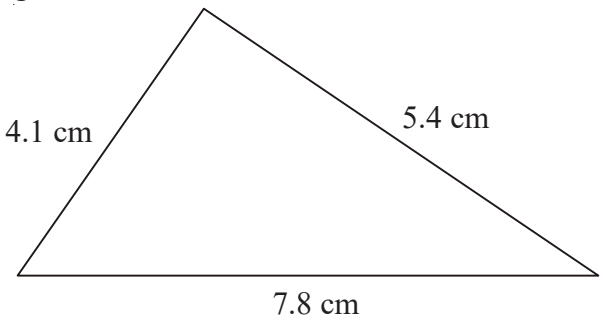
1) *ABC* is a triangle.
AC = 8 cm
BC = 9 cm
Angle *ACB* = 43°

Calculate the length of *AB*.
Give your answer correct to 3 significant figures.

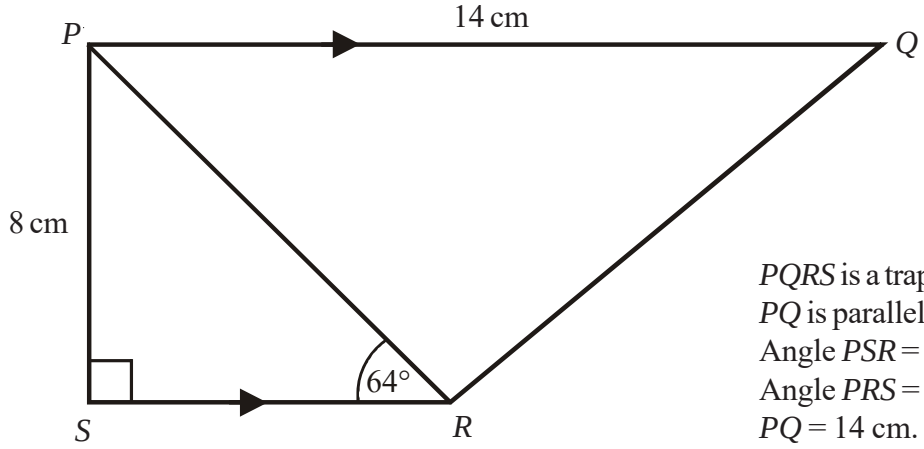


2) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.



3)



PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

a) Work out the length of *PR*.
Give your answer correct to 3 significant figures.

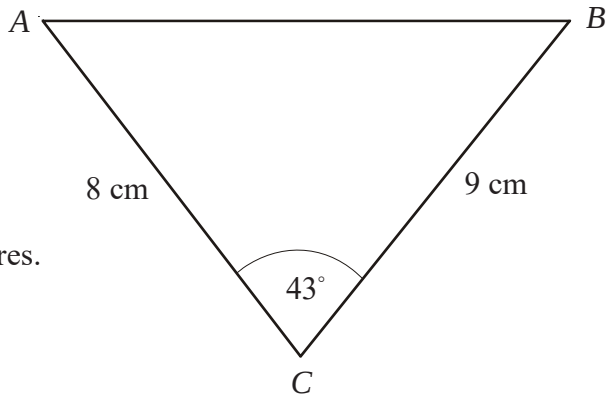
b) Work out the length of *QR*.
Give your answer correct to 3 significant figures.

The Cosine Rule

1) *ABC* is a triangle.
AC = 8 cm
BC = 9 cm
Angle *ACB* = 43°

Calculate the length of *AB*.
Give your answer correct to 3 significant figures.

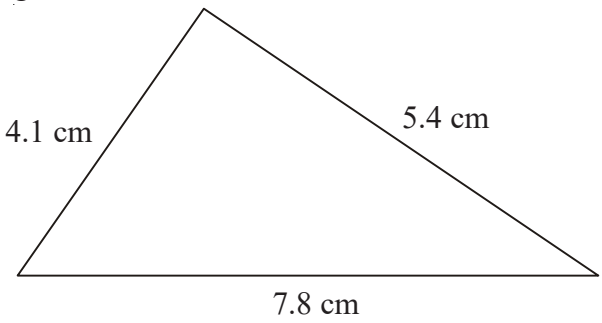
6.30 cm



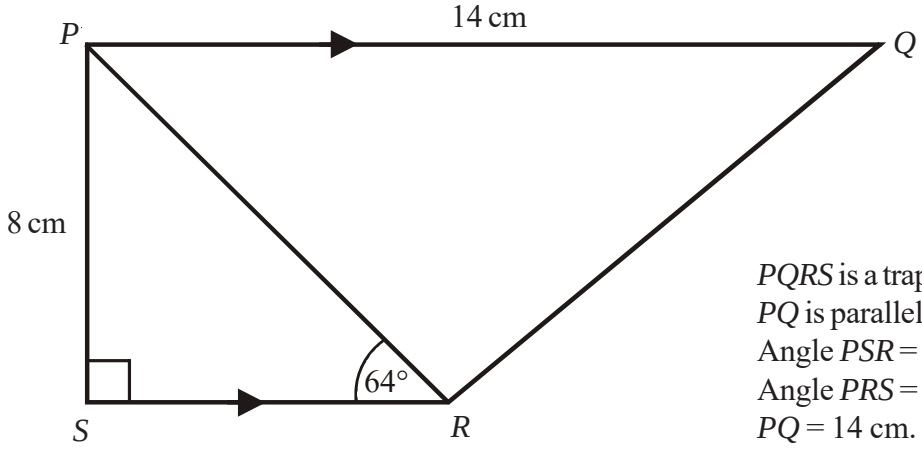
2) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.

109.6°



3)



PQRS is a trapezium.
PQ is parallel to *SR*.
Angle *PSR* = 90°
Angle *PRS* = 64°
PQ = 14 cm.
PS = 8 cm.

a) Work out the length of *PR*.
Give your answer correct to 3 significant figures. 8.90 cm

b) Work out the length of *QR*.
Give your answer correct to 3 significant figures. 12.9 cm

Area of a Triangle Using Sine

1)

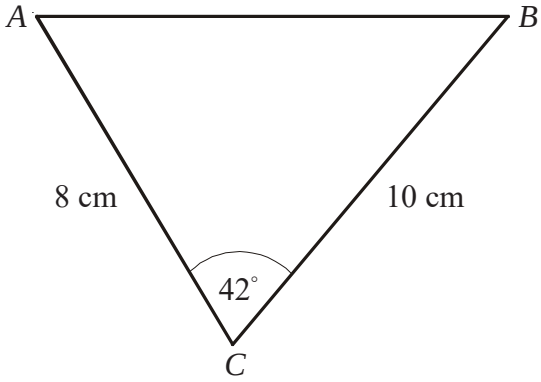


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

2)

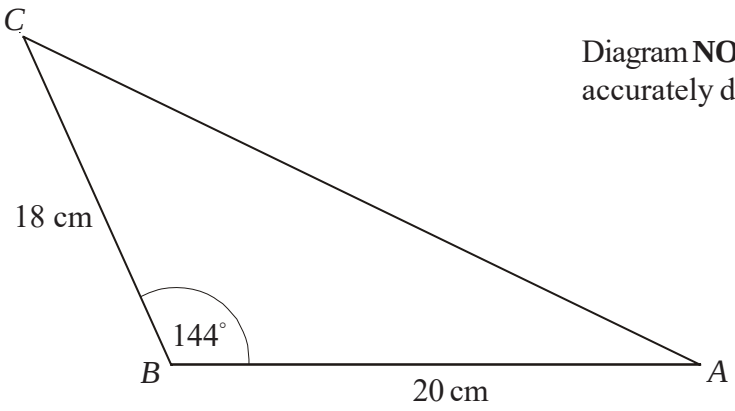


Diagram **NOT** accurately drawn.

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

3)

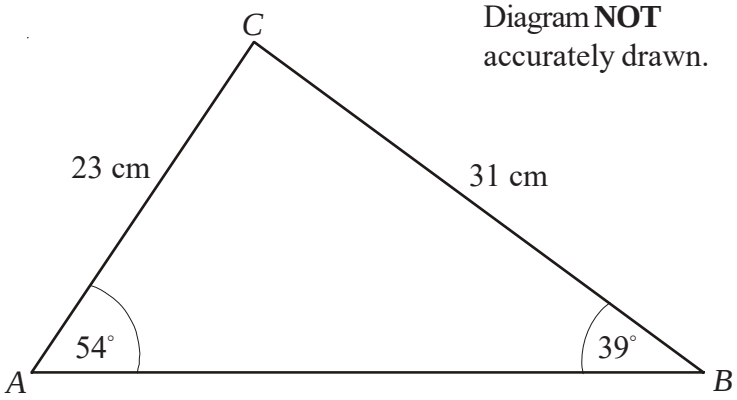


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures.

Area of a Triangle Using Sine

1)

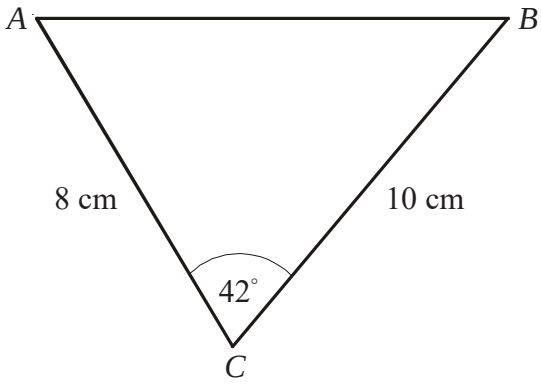


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 8 cm.
BC = 10 cm
Angle *ACB* = 42°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures. 26.8 cm²

2)

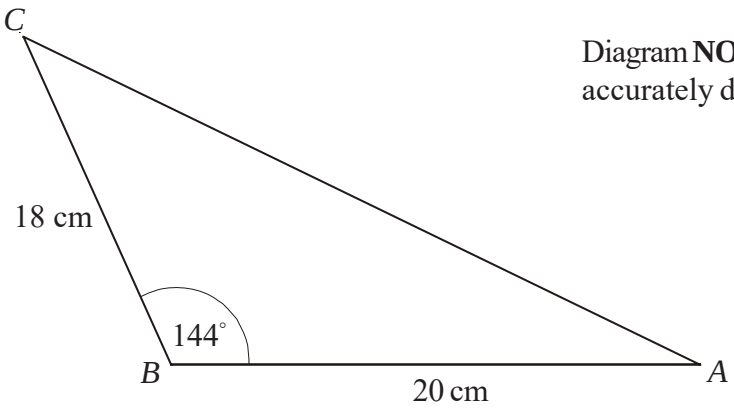


Diagram **NOT** accurately drawn.

ABC is a triangle.
AB = 20 cm.
BC = 18 cm
Angle *ABC* = 144°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures. 106 cm²

3)

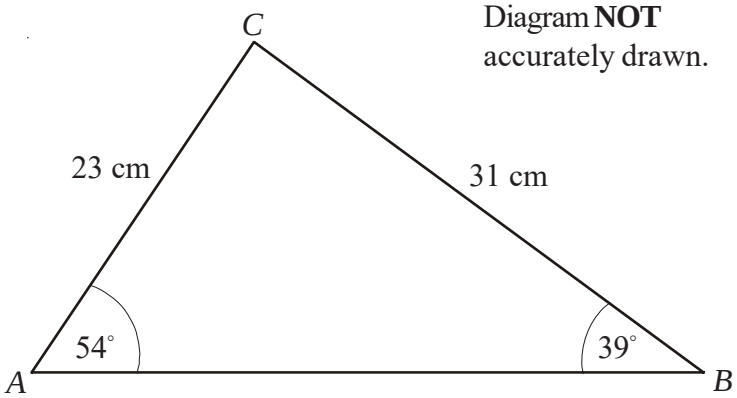


Diagram **NOT** accurately drawn.

ABC is a triangle.
AC = 23 cm.
BC = 31 cm
Angle *BAC* = 54°
Angle *ABC* = 39°

Calculate the area of triangle *ABC*.
Give your answer correct to 3 significant figures. 356 cm²

And and Or Probability Questions

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour.

2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2015 **and** Christmas day 2016.

b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015 **or** Christmas Day 2016, but **not** on both.

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour.

And and Or Probability Questions

1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour. $\frac{18}{64}$

2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2015 **and** Christmas day 2016. 0.0036

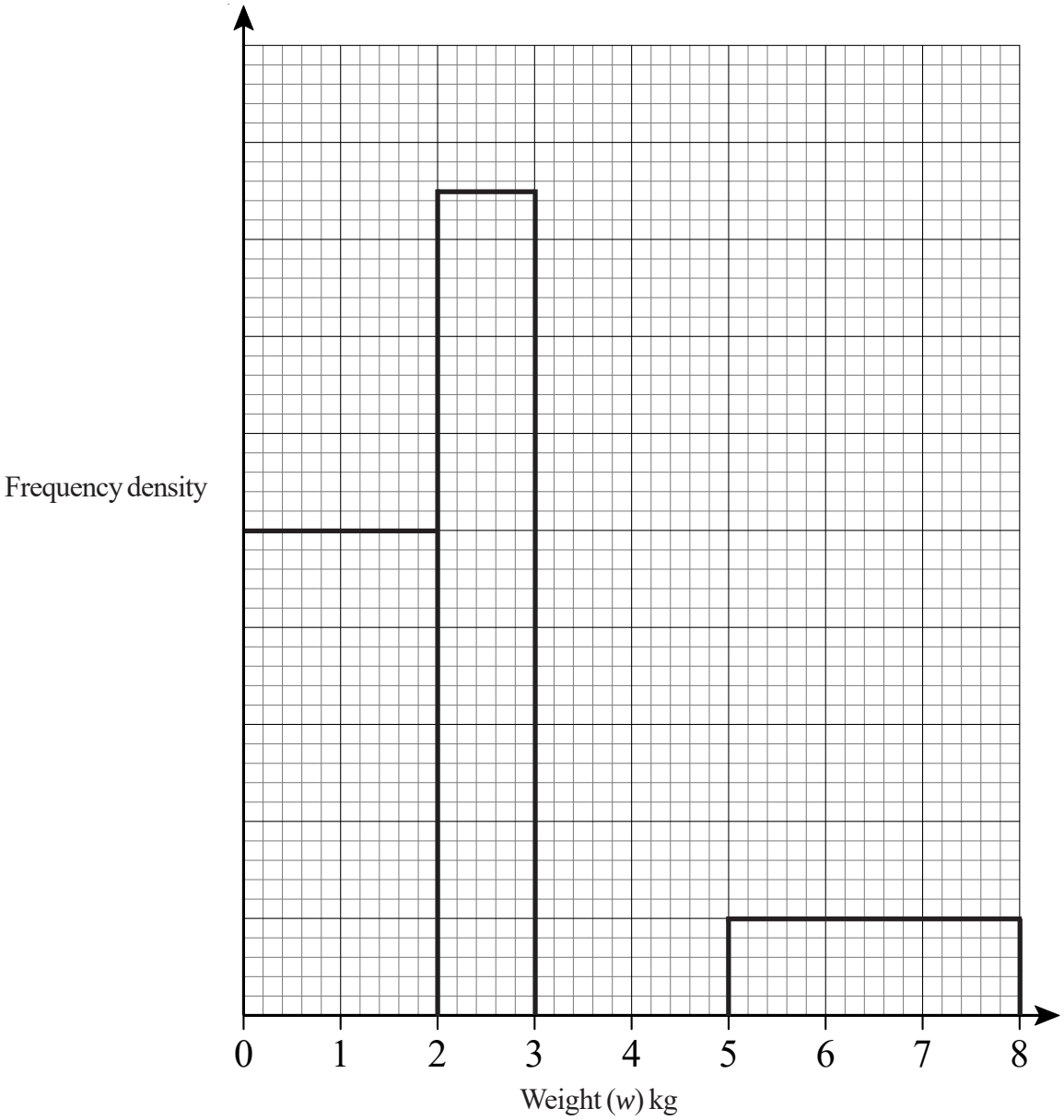
b) Work out the probability that it will snow in Paris on **either** Christmas Day 2015 **or** Christmas Day 2016, but **not** on both. 0.1128

3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour. $\frac{660}{1000}$

Histograms

The table and histogram give some information about the weights of parcels received at a post office during one Thursday.



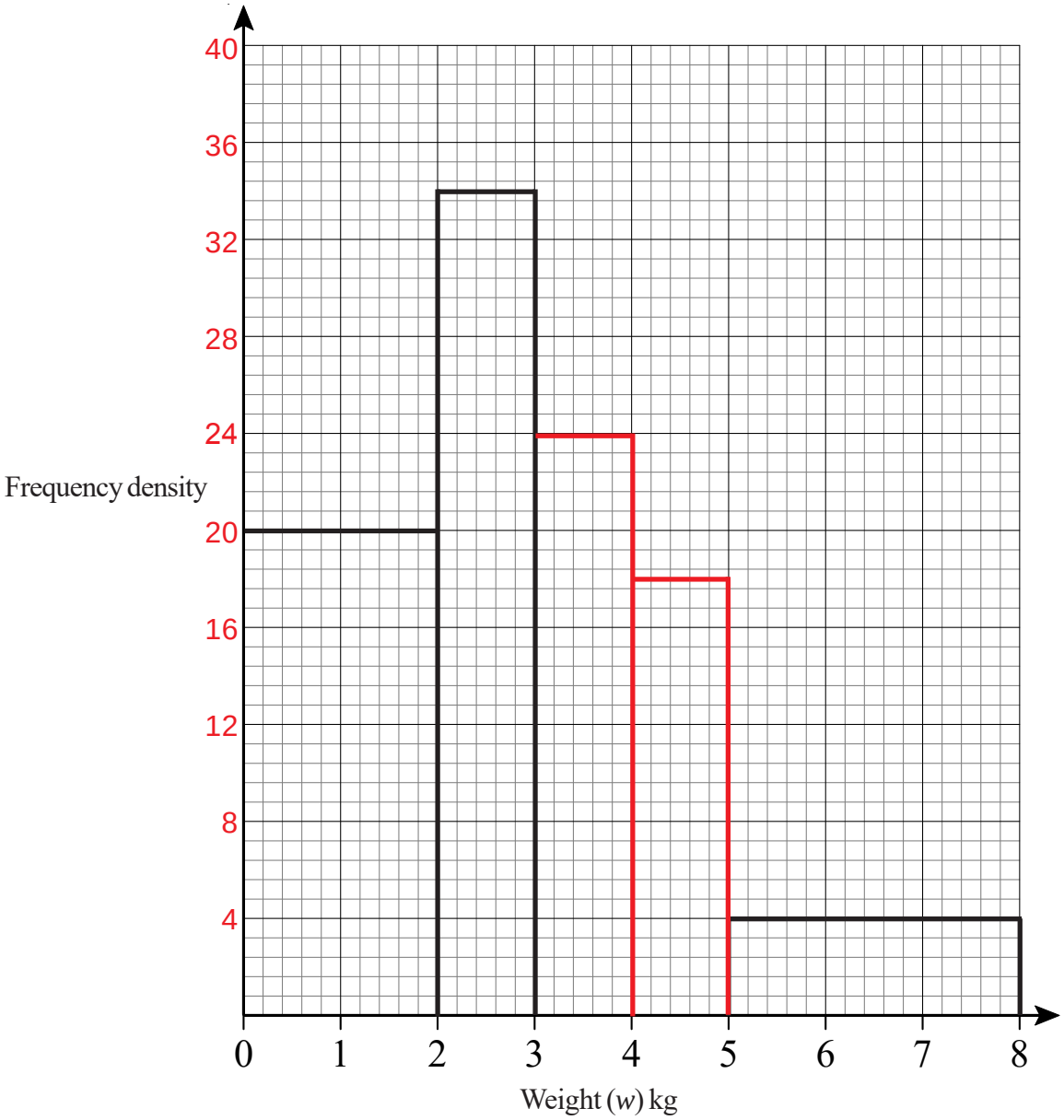
a) Use the histogram to complete the frequency table.

Weight (w) kg	Frequency
$0 < w \leqslant 2$	40
$2 < w \leqslant 3$	
$3 < w \leqslant 4$	24
$4 < w \leqslant 5$	18
$5 < w \leqslant 8$	

b) Use the table to complete the histogram.

Histograms

The table and histogram give some information about the weights of parcels received at a post office during one Thursday.



a) Use the histogram to complete the frequency table.

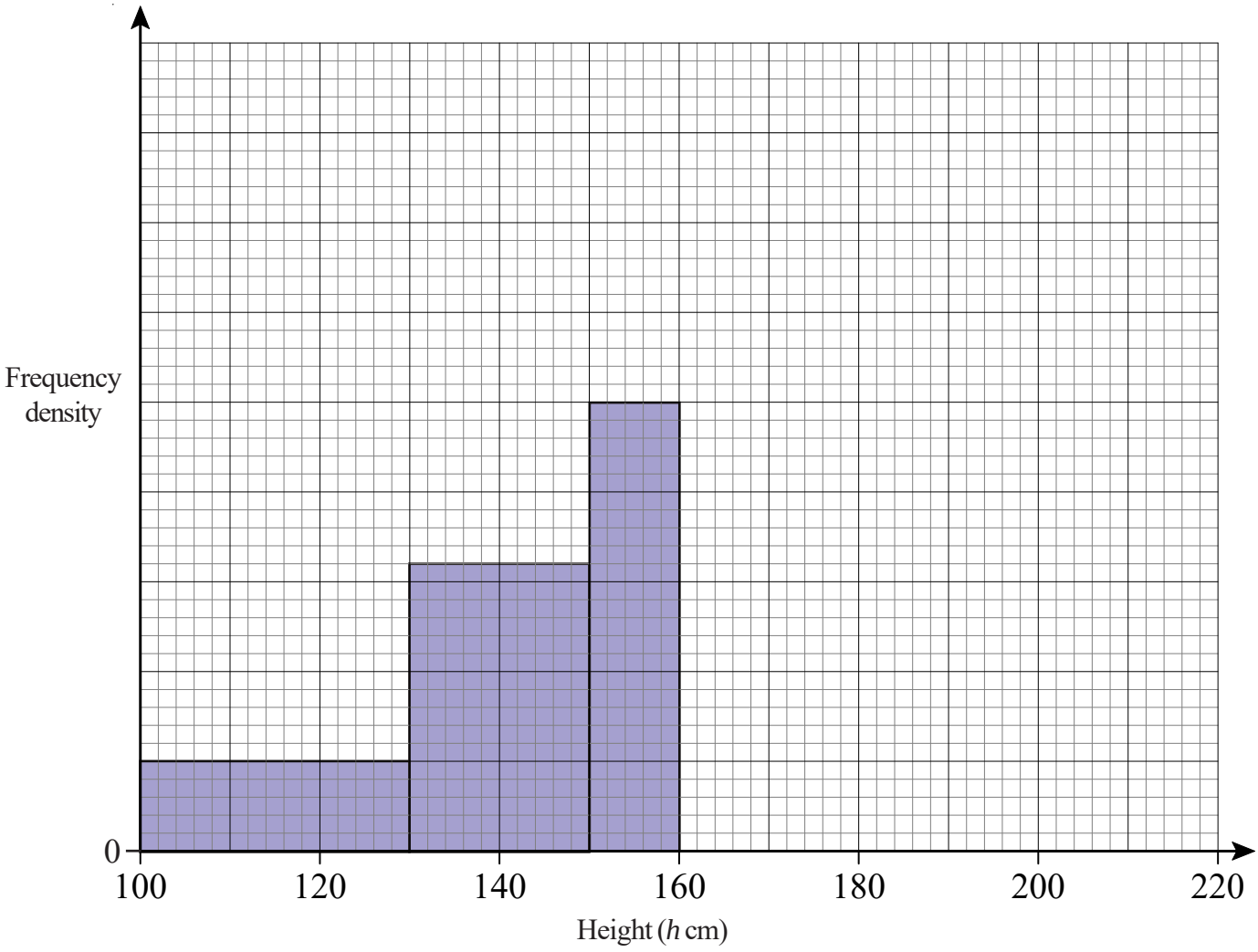
Weight (w) kg	Frequency
$0 < w \leqslant 2$	40
$2 < w \leqslant 3$	34
$3 < w \leqslant 4$	24
$4 < w \leqslant 5$	18
$5 < w \leqslant 8$	12

b) Use the table to complete the histogram.

Histograms

The incomplete table and histogram give some information about the heights (in cm) of some plants.

Height (h cm)	Frequency
$100 < h \leqslant 130$	30
$130 < h \leqslant 150$	
$150 < h \leqslant 160$	
$160 < h \leqslant 180$	40
$180 < h \leqslant 210$	18



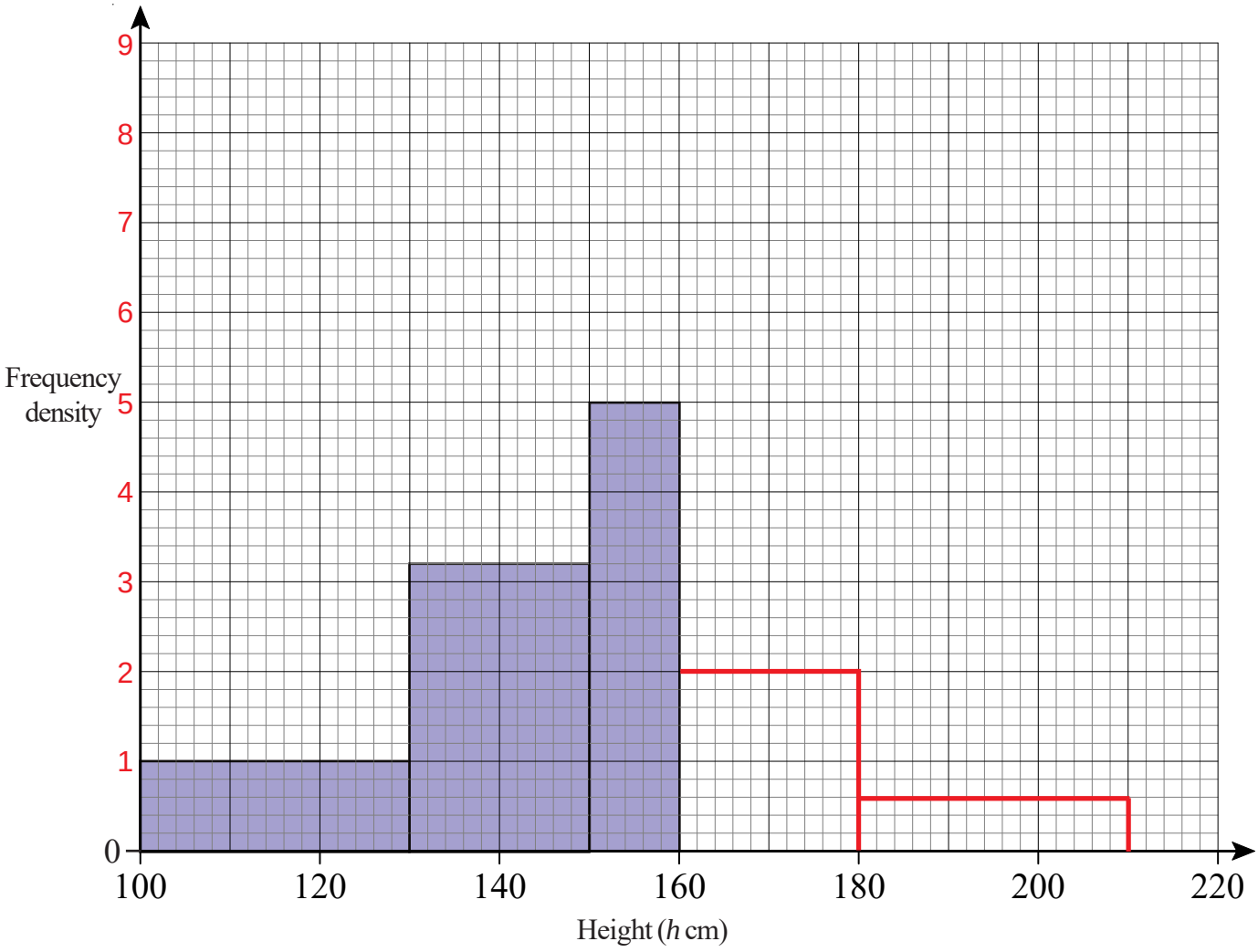
a) Use the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

The incomplete table and histogram give some information about the heights (in cm) of some plants.

Height (h cm)	Frequency
$100 < h \leqslant 130$	30
$130 < h \leqslant 150$	64
$150 < h \leqslant 160$	50
$160 < h \leqslant 180$	40
$180 < h \leqslant 210$	18



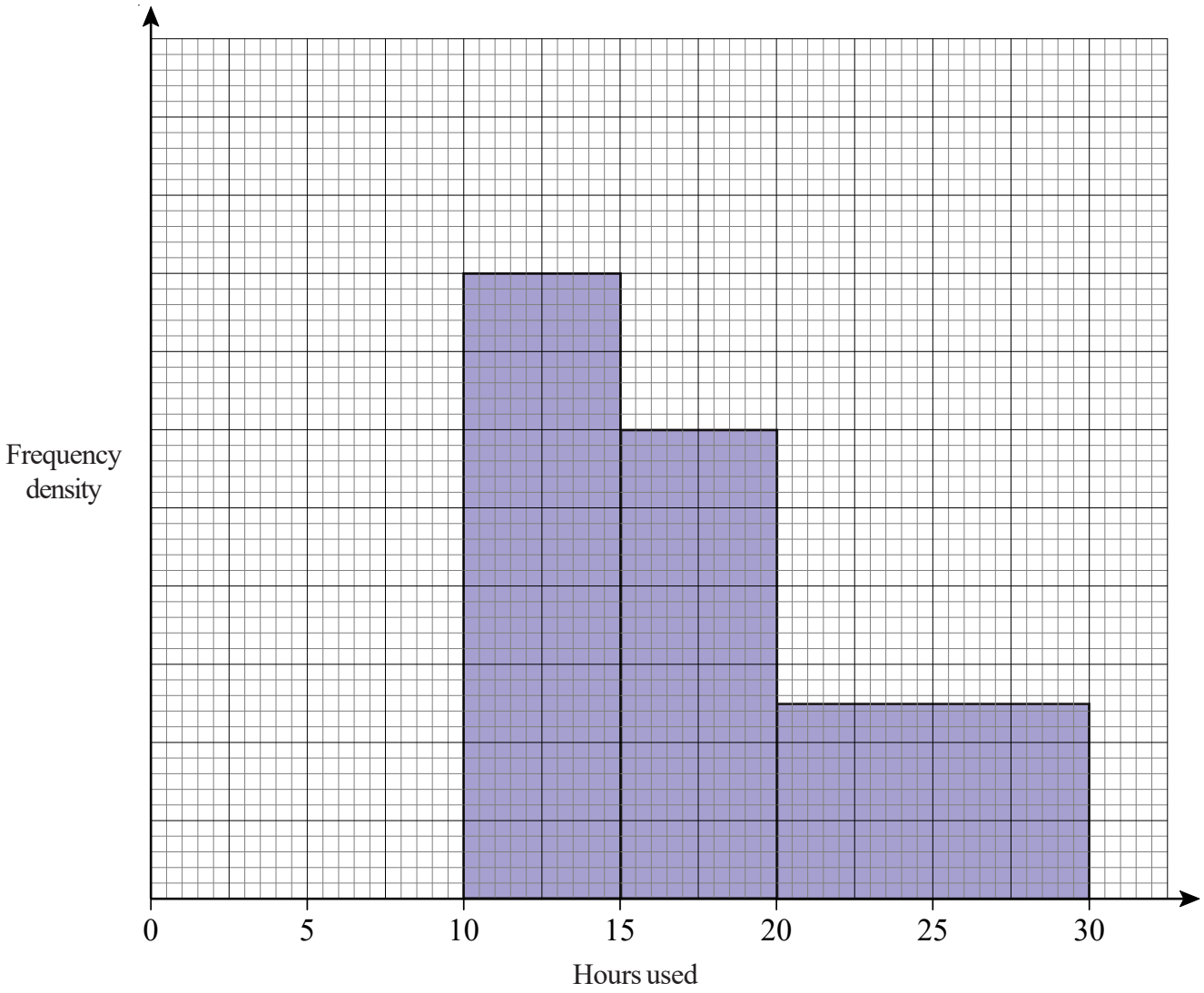
a) Use the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

Paul asked the students in his class how many hours they used the internet for last week.

The incomplete histogram was drawn using his results.



Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a) Use this information to complete the histogram.

No students used the internet for more than 30 hours.

b) Work out how many students Paul asked.

Histograms

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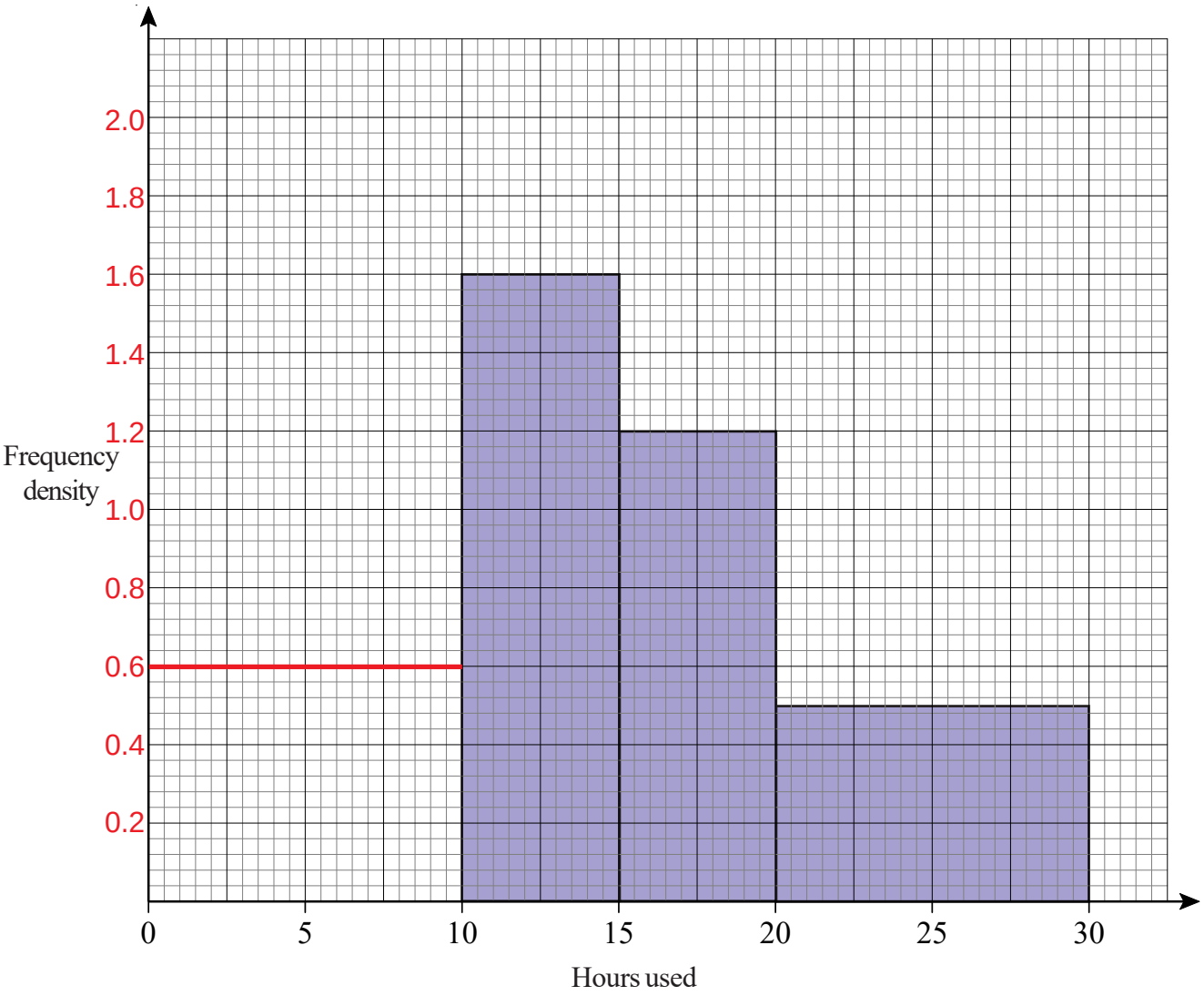


Eight students used the internet for between 10 and 15 hours.
Six students used it for between 0 and 10 hours.

a) Use this information to complete the histogram.

No students used the internet for more than 30 hours.

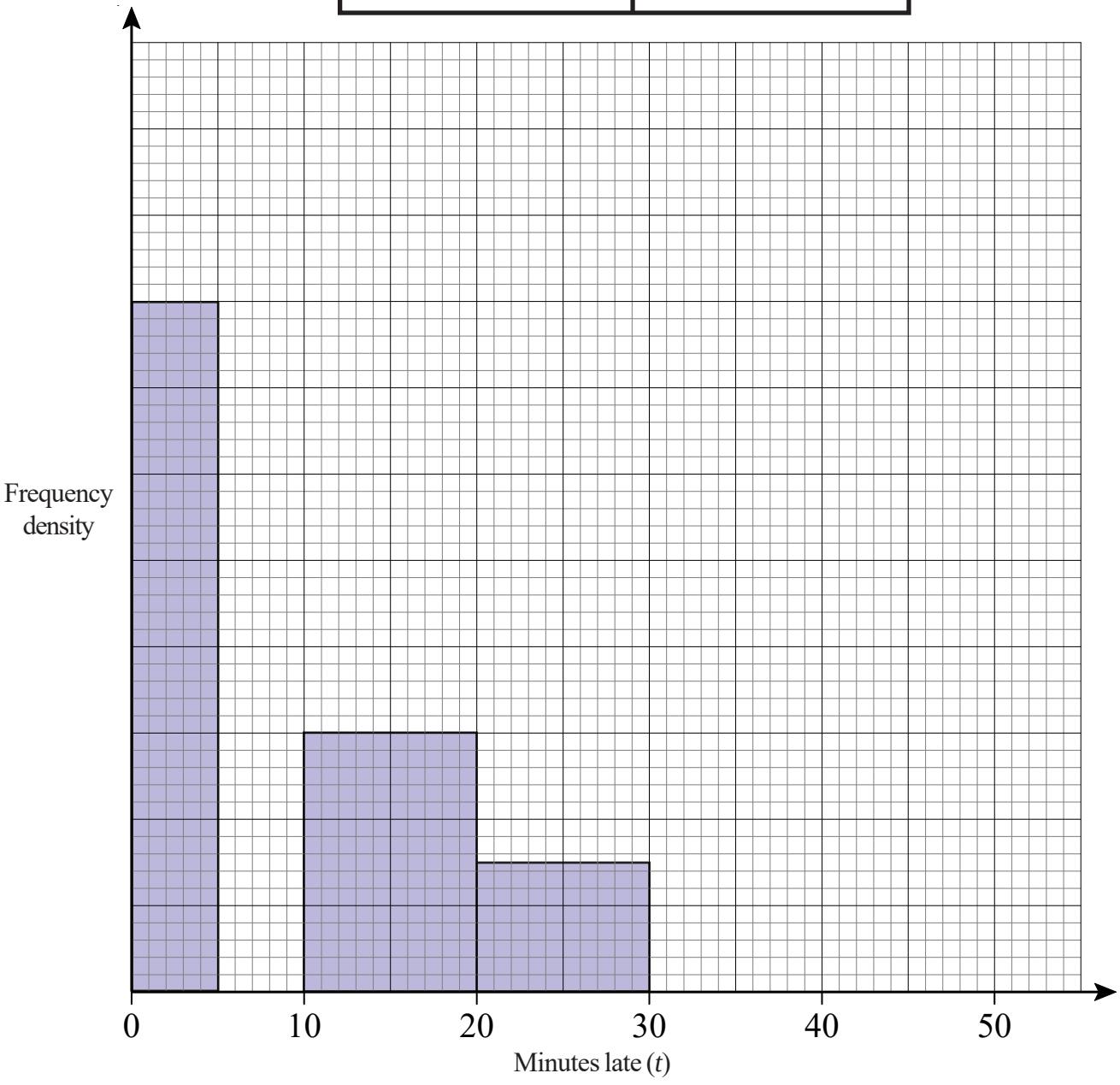
b) Work out how many students Paul asked.

6 + 8 + 6 + 5 = 25

Histograms

Some trains from Nottingham to Leeds were late.
The incomplete table and histogram give some information about how late the trains were.

Minutes late (t)	Frequency
$0 < t \leqslant 5$	16
$5 < t \leqslant 10$	10
$10 < t \leqslant 20$	
$20 < t \leqslant 30$	
$30 < t \leqslant 50$	8



a) Use the information in the histogram to complete the table.

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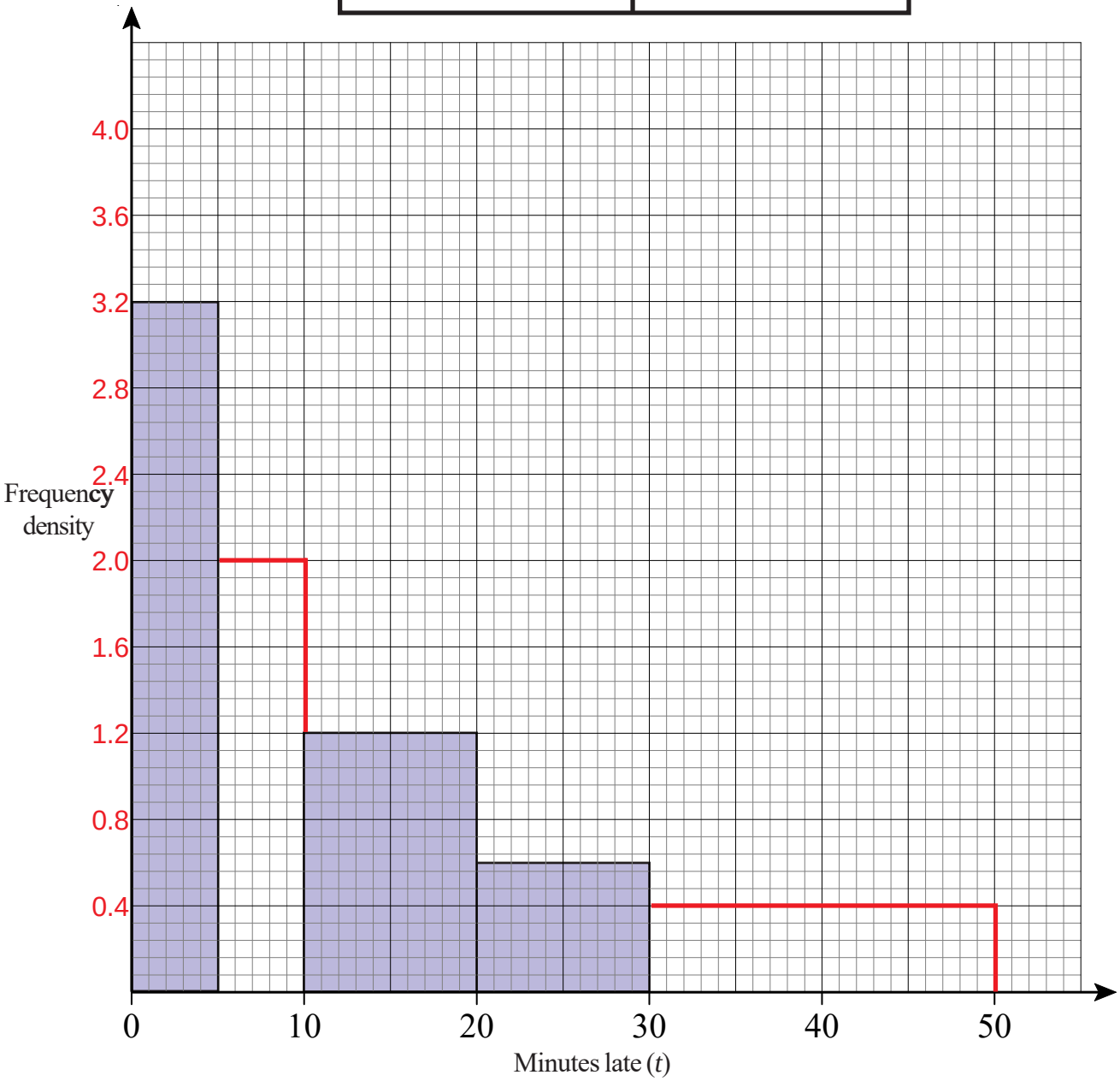


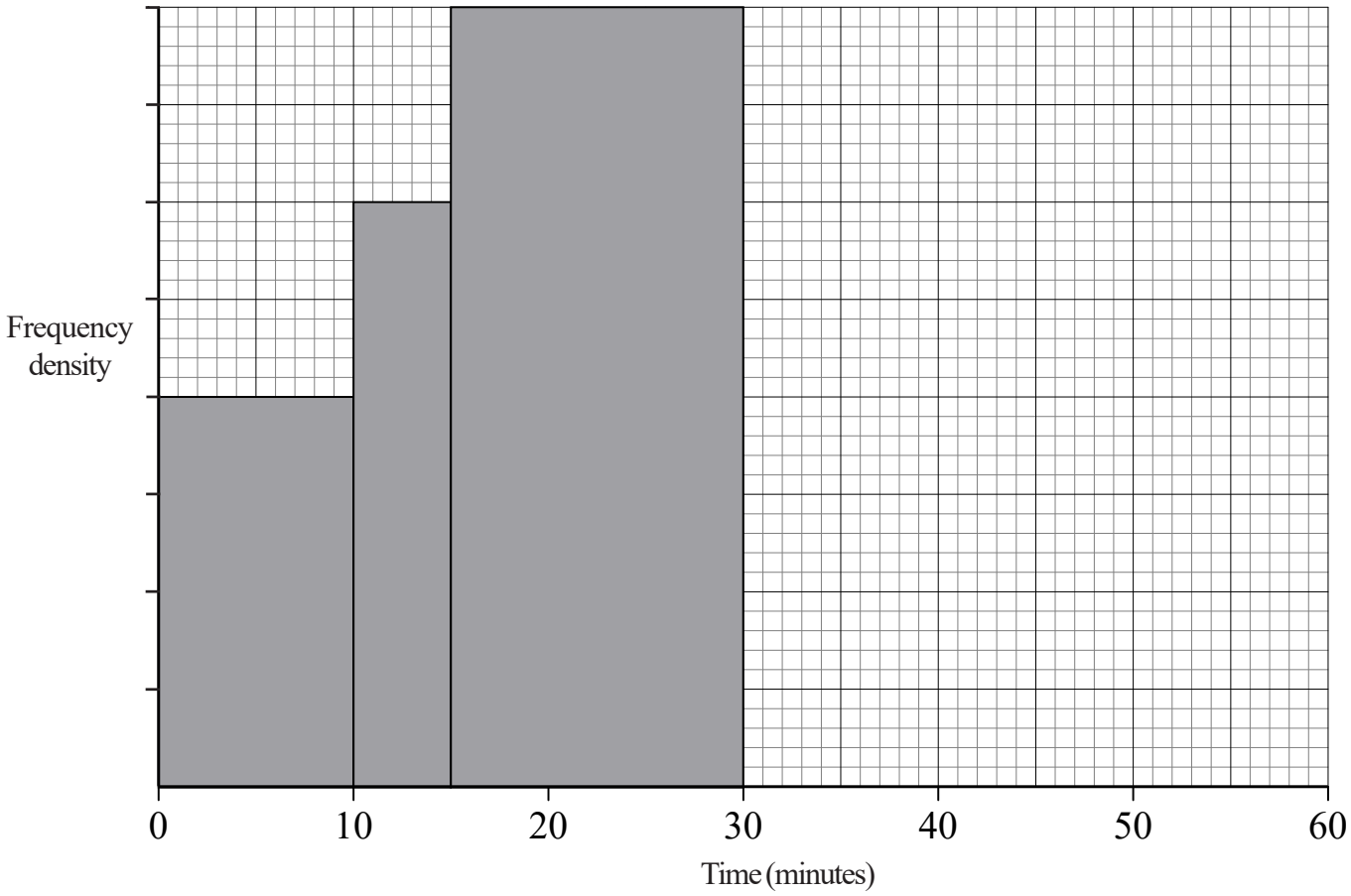
a) Use the information in the histogram to complete the table.

b) Use the information in the table to complete the histogram.

Histograms

The table and histogram give information about how long, in minutes, some students took to complete a set of homework.

Time (t) in minutes	Frequency
$0 < t \leqslant 10$	20
$10 < t \leqslant 15$	
$15 < t \leqslant 30$	
$30 < t \leqslant 50$	62
$50 < t \leqslant 60$	23



a) Use the information in the histogram to complete the table.

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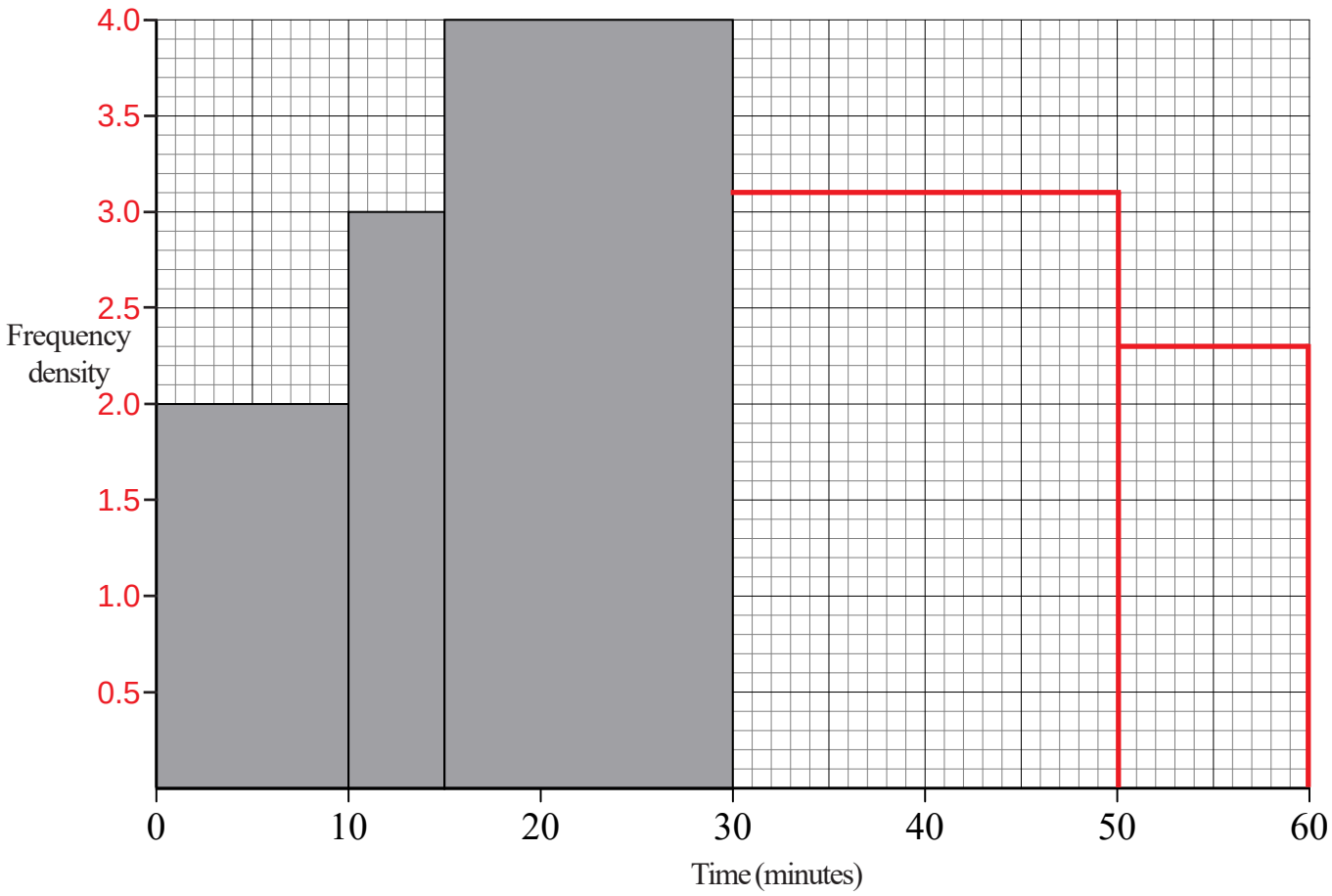
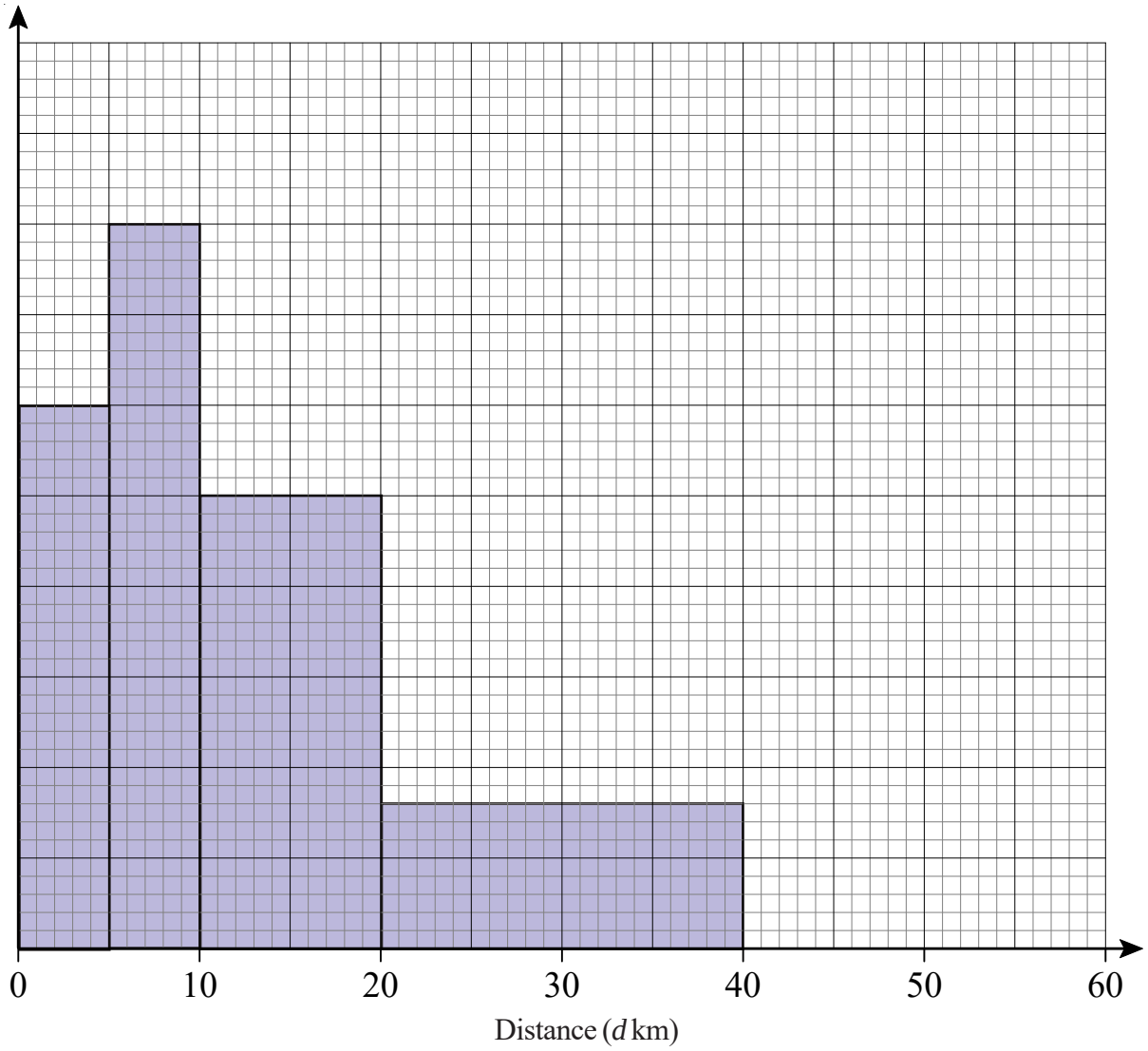


a) Use the information in the histogram to complete the table.

b) Use the table to complete the histogram.

Histograms

The incomplete histogram and table give some information about the distances some students travel to school.



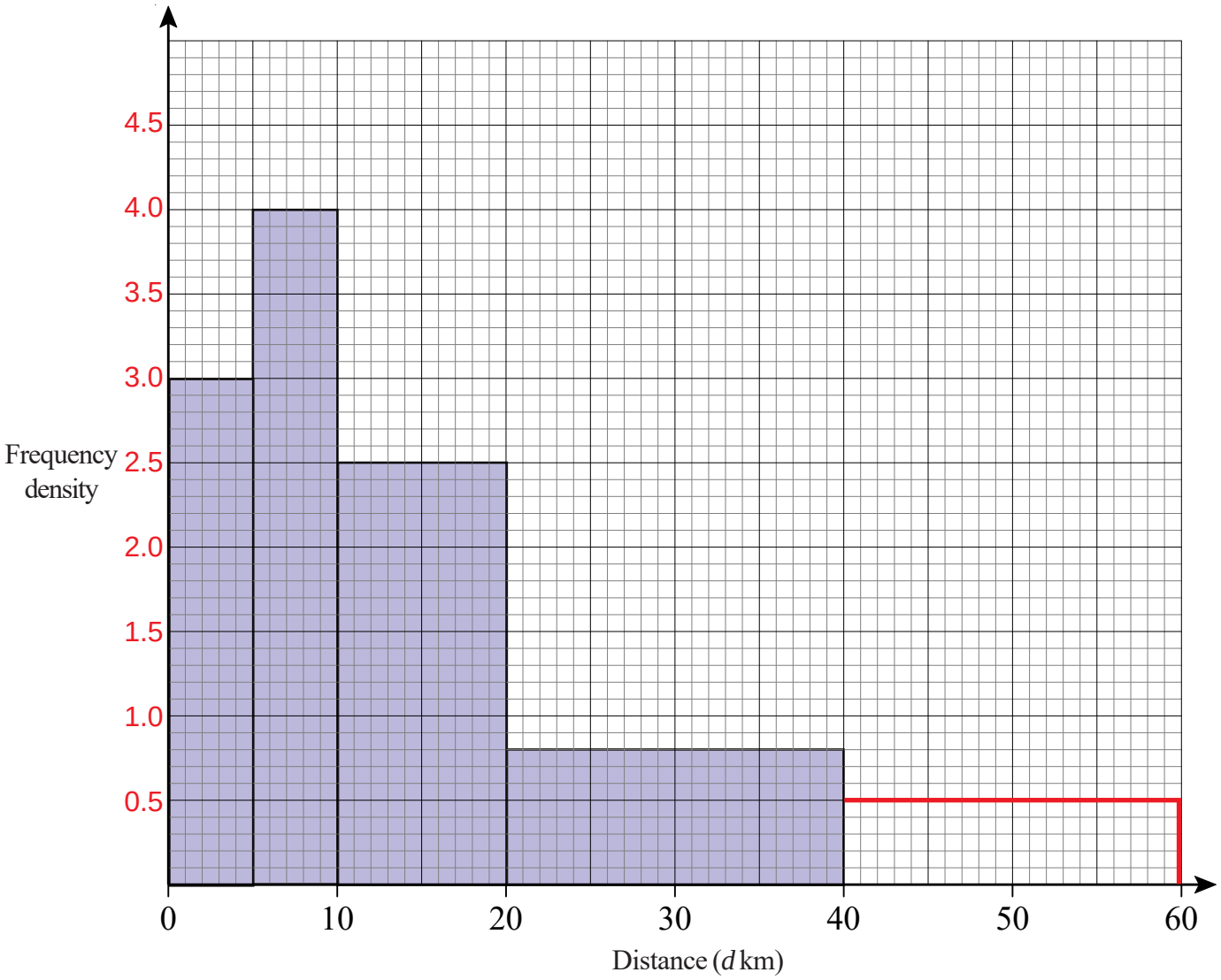
a) Use the information in the histogram to complete the frequency table.

Distance (d km)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	20
$10 < d \leqslant 20$	
$20 < d \leqslant 40$	
$40 < d \leqslant 60$	10

b) Use the information in the table to complete the histogram.

Histograms

The incomplete histogram and table give some information about the distances some students travel to school.



a) Use the information in the histogram to complete the frequency table.

Distance (*d* km)	Frequency
$0 < d \leqslant 5$	15
$5 < d \leqslant 10$	20
$10 < d \leqslant 20$	25
$20 < d \leqslant 40$	16
$40 < d \leqslant 60$	10

b) Use the information in the table to complete the histogram.

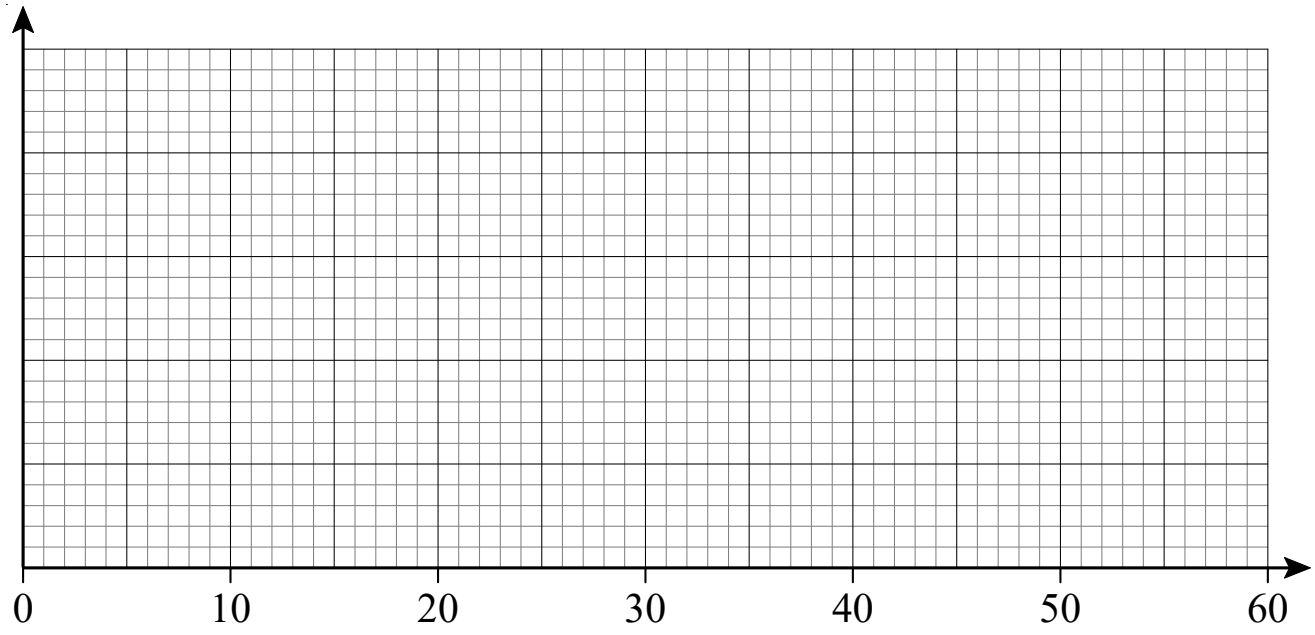
Histograms

There are 100 pupils in Year 11. The time taken by each pupil to answer a question was recorded. The following grouped frequency distribution was obtained.

Time, t seconds	$0 < t \leqslant 10$	$10 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 40$	$40 < t \leqslant 60$
Number of pupils	6	19	25	36	14

Draw a histogram to illustrate the distribution on the graph paper below.

Time taken to answer in seconds



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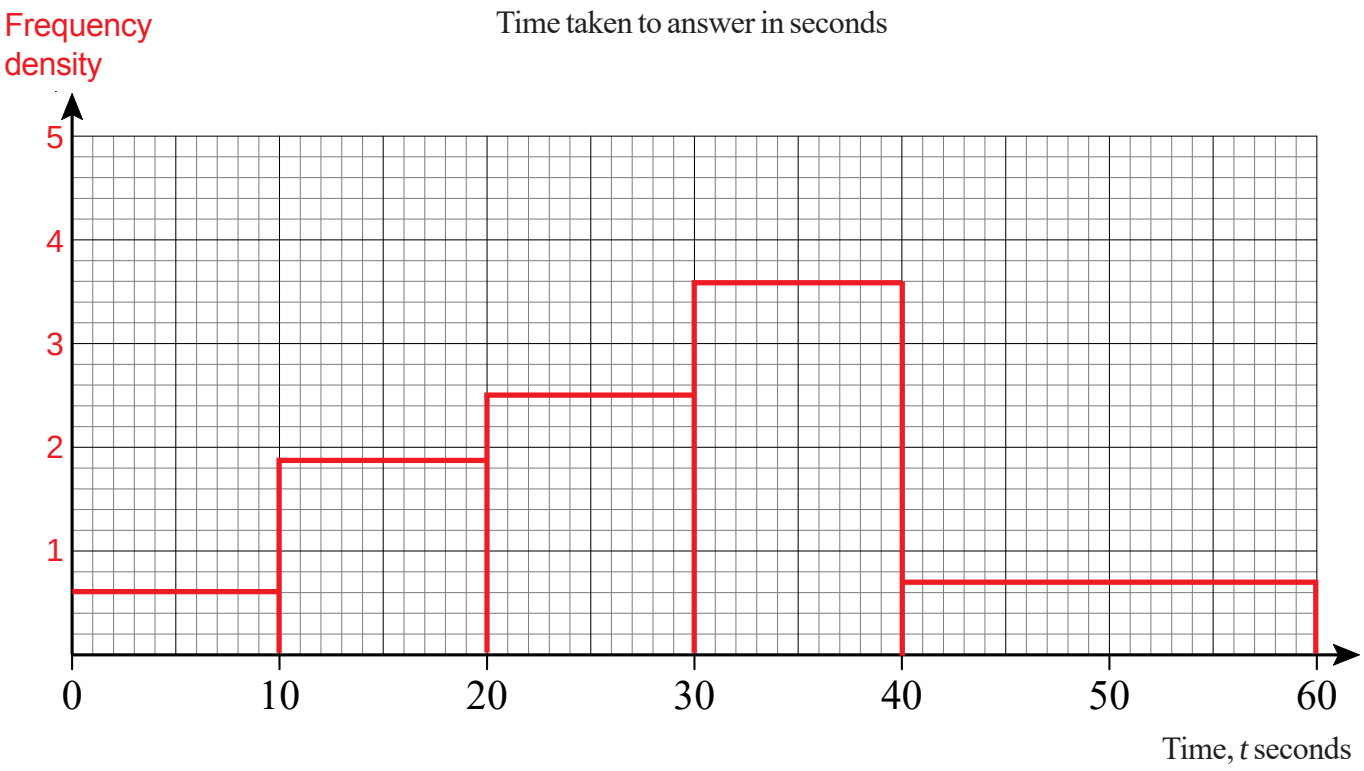
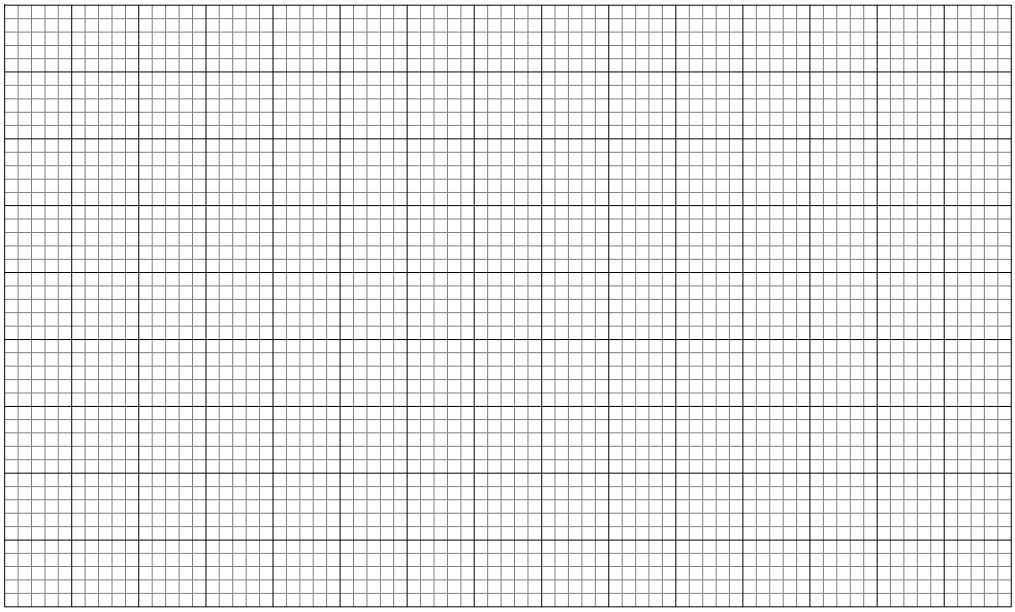


Histograms

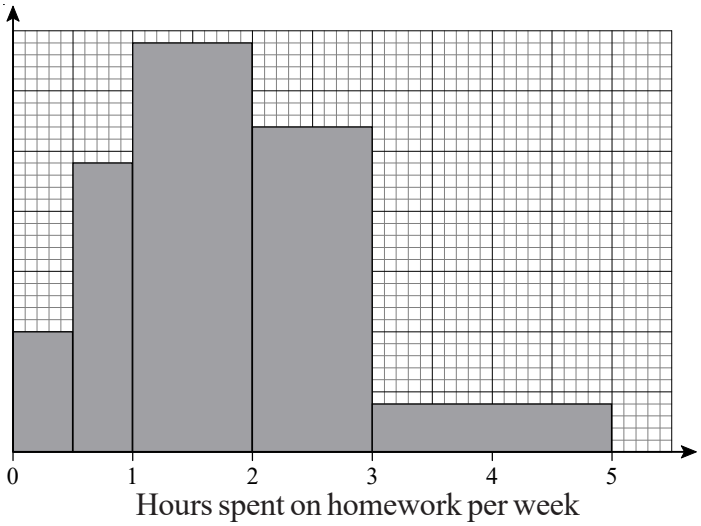
1) The table gives information about the heights, in centimetres, of some 18 year old students.

Height (h cm)	Frequency
$135 < h \leqslant 145$	12
$145 < h \leqslant 165$	46
$165 < h \leqslant 180$	45
$180 < h \leqslant 190$	25
$190 < h \leqslant 195$	4

Use the table to draw a histogram.



2) The histogram shows the amount of time, in hours, that students spend on their homework per week.



Use the histogram to complete the table.

Time (t hours)	Frequency
$0 < t \leqslant ½$	
$½ < t \leqslant 1$	
$1 < t \leqslant 2$	
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	

Histograms

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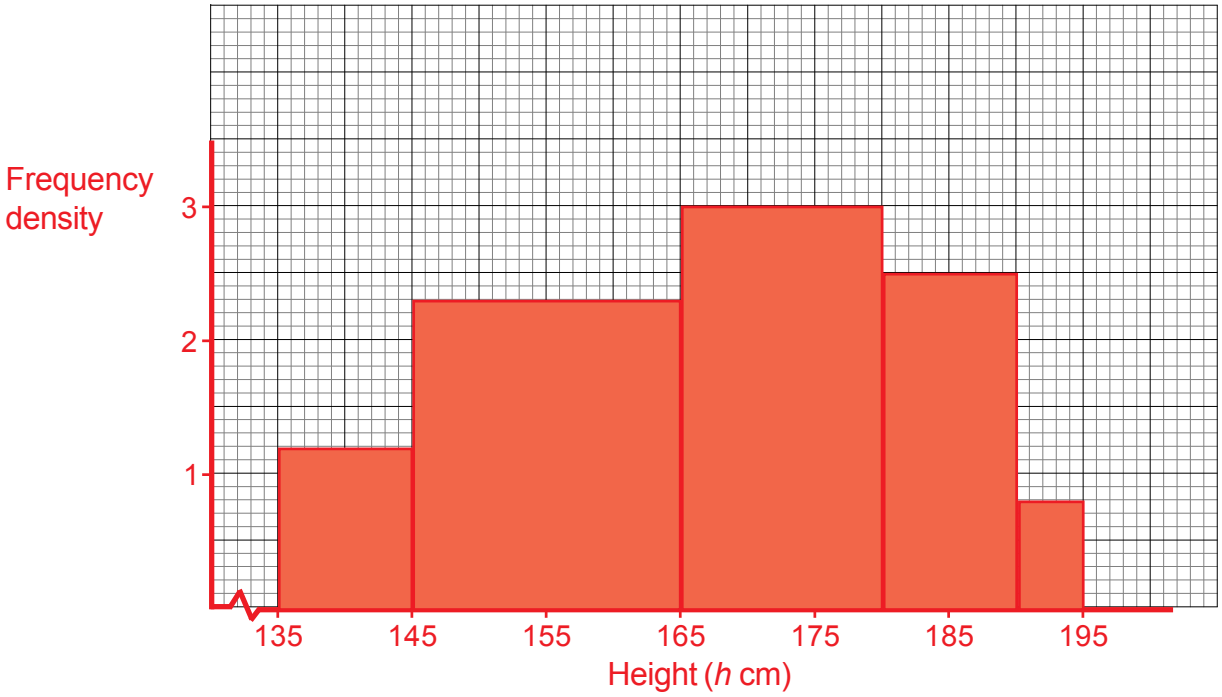

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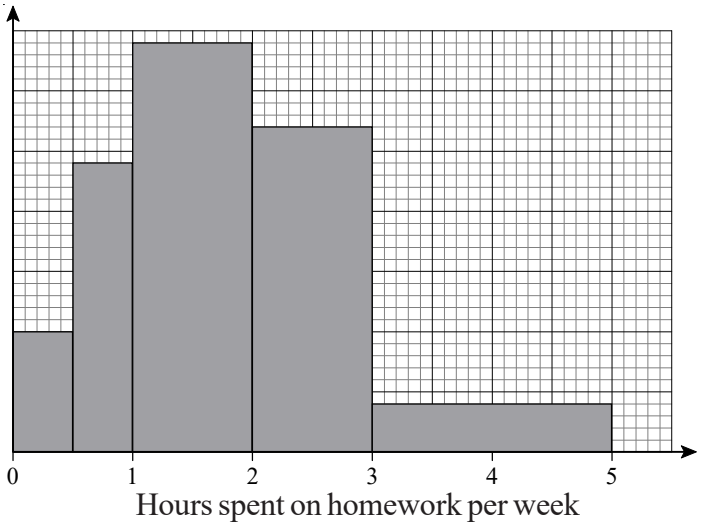


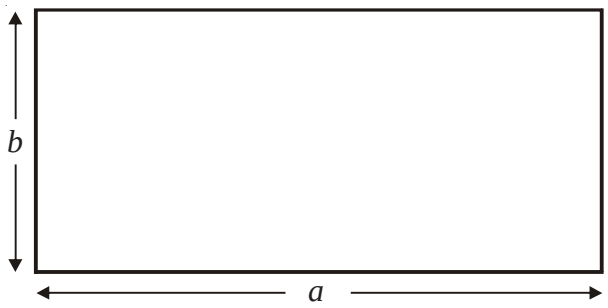
Use the histogram to complete the table.

Time (t hours)	Frequency
$0 < t \leqslant ½$	5
$½ < t \leqslant 1$	12
$1 < t \leqslant 2$	34
$2 < t \leqslant 3$	27
$3 < t \leqslant 5$	8

Upper and Lower Bounds

1) Here is a rectangle.

$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.



a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

b) Find the area of this rectangle correct to an appropriate number of significant figures.

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

b) Calculate the upper bound for the perimeter of the rectangle.

3) The voltage V of an electronic circuit is given by the formula

$$\boxed{V = IR}$$

where I is the current in amps
and R is the resistance in ohms.

Given that $V = 217$ correct to three significant figures,
$R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

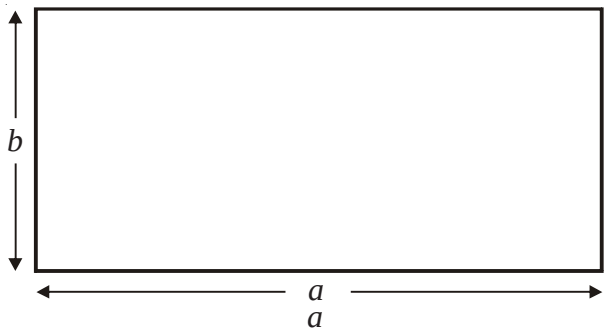
$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
Give your answer correct to 2 decimal places.

Upper and Lower Bounds

1) Here is a rectangle.

$a = 8.4$ cm correct to 1 decimal place.
$b = 3.6$ cm correct to 1 decimal place.



a) Calculate the upper bound of the area of the rectangle.
Write down all the figures on your calculator.

8.45 × 3.65 = 30.8425 cm²

b) Find the area of this rectangle correct to an appropriate number of significant figures.

Lower bound for the area is 29.6425 cm²

Area = 30 cm² correct to 1 significant figure

2) Terry measured the length and the width of a rectangle.

He measured the length to be 745 mm correct to the nearest 5 mm.
He measured the width to be 300 mm correct to the nearest 5 mm.

a) Calculate the lower bound for the area of this rectangle.
Give your answer correct to 3 significant figures.

221000 mm²

b) Calculate the upper bound for the perimeter of the rectangle.

2100 mm

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$R = 12.4$ correct to three significant figures,

calculate the lower bound of I.

17.38955823 amps

4) Sara drove for 237 miles, correct to the nearest mile.
She used 27.2 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Sara's journey.
Give your answer correct to 2 decimal places.

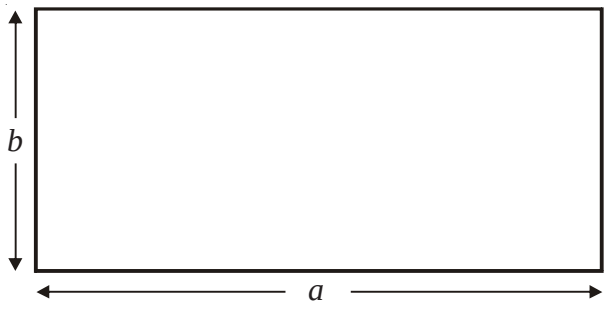
8.75 miles per litre

Upper and Lower Bounds

1)

The length of the rectangle, a,
is 45 cm correct to the nearest cm.

The width of the rectangle, b,
is 26 cm correct to the nearest cm.



Calculate the upper bound for the area of the rectangle.
Write down all the figures on your calculator display.

2) A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field.

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field.

3) A ball is thrown vertically upwards with a speed V metres per second.

The height, H metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where g m/s^2 is the acceleration due to gravity.

$V = 24.4$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(i) Write down the lower bound of g.

(ii) Calculate the upper bound of H.
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\frac{a}{b}}$

$a = 6.43$ correct to 2 decimal places.
$b = 5.514$ correct to 3 decimal places.

By considering bounds, work out the value of v to a suitable degree of accuracy.

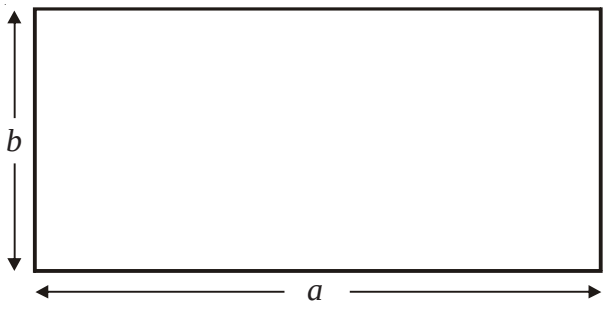
You must show all your working and give a reason for your final answer.

Upper and Lower Bounds

1)

The length of the rectangle, a,
is 45 cm correct to the nearest cm.

The width of the rectangle, b,
is 26 cm correct to the nearest cm.



Calculate the upper bound for the area of the rectangle.
Write down all the figures on your calculator display. 1205.75 cm^2

2) A field is in the shape of a rectangle.
The width of the field is 26 metres, measured to the nearest metre.

a) Work out the upper bound of the width of the field. 26.5 m

The length of the field is 135 metres, measured to the nearest 5 metres.

b) Work out the upper bound for the perimeter of the field. 328 m

3) A ball is thrown vertically upwards with a speed V metres per second.

The height, H metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where g m/s^2 is the acceleration due to gravity.

$V = 24.4$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(i) Write down the lower bound of g. 9.75 m/s

(ii) Calculate the upper bound of H. 30.7 m
Give your answer correct to 3 significant figures.

4) $v = \sqrt{\frac{a}{b}}$

$a = 6.43$ correct to 2 decimal places. lower bound = 1.079402689
$b = 5.514$ correct to 3 decimal places. upper bound = 1.080340323

By considering bounds, work out the value of v to a suitable degree of accuracy.
v = 1.08 correct to two decimal places or three significant figures.
You must show all your working and give a reason for your final answer.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
$B = 300$ correct to 1 significant figure
$C = 9$ correct to the nearest integer

a) Calculate the upper bound for $A + B$.

b) Calculate the lower bound for $B \div C$.

c) Calculate the least possible value of AC.

d) Calculate the greatest possible value of $\dfrac{A+B}{B+C}$

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using
$T = 1.2$ correct to 1 decimal place
$L = 4.50$ correct to 2 decimal places
$x = 40$ correct to the nearest integer

a) Calculate the lower bound for the value of g.
Give your answer correct to 3 decimal places.

b) Calculate the upper bound for the value of g.
Give your answer correct to 3 decimal places.

3) The diagram shows a triangle ABC.

$AB = 73$mm correct to 2 significant figures.
$BC = 80$mm correct to 1 significant figure.

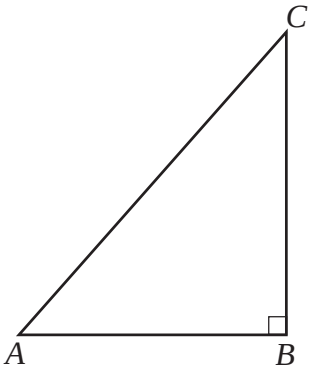


Diagram **NOT** accurately drawn

a) Write the upper and lower bounds of both AB and BC.

AB_{upper} = ... BC_{upper} = ...
AB_{lower} = ... BC_{lower} = ...

b) Calculate the upper bound for the area of the triangle ABC.

.....mm^2

Angle $CAB = x°$

c) Calculate the lower bound for the value of $\tan x°$.

Upper and Lower Bounds

1) $A = 11.3$ correct to 1 decimal place
$B = 300$ correct to 1 significant figure
$C = 9$ correct to the nearest integer

a) Calculate the upper bound for $A + B$. 361.35

b) Calculate the lower bound for $B \div C$. 26.3 (1dp)

c) Calculate the least possible value of AC. 95.625

d) Calculate the greatest possible value of $\dfrac{A+B}{B+C}$ 1.4 (1dp)

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using
$T = 1.2$ correct to 1 decimal place
$L = 4.50$ correct to 2 decimal places
$x = 40$ correct to the nearest integer

a) Calculate the lower bound for the value of g.
Give your answer correct to 3 decimal places. 8.859

b) Calculate the upper bound for the value of g.
Give your answer correct to 3 decimal places. 10.711

3) The diagram shows a triangle ABC.

$AB = 73$mm correct to 2 significant figures.
$BC = 80$mm correct to 1 significant figure.

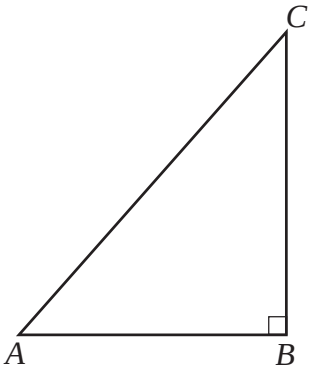


Diagram **NOT** accurately drawn

a) Write the upper and lower bounds of both AB and BC.

AB_{upper} = 73.5 BC_{upper} = 85
AB_{lower} = 72.5 BC_{lower} = 75

b) Calculate the upper bound for the area of the triangle ABC.

3123.75 mm^2

Angle $CAB = x°$

c) Calculate the lower bound for the value of $\tan x°$. 1.02 (2dp)

Surds

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$

b) $\sqrt{3} \times \sqrt{3}$

c) $\sqrt{20}$

d) $\sqrt{24}$

e) $\sqrt{72}$

f) $\sqrt{200}$

g) $\sqrt{\frac{2}{25}}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$

b) $\sqrt{8} \times \sqrt{32}$

c) $\sqrt{99} \times \sqrt{22}$

d) $\sqrt{45} \times \sqrt{20}$

e) $\sqrt{18} \times \sqrt{128}$

f) $\sqrt{28} \times \sqrt{175}$

3) Expand and simplify where possible:

a) $\sqrt{3}(3-\sqrt{3})$

b) $\sqrt{2}(6+2\sqrt{2})$

c) $\sqrt{7}(2+3\sqrt{7})$

d) $\sqrt{2}(\sqrt{32}-\sqrt{8})$

4) Expand and simplify where possible:

a) $(1+\sqrt{2})(1-\sqrt{2})$

b) $(3+\sqrt{5})(2-\sqrt{5})$

c) $(\sqrt{3}+2)(\sqrt{3}+4)$

d) $(\sqrt{5}-3)(\sqrt{5}+1)$

e) $(2+\sqrt{7})(2-\sqrt{7})$

f) $(\sqrt{6}-3)^2$

5) Work out the following, giving your answer in its simplest form:

a) $\frac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$

b) $\frac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$

c) $\frac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$

d) $\frac{(\sqrt{3}+1)^2}{\sqrt{3}}$

e) $\frac{(\sqrt{5}+3)^2}{\sqrt{20}}$

f) $\frac{(5-\sqrt{5})(2+2\sqrt{5})}{\sqrt{20}}$

Surds

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$ 7

b) $\sqrt{3} \times \sqrt{3}$ 3

c) $\sqrt{20}$ $2\sqrt{5}$

d) $\sqrt{24}$ $2\sqrt{6}$

e) $\sqrt{72}$ $6\sqrt{2}$

f) $\sqrt{200}$ $10\sqrt{2}$

g) $\sqrt{\frac{2}{25}}$ $\frac{\sqrt{2}}{5}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$ 6

b) $\sqrt{8} \times \sqrt{32}$ 16

c) $\sqrt{99} \times \sqrt{22}$ $33\sqrt{2}$

d) $\sqrt{45} \times \sqrt{20}$ 30

e) $\sqrt{18} \times \sqrt{128}$ 48

f) $\sqrt{28} \times \sqrt{175}$ 70

3) Expand and simplify where possible:

a) $\sqrt{3}(3-\sqrt{3})$ $3\sqrt{3} - 3$

b) $\sqrt{2}(6+2\sqrt{2})$ $6\sqrt{2} + 4$

c) $\sqrt{7}(2+3\sqrt{7})$ $2\sqrt{7} + 21$

d) $\sqrt{2}(\sqrt{32}-\sqrt{8})$ 4

4) Expand and simplify where possible:

a) $(1+\sqrt{2})(1-\sqrt{2})$ -1

b) $(3+\sqrt{5})(2-\sqrt{5})$ $1 - \sqrt{5}$

c) $(\sqrt{3}+2)(\sqrt{3}+4)$ $11 + 6\sqrt{3}$

d) $(\sqrt{5}-3)(\sqrt{5}+1)$ $2 - 2\sqrt{5}$

e) $(2+\sqrt{7})(2-\sqrt{7})$ -3

f) $(\sqrt{6}-3)^2$ $15 - 6\sqrt{6}$

5) Work out the following, giving your answer in its simplest form:

a) $\frac{(5+\sqrt{3})(5-\sqrt{3})}{\sqrt{22}}$ $\sqrt{22}$

b) $\frac{(4-\sqrt{5})(4+\sqrt{5})}{\sqrt{11}}$ $\sqrt{11}$

c) $\frac{(3-\sqrt{2})(3+\sqrt{2})}{\sqrt{14}}$ $\frac{\sqrt{14}}{2}$

d) $\frac{(\sqrt{3}+1)^2}{\sqrt{3}}$ $\frac{4\sqrt{3} + 6}{3}$

e) $\frac{(\sqrt{5}+3)^2}{\sqrt{20}}$ $\frac{7\sqrt{5} + 15}{5}$

f) $\frac{(5-\sqrt{5})(2+2\sqrt{5})}{\sqrt{20}}$ 4

Surds

1) $\sqrt{5} = 5^k$

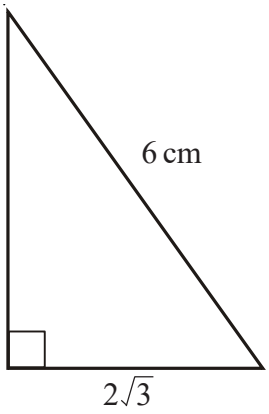
a) Write down the value of k.

b) Expand and simplify $(2+\sqrt{5})(1+\sqrt{5})$

Give your answer in the form $a + b\sqrt{c}$

where a, b and c are integers.

2) The diagram shows a right-angled triangle with lengths of sides as indicated.



The area of the triangle is A cm^2

Show that $A = k\sqrt{2}$ giving the value of k.

3) Given that

$$\frac{8-\sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}$$, where a and b are integers,

find the value of a and the value of b.

4) Work out $(2+\sqrt{3})(2-\sqrt{3})$

Give your answer in its simplest form.

Surds

1) $\sqrt{5} = 5^k$

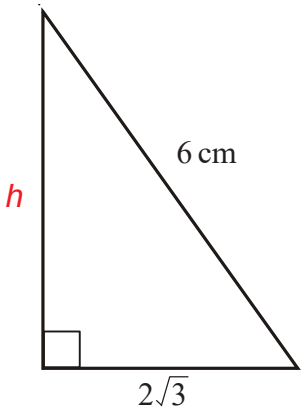
a) Write down the value of k. $\frac{1}{2}$

b) Expand and simplify $(2+\sqrt{5})(1+\sqrt{5})$

Give your answer in the form $a + b\sqrt{c}$ $7 + 3\sqrt{5}$

where a, b and c are integers.

2) The diagram shows a right-angled triangle with lengths of sides as indicated.



The area of the triangle is A cm^2

Show that $A = k\sqrt{2}$ giving the value of k.

$h^2 = 6^2 - (2\sqrt{3})^2$
$= 36 - 12$
$= 24$
$h = \sqrt{24}$
$h = 2\sqrt{6}$

Area $= \frac{2\sqrt{3} \times 2\sqrt{6}}{2}$
$= 2\sqrt{3}\sqrt{6}$
$= 2\sqrt{18}$
$= 6\sqrt{2}$ $k = 6$

3) Given that

$\frac{8-\sqrt{18}}{\sqrt{2}} = a + b\sqrt{2}$, where a and b are integers,

find the value of a and the value of b.

$\frac{8-\sqrt{18}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{8\sqrt{2}-\sqrt{36}}{2}$
$= \frac{8\sqrt{2}-6}{2}$
$= 4\sqrt{2} - 3$
$= -3 + 4\sqrt{2}$
$a = -3$ and $b = 4$

4) Work out $(2+\sqrt{3})(2-\sqrt{3})$ 1

Give your answer in its simplest form.

Surds

1) Rationalise the denominator, simplifying where possible:

a) $\frac{3}{\sqrt{2}}$

b) $\frac{2}{\sqrt{2}}$

c) $\frac{3\sqrt{2}}{\sqrt{7}}$

d) $\frac{\sqrt{5}}{\sqrt{10}}$

e) $\frac{1}{4\sqrt{8}}$

f) $\frac{\sqrt{15}}{\sqrt{3}}$

g) $\frac{1}{\sqrt{27}}$

2) Rationalise the denominator of $\frac{1}{\sqrt{3}}$

3) Rationalise the denominator of $\frac{1}{8\sqrt{8}}$ giving the answer in the form $\frac{\sqrt{2}}{p}$

Surds

1) Rationalise the denominator, simplifying where possible:

a) $\frac{3}{\sqrt{2}}$ $\frac{3\sqrt{2}}{2}$

b) $\frac{2}{\sqrt{2}}$ $\sqrt{2}$

c) $\frac{3\sqrt{2}}{\sqrt{7}}$ $\frac{3\sqrt{14}}{7}$

d) $\frac{\sqrt{5}}{\sqrt{10}}$ $\frac{\sqrt{2}}{2}$

e) $\frac{1}{4\sqrt{8}}$ $\frac{\sqrt{2}}{16}$

f) $\frac{\sqrt{15}}{\sqrt{3}}$ $\sqrt{5}$

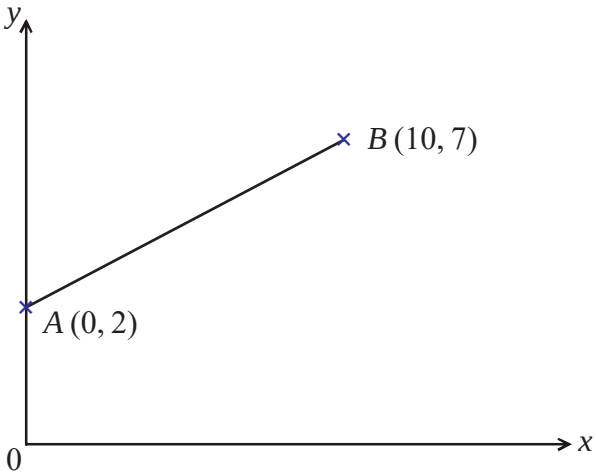
g) $\frac{1}{\sqrt{27}}$ $\frac{\sqrt{3}}{9}$

2) Rationalise the denominator of $\frac{1}{\sqrt{3}}$ $\frac{\sqrt{3}}{3}$

3) Rationalise the denominator of $\frac{1}{8\sqrt{8}}$ giving the answer in the form $\frac{\sqrt{2}}{p}$ $\frac{\sqrt{2}}{32}$

Perpendicular Lines

1)



A is the point (0, 2)
B is the point (10, 7)

a) Write down the equation of the straight line which passes through points *A* and *B*.

b) Find the equation of the line perpendicular to *AB* passing through *B*.

2) A straight line has equation $y = 2x - 5$
The point *P* lies on the straight line.
The *y* coordinate of *P* is -6

a) Find the *x* coordinate of *P*.

A straight line ***L*** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

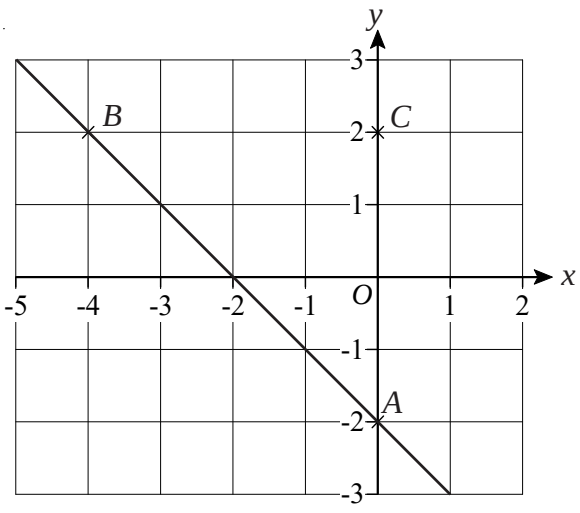
b) Find the equation of line ***L***.

c) Find the equation of the line that is perpendicular to line ***L*** and passes through point (3, 2).

3) In the diagram *A* is the point (0, -2)
B is the point (-4, 2)
C is the point (0, 2)

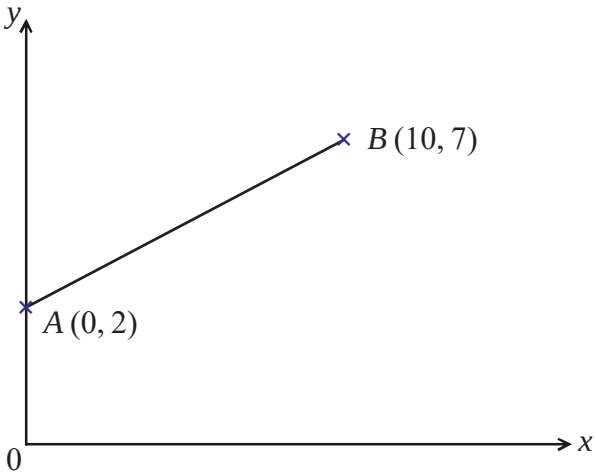
a) Find the equation of the line that passes through *C* and is parallel to *AB*.

b) Find the equation of the line that passes through *C* and is perpendicular to *AB*.



Perpendicular Lines

1)



A is the point (0, 2)
B is the point (10, 7)

a) Write down the equation of the straight line which passes through points *A* and *B*. $y = \frac{1}{2}x + 2$

b) Find the equation of the line perpendicular to *AB* passing through *B*. $y = -2x + 27$

2) A straight line has equation $y = 2x - 5$
The point *P* lies on the straight line.
The *y* coordinate of *P* is -6

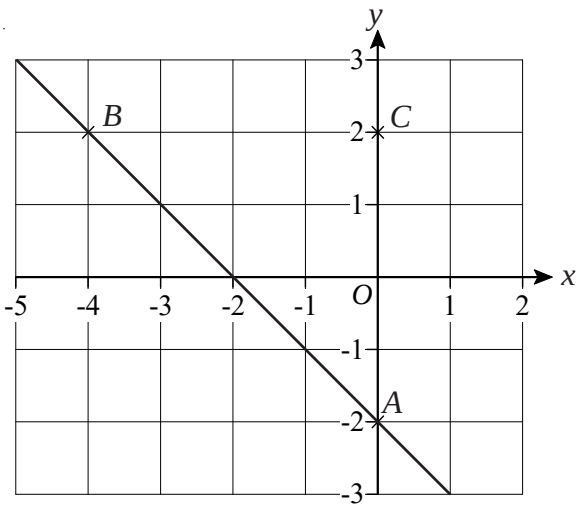
a) Find the *x* coordinate of *P*. $x = -0.5$

A straight line ***L*** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

b) Find the equation of line ***L***. $y = 2x - 4$

c) Find the equation of the line that is perpendicular to line ***L*** and passes through point (3, 2).
$y = -\frac{1}{2}x + 3\frac{1}{2}$

3) In the diagram *A* is the point (0, -2)
B is the point (-4, 2)
C is the point (0, 2)



a) Find the equation of the line that passes through *C* and is parallel to *AB*. $y = -x + 2$

b) Find the equation of the line that passes through *C* and is perpendicular to *AB*. $y = x + 2$

Completing the Square

1) Show that if $y = x^2 + 8x - 3$
then $y \geq -19$ for all values of x.

2) Show that if $y = x^2 - 10x + 30$
then $y \geq 5$ for all values of x.

3) The expression $x^2 + 4x + 10$ can be written in the form
$(x + p)^2 + q$ for all values of x.
Find the values of p and q.

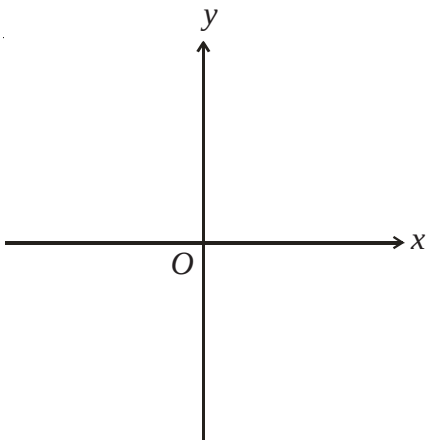
4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x,
find the value of p and the value of q.

5) For all values of x,
$$x^2 + 6x = (x + p)^2 + q$$
a) Find the values of p and q.

b) Find the minimum value of $x^2 + 6x$.

6) For all values of x,
$$x^2 - 8x - 5 = (x - p)^2 + q$$
a) Find the value of p and the value of q.

b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



c) Find the coordinates of the minimum point on the graph of $y = x^2 - 8x - 5$.

7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x.

a) Find the values of p and q.

b) The expression $10x - x^2$ has a maximum value.

(i) Find the maximum value of $10x - x^2$.

(ii) State the value of x for which this maximum value occurs.

Completing the Square

1) Show that if $y = x^2 + 8x - 3$ then $y \geq -19$ for all values of x.

$y = (x + 4)^2 - 16 - 3$
$y = (x + 4)^2 - 19$
$(x + 4)^2 \geq 0$
$y \geq -19$

2) Show that if $y = x^2 - 10x + 30$ then $y \geq 5$ for all values of x.

$y = (x - 5)^2 - 25 + 30$
$y = (x - 5)^2 + 5$
$(x - 5)^2 \geq 0$
$y \geq 5$

3) The expression $x^2 + 4x + 10$ can be written in the form $(x + p)^2 + q$ for all values of x.
Find the values of p and q.
$p = 2$ and $q = 6$

4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x, find the value of p and the value of q.
$p = 3$ and $q = 8$

5) For all values of x,

$$x^2 + 6x = (x + p)^2 + q$$

a) Find the values of p and q. $p = 3$ and $q = -9$

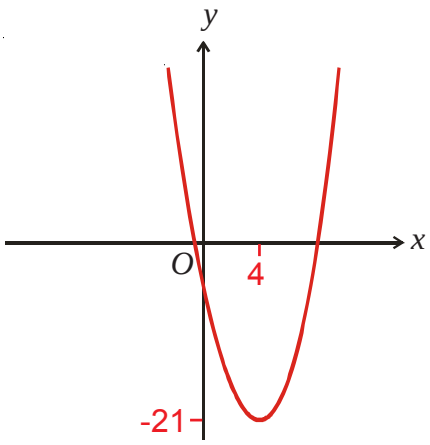
b) Find the minimum value of $x^2 + 6x$. -9

6) For all values of x,

$$x^2 - 8x - 5 = (x - p)^2 + q$$

a) Find the value of p and the value of q.
$p = 4$ and $q = -21$

b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



c) Find the coordinates of the minimum point on the graph of $y = x^2 - 8x - 5$.
(4, -21)

7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x.

a) Find the values of p and q.
$p = 25$ and $q = 5$

b) The expression $10x - x^2$ has a maximum value.

(i) Find the maximum value of $10x - x^2$.
25

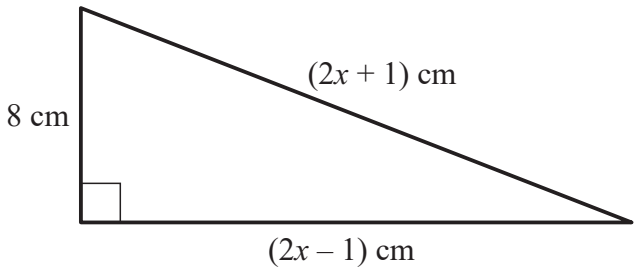
(ii) State the value of x for which this maximum value occurs.
$x = 5$

Forming and Solving Quadratic Equations

1) The area of the rectangle below is 90 cm^2.

Set up and solve a quadratic equation to work out the value of x.

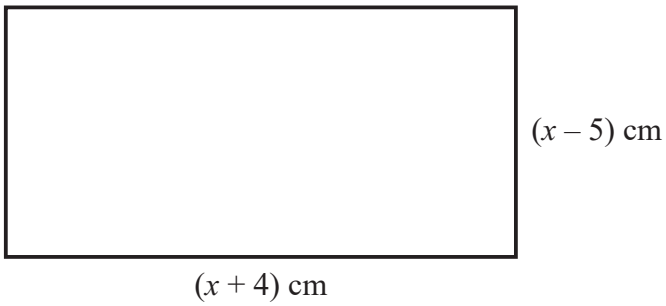
2) Work out the value of x.



You must show your working.

Forming and Solving Quadratic Equations

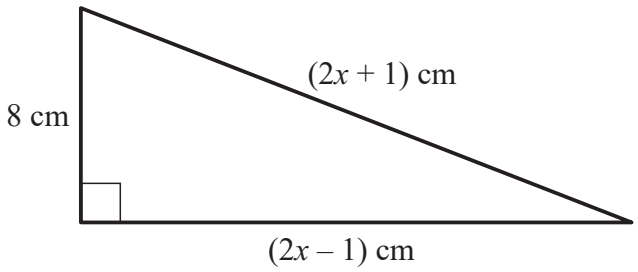
1) The area of the rectangle below is 90 cm^2.



Set up and solve a quadratic equation to work out the value of x.

$(x + 4)(x – 5) = 90$
$x^2 – x – 20 = 90$
$x^2 – x – 110 = 0$
$(x + 10)(x – 11) = 0$
$\boldsymbol{x = 11}$ (reject $x = –10$ as this would make both lengths negative)

2) Work out the value of x.



You must show your working.

$8^2 + (2x – 1)^2 = (2x + 1)^2$
$64 + 4x^2 – 4x + 1 = 4x^2 + 4x + 1$
$64 = 8x$
$\boldsymbol{x = 8}$

Algebraic Fractions

1) Simplify fully

a) $\frac{9x^2}{21x^3}$

b) $\frac{10xy^3}{5y^2}$

c) $\frac{18a^3b^2}{2ab^2}$

d) $\frac{4x^2+12x}{10x}$

e) $\frac{2a^2b-14a^2b^3}{6a^3b^3}$

f) $\frac{5x^2y+5xy^2}{10x^2y^2}$

2) Simplify fully

a) $\frac{x^2+x}{x^2+6x+5}$

b) $\frac{x^2-6x+8}{2x^2-8x}$

c) $\frac{x^2+7x+10}{x^2+5x}$

3) a) Factorise $4x^2-12x+9$

b) Simplify $\frac{6x^2-7x-3}{4x^2-12x+9}$

Algebraic Fractions

1) Simplify fully

a) $\frac{9x^2}{21x^3}$ $\frac{3}{7x}$

b) $\frac{10xy^3}{5y^2}$ $2xy$

c) $\frac{18a^3b^2}{2ab^2}$ $9a^2$

d) $\frac{4x^2+12x}{10x}$ $\frac{2(x+3)}{5}$

e) $\frac{2a^2b-14a^2b^3}{6a^3b^3}$ $\frac{1-7b^2}{3ab^2}$

f) $\frac{5x^2y+5xy^2}{10x^2y^2}$ $\frac{x+y}{2xy}$

2) Simplify fully

a) $\frac{x^2+x}{x^2+6x+5}$ $\frac{x}{x+5}$

b) $\frac{x^2-6x+8}{2x^2-8x}$ $\frac{x-2}{2x}$

c) $\frac{x^2+7x+10}{x^2+5x}$ $\frac{x+2}{x}$

3) a) Factorise $4x^2-12x+9$ $(2x-3)^2$

b) Simplify $\frac{6x^2-7x-3}{4x^2-12x+9}$ $\frac{3x+1}{2x-3}$

Algebraic Fractions

1) Write as single fractions in their simplest form

a) $\frac{3}{x}+\frac{3}{2x}$

b) $\frac{5}{3x}-\frac{3}{4x}$

c) $\frac{x+2}{5}+\frac{x-1}{2}$

d) $\frac{3}{x+2}-\frac{5}{2x+1}$

2) a) Factorise $2x^2+7x+6$

b) Write as a single fraction in its simplest form $\frac{3}{x+2}+\frac{4x}{2x^2+7x+6}$

3) Solve

a) $\frac{1}{x}+\frac{1}{3x}=2$

b) $\frac{1}{x-2}+\frac{3}{x+6}=\frac{1}{2}$

c) $\frac{1}{x-5}+\frac{6}{x}=2$

d) $\frac{7}{x+2}+\frac{1}{x-1}=4$

e) $\frac{3}{x+2}+\frac{1}{x-2}=\frac{7}{x^2-4}$

f) $\frac{x}{2x-1}+\frac{2}{x+2}=1$

Algebraic Fractions

1) Write as single fractions in their simplest form

a) $\frac{3}{x}+\frac{3}{2x}$ $\frac{9}{2x}$

b) $\frac{5}{3x}-\frac{3}{4x}$ $\frac{11}{12x}$

c) $\frac{x+2}{5}+\frac{x-1}{2}$ $\frac{7x-1}{10}$

d) $\frac{3}{x+2}-\frac{5}{2x+1}$ $\frac{x-7}{(x+2)(2x+1)}$

2) a) Factorise $2x^2+7x+6$ $(x+2)(2x+3)$

b) Write as a single fraction in its simplest form $\frac{3}{x+2}+\frac{4x}{2x^2+7x+6}$ $\frac{10x+9}{(x+2)(2x+3)}$

3) Solve

a) $\frac{1}{x}+\frac{1}{3x}=2$ $x=\frac{2}{3}$

b) $\frac{1}{x-2}+\frac{3}{x+6}=\frac{1}{2}$ $x=-2$ or 6

c) $\frac{1}{x-5}+\frac{6}{x}=2$ $x=2.5$ or 6

d) $\frac{7}{x+2}+\frac{1}{x-1}=4$ $x=-0.5$ or 1.5

e) $\frac{3}{x+2}+\frac{1}{x-2}=\frac{7}{x^2-4}$ $x=2.75$

f) $\frac{x}{2x-1}+\frac{2}{x+2}=1$ $x=0$ or 3

Simultaneous Equations with a Quadratic

1) Solve these simultaneous equations.

$y = x$

$y = x^2 - 6$

2) Solve these simultaneous equations.

$y = x^2 - 4$

$y = 3x$

3) Solve these simultaneous equations.

$y = x^2 - x - 13$

$y = x + 2$

4) Solve these simultaneous equations.

$y = x^2 - 35$

$x - y = 5$

5) Solve these simultaneous equations.

$x^2 + y^2 = 26$

$y + 6 = x$

6) Sarah said that the line $y = 7$ cuts the curve $x^2 + y^2 = 25$ at two points.

a) By eliminating y show that Sarah is **not** correct.

b) By eliminating y, find the solutions to the simultaneous equations

$x^2 + y^2 = 25$

$y = 3x - 9$

Simultaneous Equations with a Quadratic

1) Solve these simultaneous equations.

$y = x$

$y = x^2 - 6$

$x = 3$ and $y = 3$

$x = -2$ and $y = -2$

2) Solve these simultaneous equations.

$y = x^2 - 4$

$y = 3x$

$x = 4$ and $y = 12$

$x = -1$ and $y = -3$

3) Solve these simultaneous equations.

$y = x^2 - x - 13$

$y = x + 2$

$x = 5$ and $y = 7$

$x = -3$ and $y = -1$

4) Solve these simultaneous equations.

$y = x^2 - 35$

$x - y = 5$

$x = 6$ and $y = 1$

$x = -5$ and $y = -10$

5) Solve these simultaneous equations.

$x^2 + y^2 = 26$

$y + 6 = x$

$x = 5$ and $y = -1$

$x = 1$ and $y = -5$

6) Sarah said that the line $y = 7$ cuts the curve $x^2 + y^2 = 25$ at two points.

$x^2 + 49 = 25$

$x^2 = -24$

a) By eliminating y show that Sarah is **not** correct.

There is no solution to $x^2 = -24$ hence $y = 7$ does not cut the curve.

b) By eliminating y, find the solutions to the simultaneous equations

$x^2 + y^2 = 25$

$y = 3x - 9$

$x^2 + (3x - 9)^2 = 25$

$x^2 + 9x^2 - 54x + 81 = 25$

$10x^2 - 54x + 56 = 0$

$5x^2 - 27x + 28 = 0$

$(5x - 7)(x - 4) = 0$

$x = 1.4$ or $x = 4$

$x = 1.4$ and $y = -4.8$

$x = 4$ and $y = 3$

Solving Quadratic Inequalities

1) Solve the inequality $x^2 + x - 12 \leq 0$

2) Solve the inequality $x^2 - 5x - 6 > 0$

3) Solve the inequality $x^2 - 9 \geq 0$

4) Solve the inequality $2x^2 - 13x + 15 < 0$

5) Solve the inequality $6x^2 + 13x - 5 > 0$

Solving Quadratic Inequalities

1) Solve the inequality $x^2 + x - 12 \leq 0$

$-4 \leq x \leq 3$

2) Solve the inequality $x^2 - 5x - 6 > 0$

$x < -1, x > 6$

3) Solve the inequality $x^2 - 9 \geq 0$

$x \leq -3, x \geq 3$

4) Solve the inequality $2x^2 - 13x + 15 < 0$

$1.5 < x < 5$

5) Solve the inequality $6x^2 + 13x - 5 > 0$

$x < -2.5, x > \frac{1}{3}$

Inverse Functions

1) Find $f^{-1}(x)$ if $f(x) = \frac{x}{4} + 3$

2) a) Find $f^{-1}(x)$ where $f(x) = 2x - 3$

b) Find $f^{-1}(19)$

3) a) Find $f^{-1}(x)$ where $f(x) = x^3 - 1$

b) Find $f^{-1}(26)$

4) Find $f^{-1}(x)$ where $f(x) = \frac{4x - 1}{x}$

5) Find $f^{-1}(x)$ where $f(x) = \frac{2x}{x + 5}$

Inverse Functions

1) Find $f^{-1}(x)$ if $f(x) = \frac{x}{4} + 3$

$f^{-1}(x) = 4(x - 3)$

2) a) Find $f^{-1}(x)$ where $f(x) = 2x - 3$ $f^{-1}(x) = \frac{x + 3}{2}$

b) Find $f^{-1}(19)$ 11

3) a) Find $f^{-1}(x)$ where $f(x) = x^3 - 1$ $f^{-1}(x) = \sqrt[3]{x + 1}$

b) Find $f^{-1}(26)$ 3

4) Find $f^{-1}(x)$ where $f(x) = \frac{4x - 1}{x}$ $f^{-1}(x) = \frac{1}{4 - x}$

5) Find $f^{-1}(x)$ where $f(x) = \frac{2x}{x + 5}$ $f^{-1}(x) = \frac{5x}{2 - x}$

Composite Functions

1) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find f(5)

b) Find f(-1)

c) Find g(3)

d) Find g(-5)

2) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find fg(3)

b) Find gf(3)

c) Find gf(0)

3) For all values of x,

$f(x) = x^2 + 3x$, $g(x) = x + 5$

a) Find fg(x)

b) Find gf(x)

4) For all values of x,

$f(x) = x + 5$, $g(x) = x^2 - 2$

Solve fg(x) = gf(x)

Composite Functions

1) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find f(5) 23

b) Find f(-1) -1

c) Find g(3) 9

d) Find g(-5) 1

2) For all values of x,

$f(x) = x^2 - 2$, $g(x) = x + 6$

a) Find fg(3) 79

b) Find gf(3) 13

c) Find gf(0) 4

3) For all values of x,

$f(x) = x^2 + 3x$, $g(x) = x + 5$

a) Find fg(x) $x^2 + 13x + 40$

b) Find gf(x) $x^2 + 3x + 5$

4) For all values of x,

$f(x) = x + 5$, $g(x) = x^2 - 2$

Solve fg(x) = gf(x) $x = -2$

Differentiation - Graphs

1) Find the gradient of the curve $y = 3x^2 - 5x + 4$ at the point $P(3, 16)$.

2) Find the gradient of the curve $y = x^4 - 3x^2$ at the point $Q(-1, -2)$.

3) Find the gradient of the curve $y = x^2 - 3x + 1$ at the point where $x = 4$.

4) Find the gradient of the curve $y = x^3 - x^2$ at the point where $x = -2$.

5) Find the gradient of the curve $y = -2x(x - 4)$ at the point where $x = -1$.

6) Find the coordinates of the point on the curve $y = x^2 + 7x + 3$ where the gradient is 17.

7) Find the x-coordinates of the two points on the curve $y = x^3 - 3x^2 - 9x + 4$ where the gradient is 0.

8) Find the x-coordinates of the two points on the curve $y = \frac{1}{3}x^3 + x^2 - 8x$ where the gradient is 0.

9) A curve has equation $y = 2x^2 - 6x + 1$

Find the coordinates of the turning point of this curve.

10) A curve has equation $y = 11 + 8x - 2x^2$

Find the turning point of the curve and determine whether this point is a minimum or a maximum.

11) A curve has equation $y = x^3 - 3x^2 + 5$

Find the stationary points of the curve and determine whether each point is a minimum or a maximum.

12) A curve has equation $y = x^3 - 6x^2 - 15x + 10$

Find the stationary points of the curve and determine whether each point is a minimum or a maximum.

Differentiation - Graphs

1) Find the gradient of the curve $y = 3x^2 - 5x + 4$ at the point $P(3, 16)$. At $x = 3$, $\frac{dy}{dx} = 13$

2) Find the gradient of the curve $y = x^4 - 3x^2$ at the point $Q(-1, -2)$. At $x = -1$, $\frac{dy}{dx} = 2$

3) Find the gradient of the curve $y = x^2 - 3x + 1$ at the point where $x = 4$. At $x = 4$, $\frac{dy}{dx} = 5$

4) Find the gradient of the curve $y = x^3 - x^2$ at the point where $x = -2$. At $x = -2$, $\frac{dy}{dx} = 16$

5) Find the gradient of the curve $y = -2x(x - 4)$ at the point where $x = -1$. At $x = -1$, $\frac{dy}{dx} = 12$

6) Find the coordinates of the point on the curve $y = x^2 + 7x + 3$ where the gradient is 17. (5, 63)

7) Find the x-coordinates of the two points on the curve $y = x^3 - 3x^2 - 9x + 4$ where the gradient is 0.
$x = -1, 3$

8) Find the x-coordinates of the two points on the curve $y = \frac{1}{3}x^3 + x^2 - 8x$ where the gradient is 0.
$x = -4, 2$

9) A curve has equation $y = 2x^2 - 6x + 1$

Find the coordinates of the turning point of this curve. (1.5, −3.5)

10) A curve has equation $y = 11 + 8x - 2x^2$

Find the turning point of the curve and determine whether this point is a minimum or a maximum.

(2, 19) and maximum point

11) A curve has equation $y = x^3 - 3x^2 + 5$

Find the stationary points of the curve and determine whether each point is a minimum or a maximum.

(0, 5) and maximum point
(2, 1) and minimum point

12) A curve has equation $y = x^3 - 6x^2 - 15x + 10$

Find the stationary points of the curve and determine whether each point is a minimum or a maximum.

(–1, 18) and maximum point
(5, –90) and minimum point

Differentiation - Applications

1) A particle moves so that its distance from the origin, in metres, at time t seconds is given by

$s = t^3 + 5t^2 - 4t$

a) Find an expression for the velocity of the particle.

b) Find the velocity of the particle at $t = 2$

2) An object moves along a straight line so that its distance from the origin, in metres, at time t seconds is given by

$s = t^3 - 3t^2 + 10t$

a) Find an expression for the velocity of the object.

b) Find the velocity of the object at $t = 5$

c) Find the acceleration of the object at $t = 3$

3) An object is moving along a straight line and its velocity (v in m/s) at time t seconds is given by

$v = 3t - 6t^2$

a) Find the velocity of the object at $t = 10$

b) Find the acceleration of the object at $t = 2$

c) Find the time t when the acceleration of the object is zero.

4) A ball is dropped from the top of a tower.

The height of the ball (h metres) above the ground at t seconds is given by

$h = 108 - 3t^2$

a) What is the height of the tower?

b) How long will it take for the ball to hit the ground?

c) Find the velocity of the ball when it hits the ground.

Differentiation - Applications

1) A particle moves so that its distance from the origin, in metres, at time t seconds is given by

$s = t^3 + 5t^2 - 4t$

a) Find an expression for the velocity of the particle. $v = 3t^2 + 10t - 4$

b) Find the velocity of the particle at $t = 2$ $v = 28$ m/s

2) An object moves along a straight line so that its distance from the origin, in metres, at time t seconds is given by

$s = t^3 - 3t^2 + 10t$

a) Find an expression for the velocity of the object. $v = 3t^2 - 6t + 10$

b) Find the velocity of the object at $t = 5$ $v = 55$ m/s

c) Find the acceleration of the object at $t = 3$ $a = 12$ m/s^2

3) An object is moving along a straight line and its velocity (v in m/s) at time t seconds is given by

$v = 3t - 6t^2$

a) Find the velocity of the object at $t = 10$ $v = -570$ m/s

b) Find the acceleration of the object at $t = 2$ $a = -21$ m/s^2

c) Find the time t when the acceleration of the object is zero. $t = 0.25$ s

4) A ball is dropped from the top of a tower.

The height of the ball (h metres) above the ground at t seconds is given by

$h = 108 - 3t^2$

a) What is the height of the tower? $h = 108$ m

b) How long will it take for the ball to hit the ground? $t = 6$ s

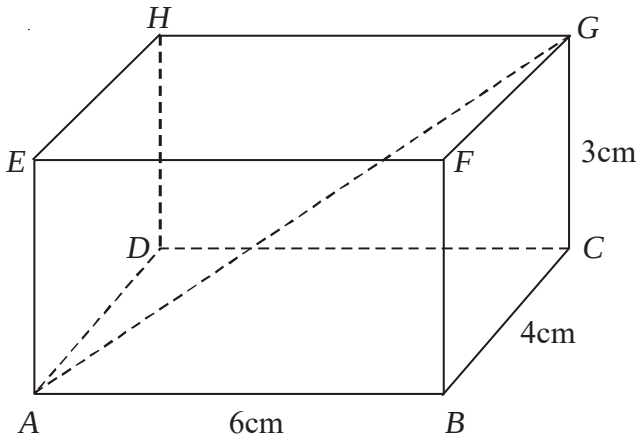
c) Find the velocity of the ball when it hits the ground. $v = -36$ m/s

Pythagoras in 3D

1) The diagram shows a box in the shape of a cuboid.
$AB = 6$cm, $BC = 4$cm, $CG = 3$cm

A string runs diagonally across the box from A to G.

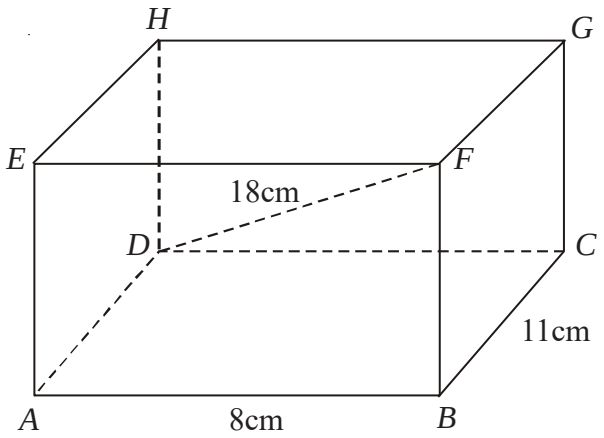
Calculate the length of the string AG.
Give your answer correct to 3 significant figures.



2) The diagram shows a box in the shape of a cuboid.
$AB = 8$cm, $BC = 11$cm

A string runs diagonally across the box from D to F and is 18cm long.

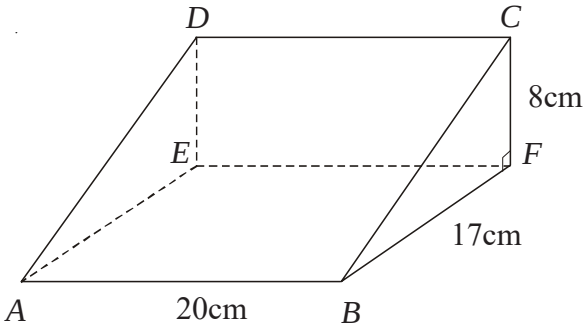
Calculate the length AE.
Give your answer correct to 3 significant figures.



3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.

Calculate the length AC
Give your answer correct to 3 significant figures.

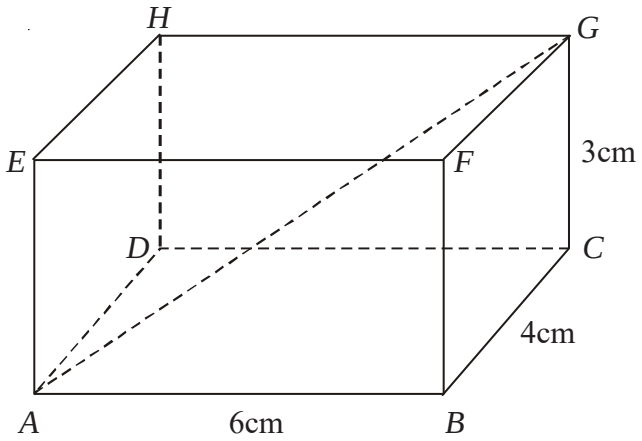


Pythagoras in 3D

1) The diagram shows a box in the shape of a cuboid.
$AB = 6\text{cm}$, $BC = 4\text{cm}$, $CG = 3\text{cm}$

A string runs diagonally across the box from A to G.

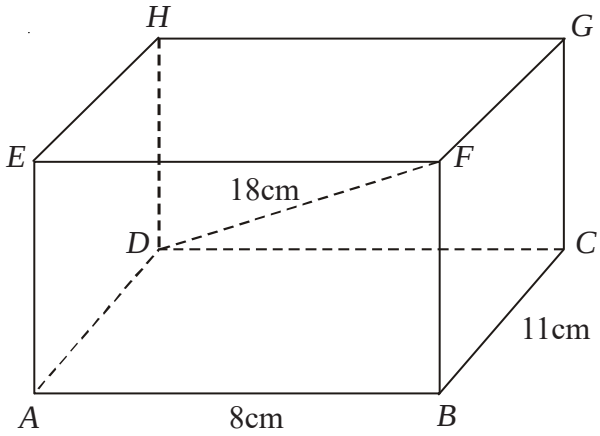
Calculate the length of the string AG.
Give your answer correct to 3 significant figures. 7.81 cm



2) The diagram shows a box in the shape of a cuboid.
$AB = 8\text{cm}$, $BC = 11\text{cm}$

A string runs diagonally across the box from D to F and is 18cm long.

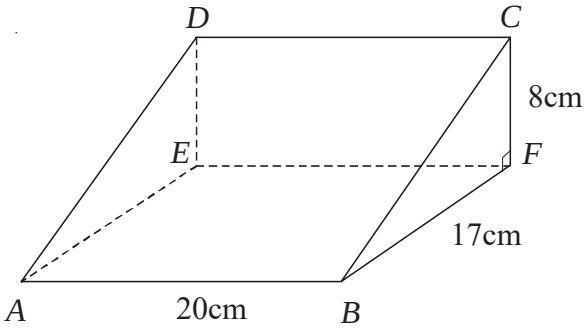
Calculate the length AE. 11.8 cm
Give your answer correct to 3 significant figures.



3) The diagram shows a wedge in the shape of a prism.
Angle BFC is a right angle.

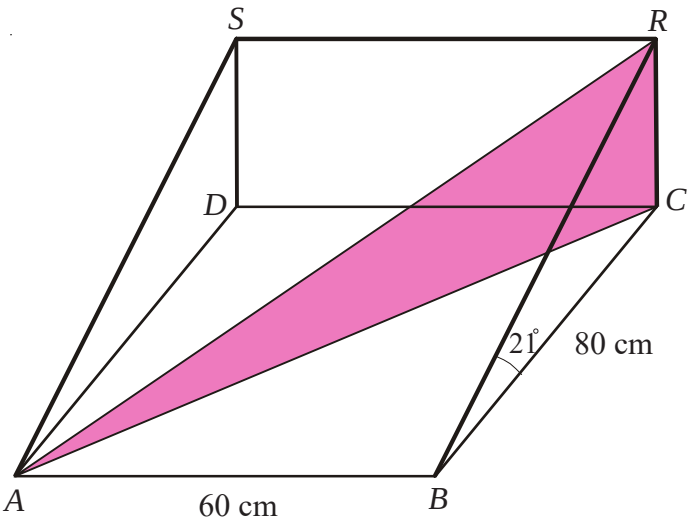
String runs diagonally across the wedge from A to C.

Calculate the length AC
Give your answer correct to 3 significant figures. 27.4 cm



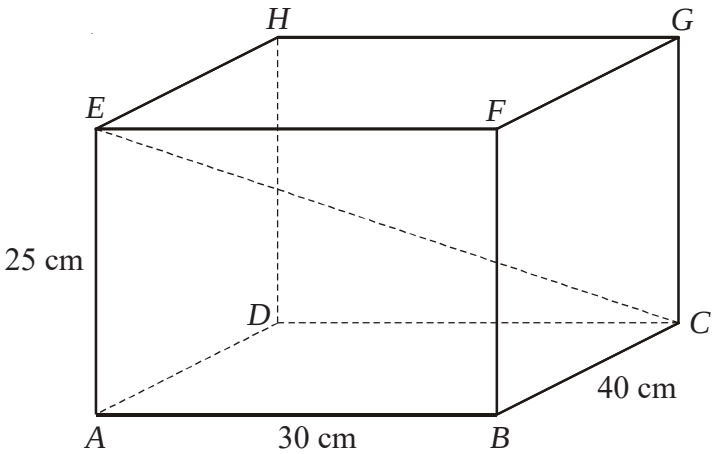
Trigonometry in 3D

1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.



Calculate the angle that *AR* makes with the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.

2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.

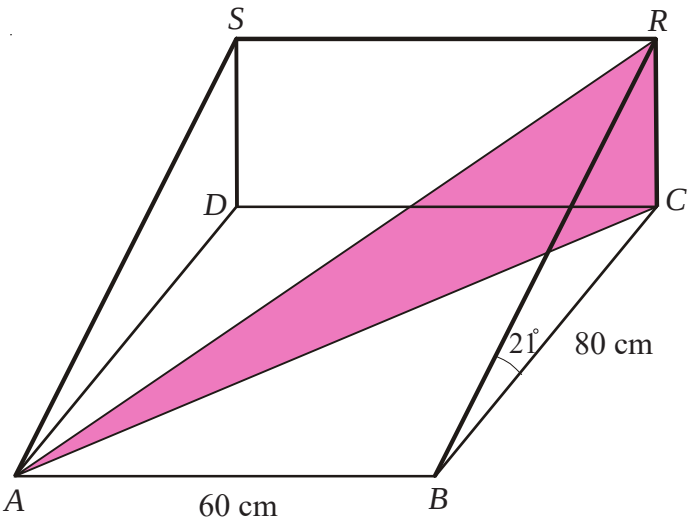


a) Work out the length of the string *CE*.
Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place.

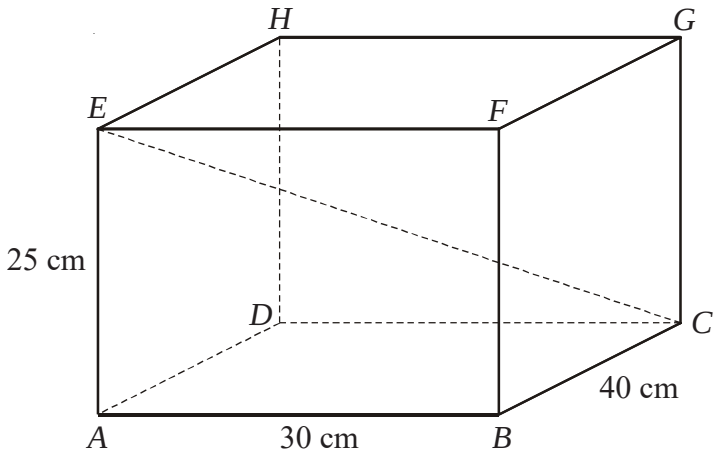
Trigonometry in 3D

1) The diagram shows a wedge.
The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
The sloping face *ABRS* makes an angle of 21° to the horizontal.



Calculate the angle that *AR* makes with the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place. 17.1°

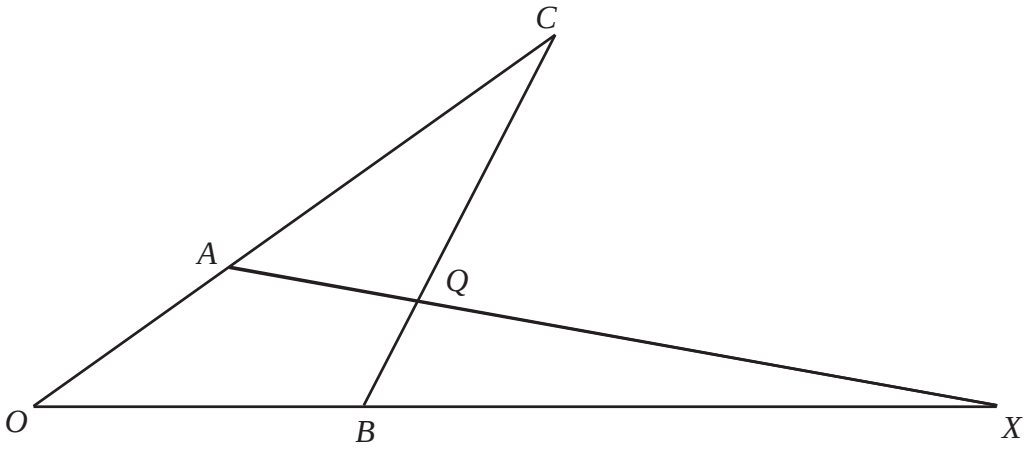
2) The diagram shows a box in the shape of a cuboid.
A string runs diagonally across the box from *C* to *E*.



a) Work out the length of the string *CE*. 55.9 cm
Give your answer correct to 1 decimal place.

b) Work out the angle between the string *CE* and the horizontal plane *ABCD*.
Give your answer correct to 1 decimal place. 26.6°

Vectors



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

OAC, OBX and BQC are all straight lines.

$AC = 2OA$ and $BQ : QC = 1 : 3$

a) Find, in terms of **a** and **b**, the vectors which represent

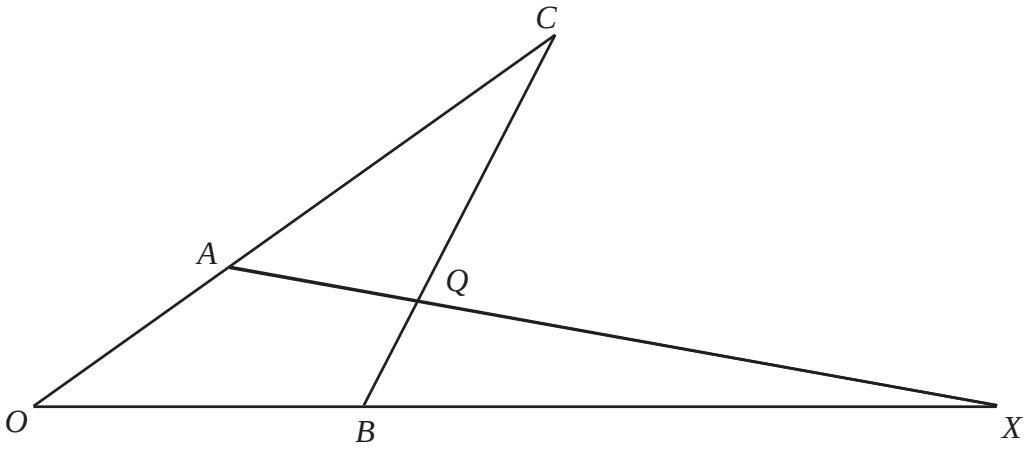
(i) $\overrightarrow{BC}$

(ii) $\overrightarrow{AQ}$

Given that $\overrightarrow{BX} = 8\mathbf{b}$

b) Show that AQX is a straight line.

Vectors



In the diagram,

$\overrightarrow{OA} = 4\mathbf{a}$ and $\overrightarrow{OB} = 4\mathbf{b}$

OAC, OBX and BQC are all straight lines.

$AC = 2OA$ and $BQ : QC = 1 : 3$

a) Find, in terms of **a** and **b**, the vectors which represent

(i) $\overrightarrow{BC}$ $12\mathbf{a} - 4\mathbf{b}$ or $-4\mathbf{b} + 12\mathbf{a}$

(ii) $\overrightarrow{AQ}$ $3\mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + 3\mathbf{b}$

Given that $\overrightarrow{BX} = 8\mathbf{b}$

b) Show that AQX is a straight line.

$\overrightarrow{AQ} = -\mathbf{a} + 12\mathbf{b}$

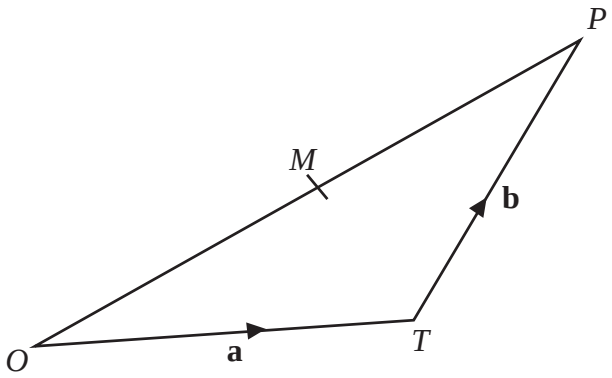
$\overrightarrow{AX} = -4\mathbf{a} + 12\mathbf{b}$

$\overrightarrow{AX} = 4\overrightarrow{AQ}$

Because AX and AQ both start from the same point, AQX is a straight line.

Vectors

1)



OPT is a triangle.
M is the midpoint of *OP*.

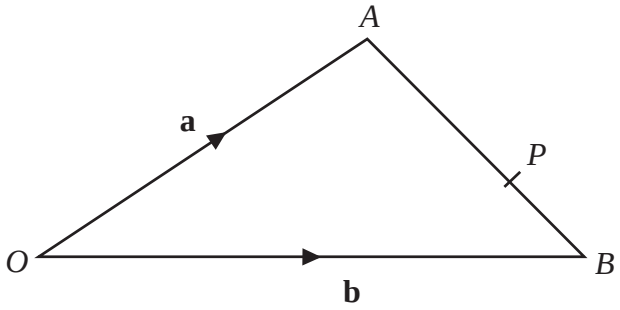
$\overrightarrow{OT} = \mathbf{a}$

$\overrightarrow{TP} = \mathbf{b}$

a) Express $\overrightarrow{OM}$ in terms of **a** and **b**.

b) Express $\overrightarrow{TM}$ in terms of **a** and **b**.
Give your answer in its simplest form.

2)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

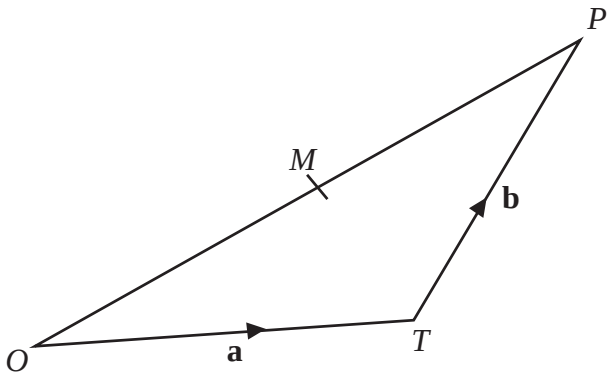
a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

P is the point on *AB* so that $AP : PB = 2 : 1$

b) Find the vector $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

Vectors

1)



OPT is a triangle.
M is the midpoint of *OP*.

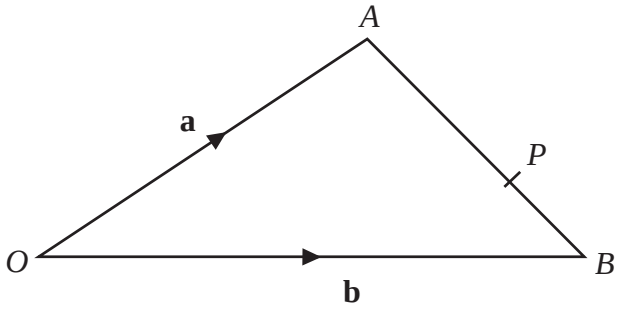
$\overrightarrow{OT} = \mathbf{a}$

$\overrightarrow{TP} = \mathbf{b}$

a) Express $\overrightarrow{OM}$ in terms of **a** and **b**. $\overrightarrow{OM} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

b) Express $\overrightarrow{TM}$ in terms of **a** and **b**. $\overrightarrow{TM} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$
Give your answer in its simplest form.

2)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

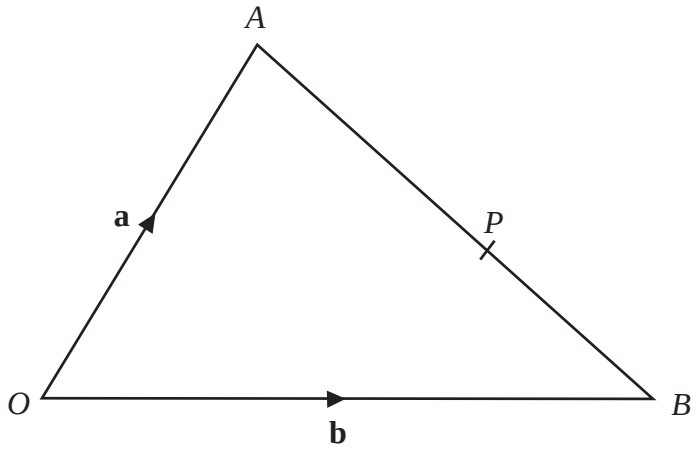
a) Find the vector $\overrightarrow{AB}$ in terms of **a** and **b**. $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

P is the point on *AB* so that $AP : PB = 2 : 1$

b) Find the vector $\overrightarrow{OP}$ in terms of **a** and **b**. $\overrightarrow{OP} = \frac{1}{3}(\mathbf{a} + 2\mathbf{b})$
Give your answer in its simplest form.

Vectors

1)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

a) Find the vector *AB* in terms of **a** and **b**.

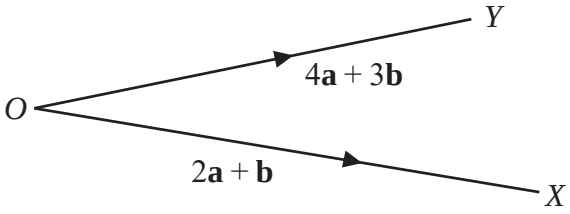
P is the point on *AB* so that $AP : PB = 3 : 2$

b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

2)

$OX = 2\mathbf{a} + \mathbf{b}$

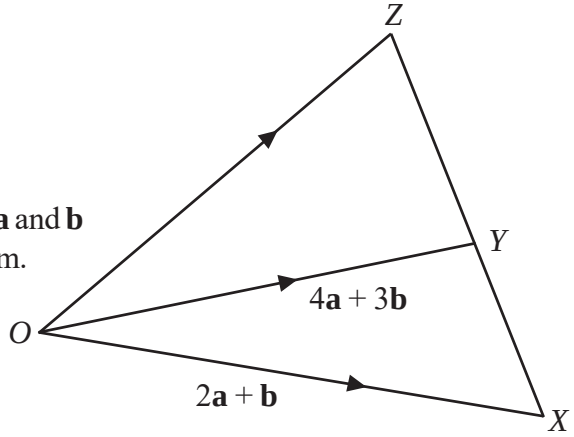
$OY = 4\mathbf{a} + 3\mathbf{b}$



a) Express the vector *XY* in terms of **a** and **b**
Give your answer in its simplest form.

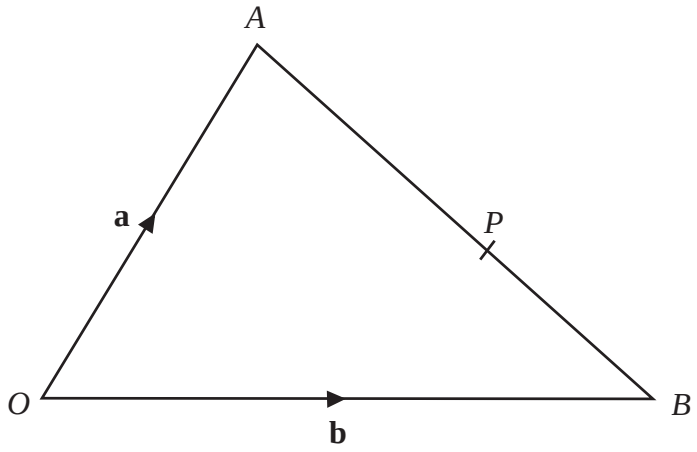
XYZ is a straight line.
$XY : YZ = 2 : 3$

b) Express the vector *OZ* in terms of **a** and **b**
Give your answer in its simplest form.



Vectors

1)



OAB is a triangle.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$

a) Find the vector *AB* in terms of **a** and **b**. $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

P is the point on *AB* so that $AP : PB = 3 : 2$

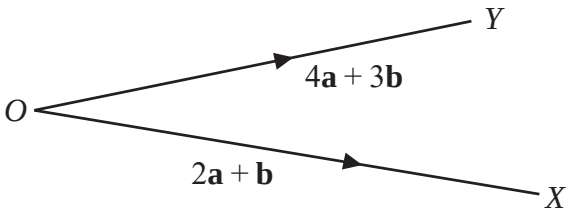
b) Show that $\overrightarrow{OP} = \frac{1}{5}(2\mathbf{a} + 3\mathbf{b})$

$$\begin{aligned}\overrightarrow{OP} &= \overrightarrow{OA} + \overrightarrow{AP} \\ &= \overrightarrow{OA} + \tfrac{3}{5}\overrightarrow{AB} \\ &= \mathbf{a} + \tfrac{3}{5}(\mathbf{b} - \mathbf{a}) \\ &= \mathbf{a} + \tfrac{3}{5}\mathbf{b} - \tfrac{3}{5}\mathbf{a} \\ &= \tfrac{2}{5}\mathbf{a} + \tfrac{3}{5}\mathbf{b} \\ &= \tfrac{1}{5}(2\mathbf{a} + 3\mathbf{b})\end{aligned}$$

2)

$OX = 2\mathbf{a} + \mathbf{b}$

$OY = 4\mathbf{a} + 3\mathbf{b}$

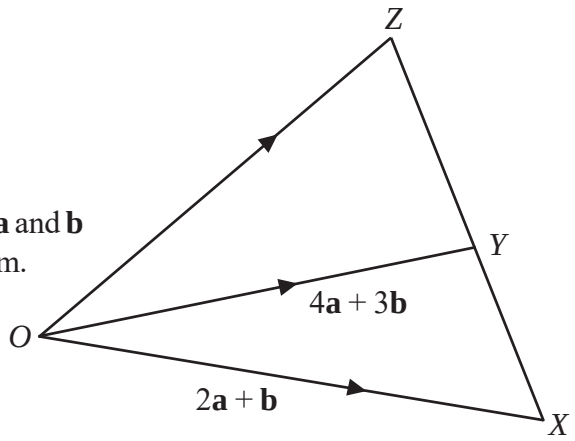


a) Express the vector *XY* in terms of **a** and **b**
Give your answer in its simplest form. $\overrightarrow{XY} = 2(\mathbf{a} + \mathbf{b})$

XYZ is a straight line.
$XY : YZ = 2 : 3$

b) Express the vector *OZ* in terms of **a** and **b**
Give your answer in its simplest form.

$\overrightarrow{OZ} = 7\mathbf{a} + 6\mathbf{b}$



Vectors

1) The diagram shows a trapezium $PQRS$.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.
PS is three times the length of QR.

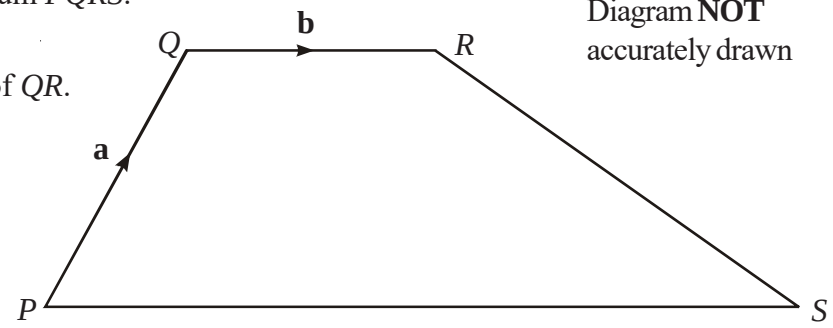


Diagram **NOT** accurately drawn

Find, in terms of **a** and **b**, expressions for

a) $\overrightarrow{QP}$ b) $\overrightarrow{PR}$ c) $\overrightarrow{PS}$ d) $\overrightarrow{QS}$

---

2) In triangle ABC, P and Q are the midpoints of AB and AC.

$\overrightarrow{AP} = \mathbf{p}$ and $\overrightarrow{AQ} = \mathbf{q}$.

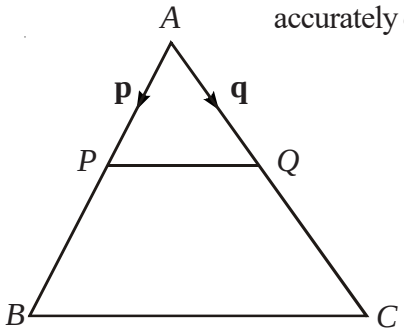


Diagram **NOT** accurately drawn

a) Find, in terms of **p** and **q**, expressions for

(i) $\overrightarrow{PQ}$ (ii) $\overrightarrow{AB}$ (iii) $\overrightarrow{AC}$ (iv) $\overrightarrow{BC}$

b) Use your results from (a) to prove that PQ is parallel to BC.

---

3)

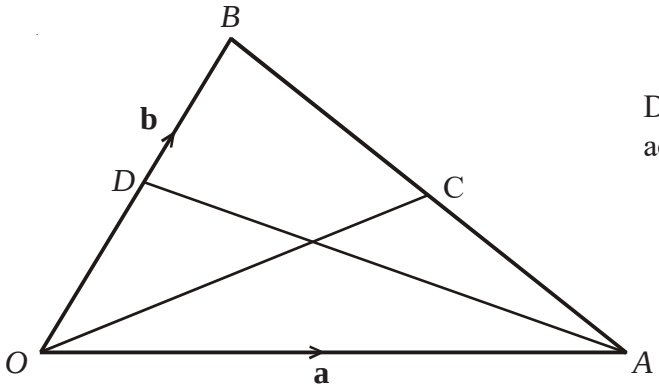


Diagram **NOT** accurately drawn

OAB is a triangle.
D is the midpoint of OB.
C is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(i) Find $\overrightarrow{OC}$ in terms of **a** and **b**.

(ii) Show that DC is parallel to OA.

Vectors

1) The diagram shows a trapezium $PQRS$.
$\overrightarrow{PQ} = \mathbf{a}$ and $\overrightarrow{QR} = \mathbf{b}$.
PS is three times the length of QR.

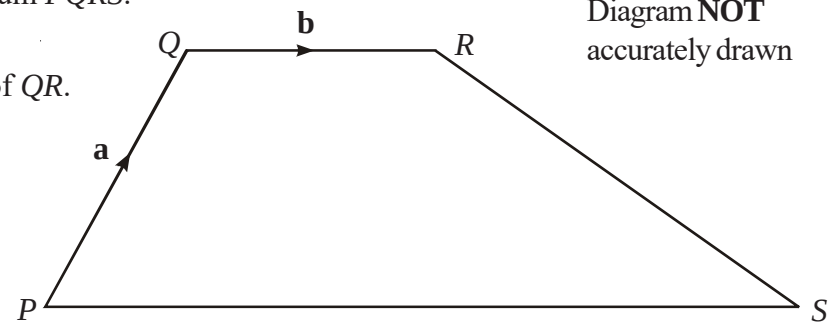


Diagram **NOT** accurately drawn

Find, in terms of **a** and **b**, expressions for

a) $\overrightarrow{QP}$ = -a b) $\overrightarrow{PR}$ = a + b c) $\overrightarrow{PS}$ = 3b d) $\overrightarrow{QS}$ = 3b – a

---

2) In triangle ABC, P and Q are the midpoints of AB and AC.

$\overrightarrow{AP} = \mathbf{p}$ and $\overrightarrow{AQ} = \mathbf{q}$.

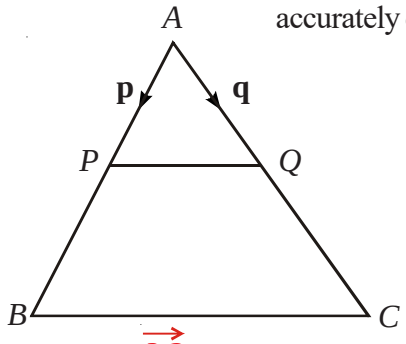


Diagram **NOT** accurately drawn

a) Find, in terms of **p** and **q**, expressions for

(i) $\overrightarrow{PQ}$ q - p (ii) $\overrightarrow{AB}$ 2p (iii) $\overrightarrow{AC}$ 2q (iv) $\overrightarrow{BC}$ 2q - 2p

b) Use your results from (a) to prove that PQ is parallel to BC.

$\overrightarrow{PQ}$ = q – p
$\overrightarrow{BC}$ = 2q – 2p
= 2(q – p)
Therefore $\overrightarrow{PQ}$ is parallel to $\overrightarrow{BC}$

---

3)

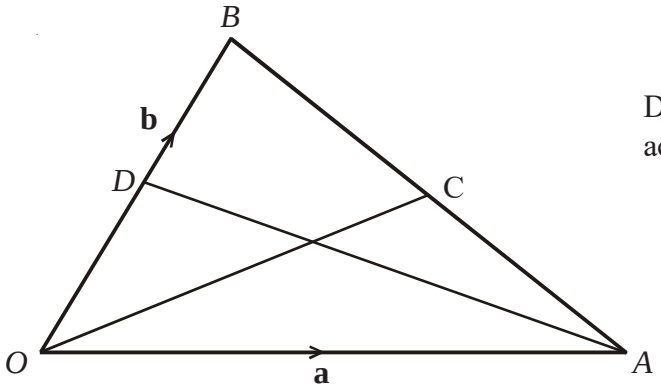


Diagram **NOT** accurately drawn

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D is the midpoint of OB.
C is the midpoint of AB.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$

(i) Find $\overrightarrow{OC}$ in terms of **a** and **b**.
$\overrightarrow{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

(ii) Show that DC is parallel to OA.

$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$
$\overrightarrow{AC} = \frac{1}{2}\overrightarrow{AB}$
$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$
$\overrightarrow{OC} = \mathbf{a} + \frac{1}{2}(-\mathbf{a} + \mathbf{b})$
$\overrightarrow{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

$\overrightarrow{DC} = \overrightarrow{DO} + \overrightarrow{OC}$
$= -\frac{1}{2}\mathbf{b} + \frac{1}{2}(\mathbf{a} + \mathbf{b})$
$= \frac{1}{2}\mathbf{a}$
$\overrightarrow{OA} = \mathbf{a}$ Therefore $\overrightarrow{DC}$ is parallel to $\overrightarrow{OA}$

Vectors

1)

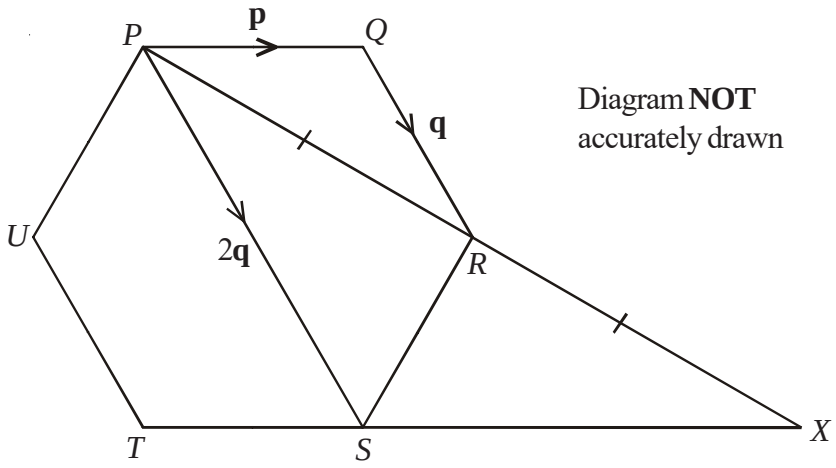

Diagram **NOT** accurately drawn

PQRSTU is a regular hexagon.

$\overrightarrow{PQ} = \mathbf{p}$ $\overrightarrow{QR} = \mathbf{q}$ $\overrightarrow{PS} = 2\mathbf{q}$

a) Find the vector *PR* in terms of **p** and **q**.

$\overrightarrow{PR} = \overrightarrow{RX}$

b) Prove that *PQ* is parallel to *SX*

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2)

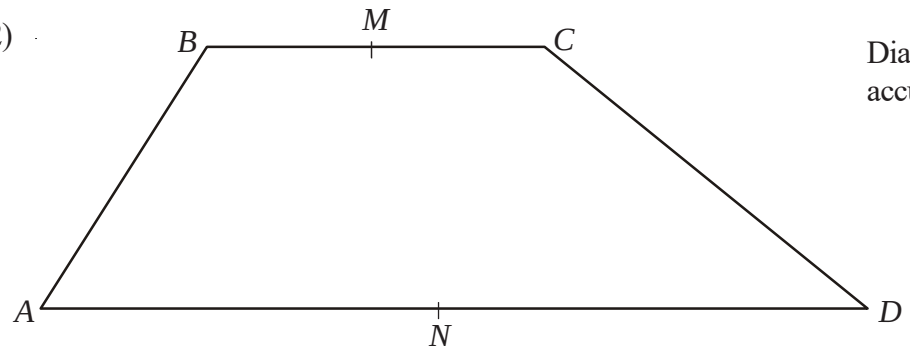

Diagram **NOT** accurately drawn

ABCD is a trapezium with *BC* parallel to *AD*.

$\overrightarrow{AB} = 3\mathbf{b}$ $\overrightarrow{BC} = 3\mathbf{a}$ $\overrightarrow{AD} = 9\mathbf{a}$

M is the midpoint of *BC* and *N* is the midpoint of *AD*.

a) Find the vector *MN* in terms of **a** and **b**.

X is the midpoint of *MN* and *Y* is the midpoint of *CD*.

b) Prove that *XY* is parallel to *AD*.

Vectors

1)

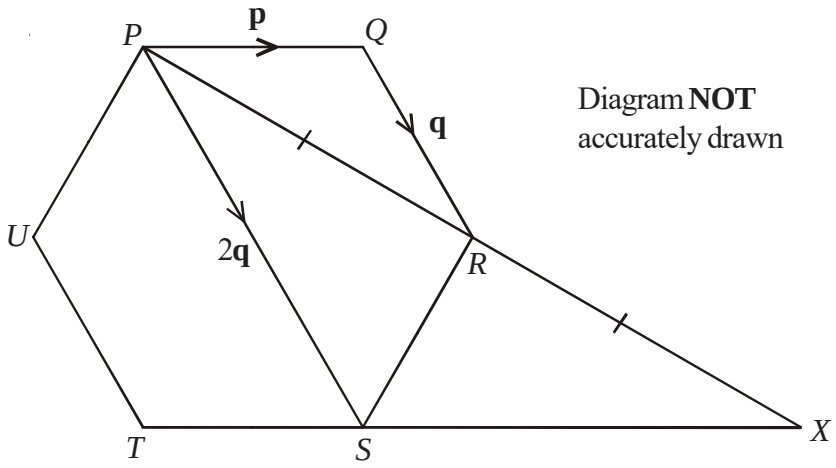

Diagram **NOT** accurately drawn

PQRSTU is a regular hexagon.

$\overrightarrow{PQ} = \mathbf{p}$ $\overrightarrow{QR} = \mathbf{q}$ $\overrightarrow{PS} = 2\mathbf{q}$

a) Find the vector *PR* in terms of **p** and **q**. $\overrightarrow{PR} = \mathbf{p} + \mathbf{q}$

$\overrightarrow{PR} = \overrightarrow{RX}$

b) Prove that *PQ* is parallel to *SX*

$\overrightarrow{SX} = \overrightarrow{SP} + \overrightarrow{PX}$
$= \overrightarrow{SP} + 2\overrightarrow{PR}$
$= -2\mathbf{q} + 2(\mathbf{p} + \mathbf{q})$
$= -2\mathbf{q} + 2\mathbf{p} + 2\mathbf{q}$
$= 2\mathbf{p}$
$\overrightarrow{PQ} = \mathbf{p}$ Therefore $\overrightarrow{PQ}$ is parallel to $\overrightarrow{SX}$

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2)

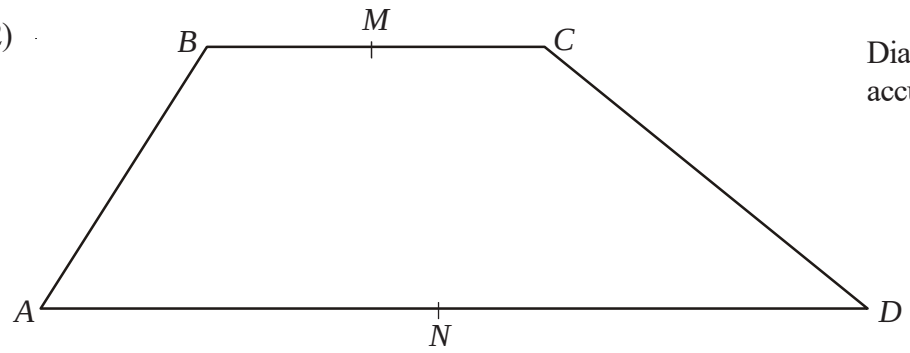

Diagram **NOT** accurately drawn

ABCD is a trapezium with *BC* parallel to *AD*.

$\overrightarrow{AB} = 3\mathbf{b}$ $\overrightarrow{BC} = 3\mathbf{a}$ $\overrightarrow{AD} = 9\mathbf{a}$

M is the midpoint of *BC* and *N* is the midpoint of *AD*.

a) Find the vector *MN* in terms of **a** and **b**.

$\overrightarrow{MN} = 3\mathbf{a} - 3\mathbf{b}$

X is the midpoint of *MN* and *Y* is the midpoint of *CD*.

b) Prove that *XY* is parallel to *AD*.

$\overrightarrow{XY} = \overrightarrow{XN} + \overrightarrow{ND} + \overrightarrow{DY}$
$= \frac{1}{2}\overrightarrow{MN} + \overrightarrow{ND} + \overrightarrow{DY}$
$= \frac{1}{2}(3\mathbf{a} - 3\mathbf{b}) + 4\frac{1}{2}\mathbf{a} + \overrightarrow{DY}$
$= 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + \overrightarrow{DY}$

$\overrightarrow{DY} = \frac{1}{2}\overrightarrow{DC}$
$= \frac{1}{2}(\overrightarrow{DA} + \overrightarrow{AB} + \overrightarrow{BC})$
$= -4\frac{1}{2}\mathbf{a} + 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{a}$
$= 1\frac{1}{2}\mathbf{b} - 3\mathbf{a}$

$\overrightarrow{XY} = 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{b} - 3\mathbf{a}$
$= 3\mathbf{a}$
Therefore $\overrightarrow{XY}$ is parallel to $\overrightarrow{AD}$