2015 GCSE Syllabus Worksheets

Foundation Worksheets

Grades 1 to 5

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Grade 2

Grade 3

Grade 4

Grade 5

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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:

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

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 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

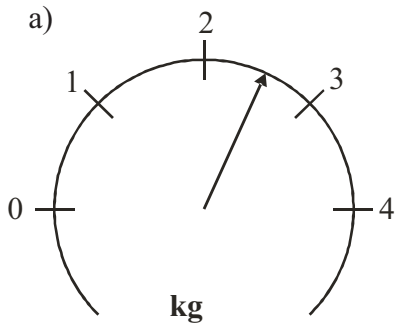
5) Put these numbers in order, starting with the smallest:

5.004, 4.889, 4.099, 5.002, 4.095

Reading Scales

1) Estimate the reading on each of these scales:

a)



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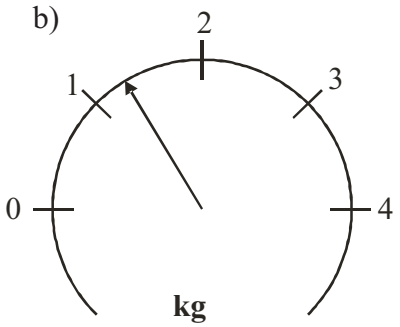

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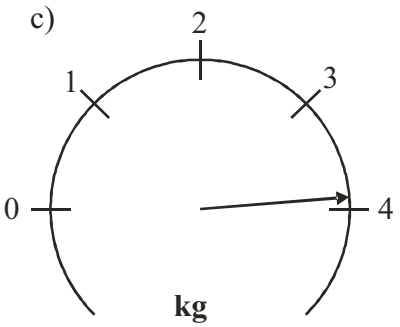

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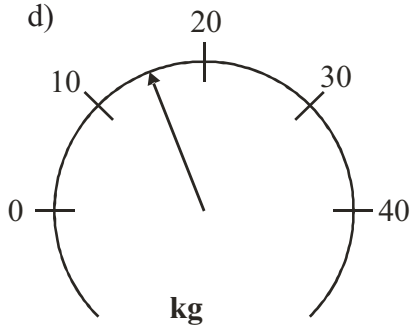

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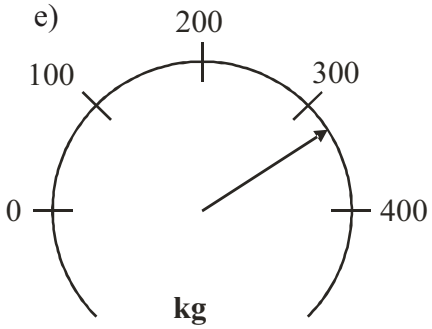

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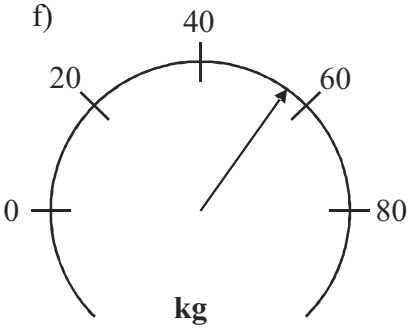
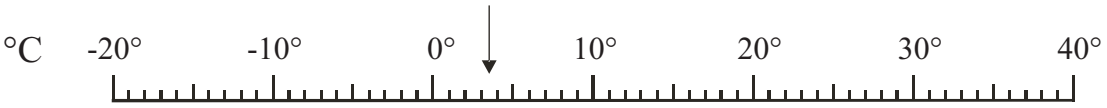


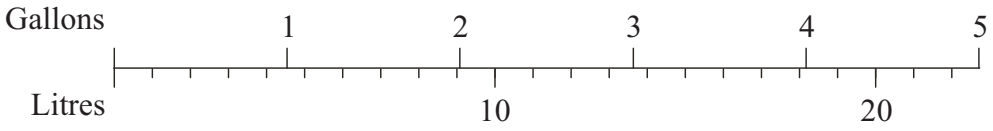
2) This scale shows degrees Centigrade.



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.

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

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?

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.

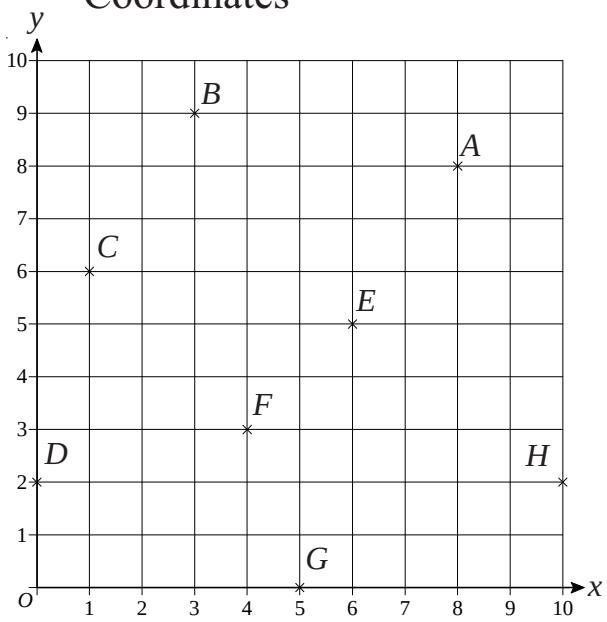
4) Write the following using algebraic notation:

   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.

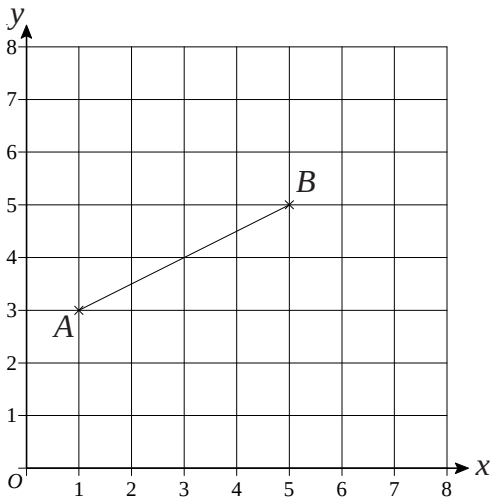
Coordinates

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*.

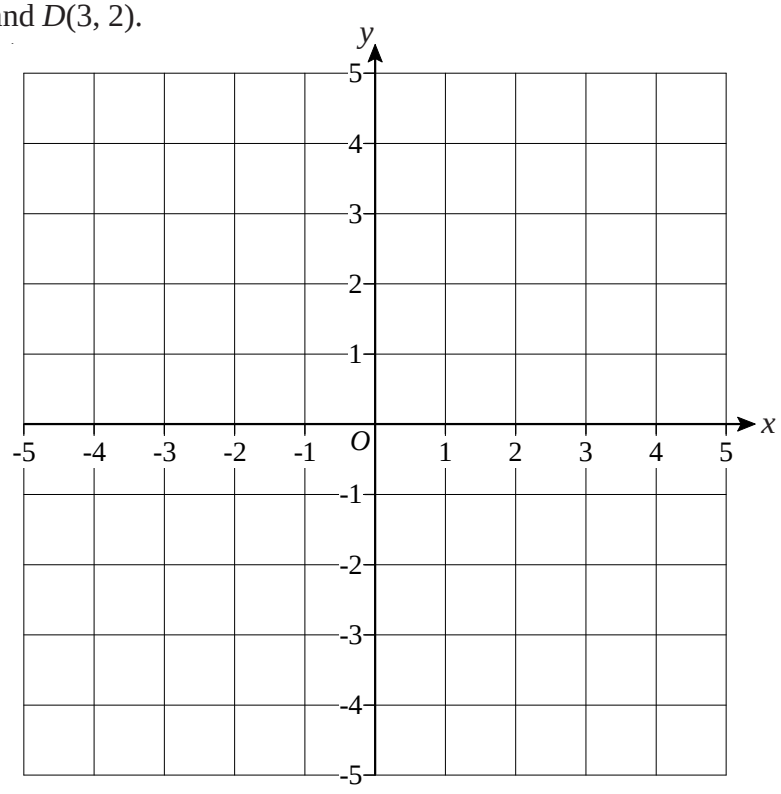
4) Using the same pair of axes,

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*.



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°

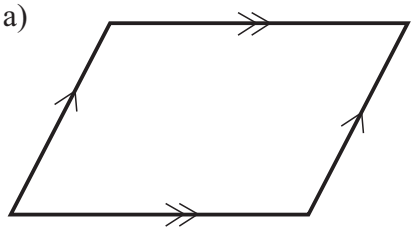
b) A right-angled triangle

c) A scalene triangle

d) An isosceles triangle

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

a)



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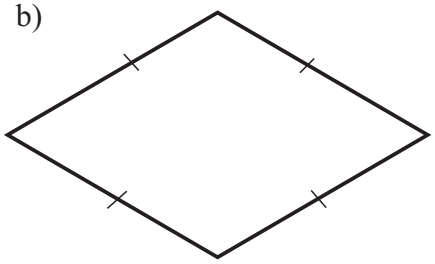

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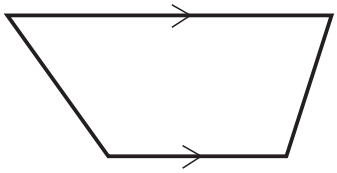

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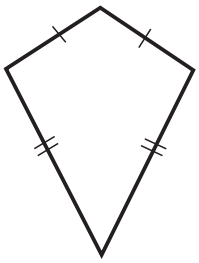
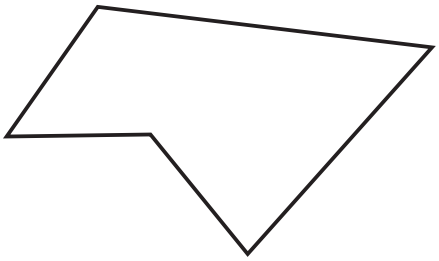


Polygons

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

a)



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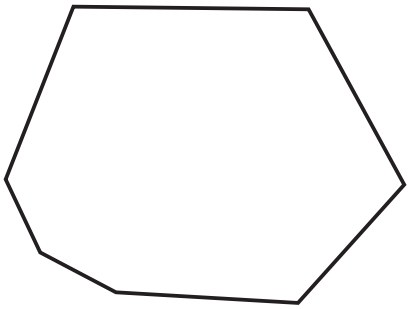


2) a) What is the name given to a 10-sided shape?

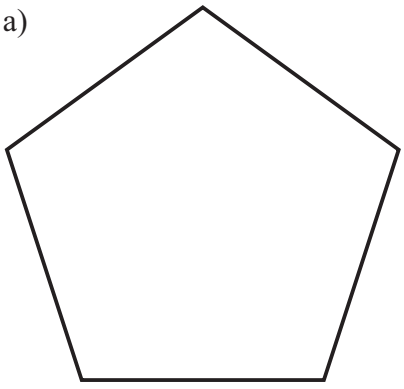
b) What is the name given to an 8-sided shape?

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)



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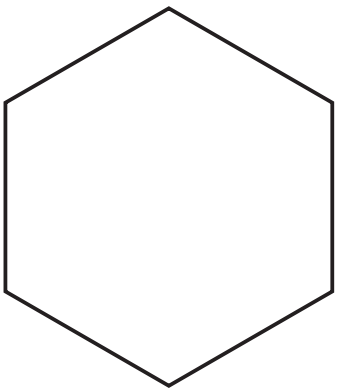
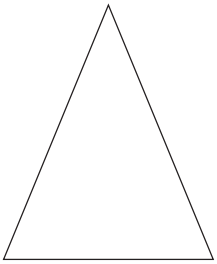
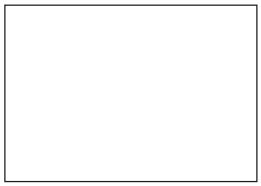


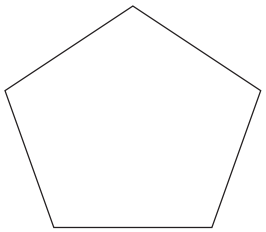
Symmetries

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

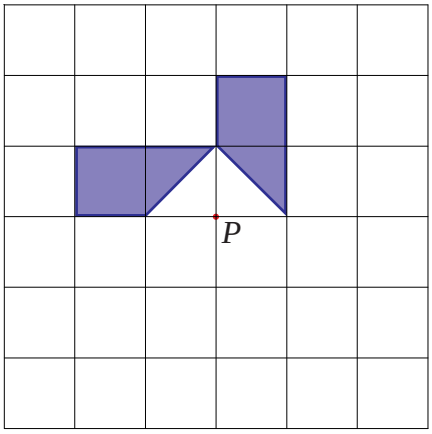




2) What is the order of rotational symmetry of the two shapes below?



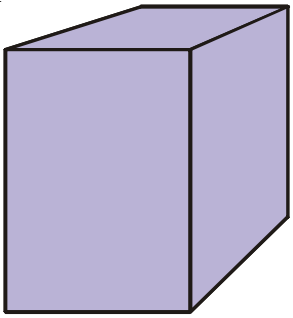
3) The diagram below, shows part of a shape.

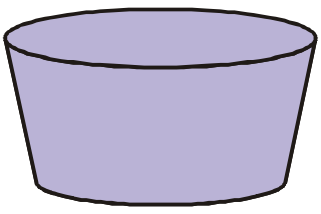


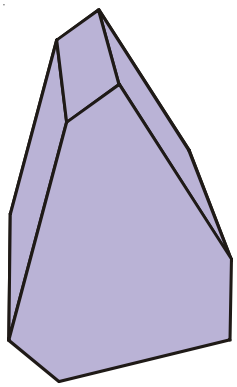
The shape has rotational symmetry of order 4 about point *P*.

Complete the shape.

4) On each of the shapes below, draw one plane of symmetry.

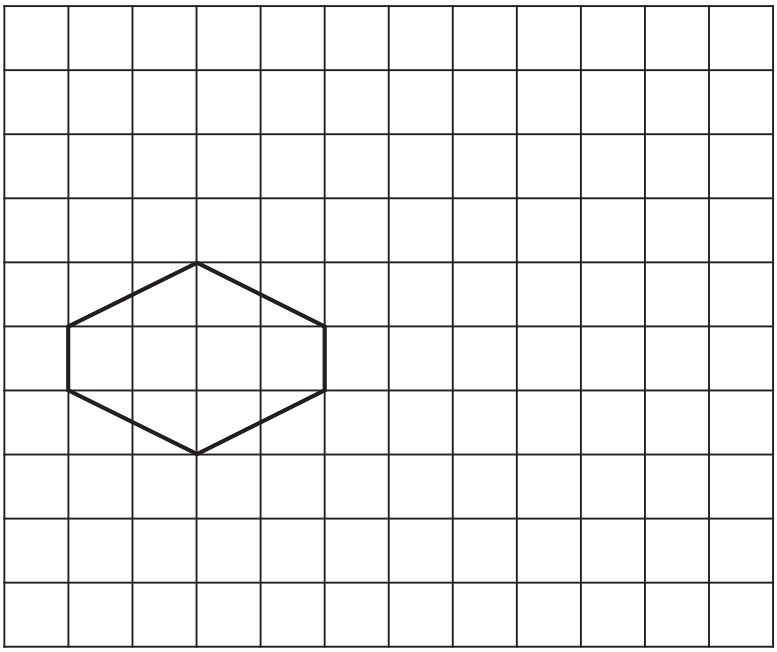






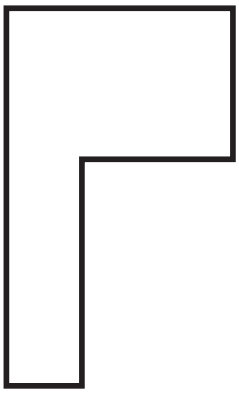
Tessellations and Congruent Shapes

1) Show how this shape will tessellate.
You must draw six more shapes.

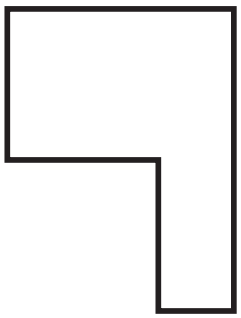


2) Two of these shapes are congruent.
Which are they?

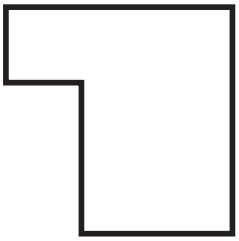
a)



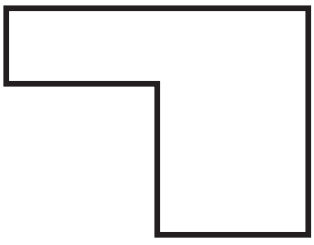
b)



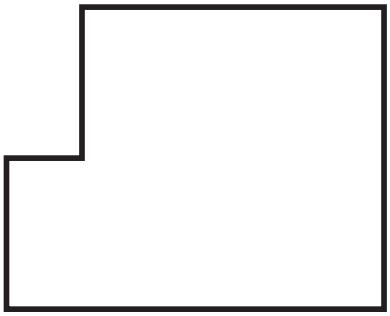
c)



d)



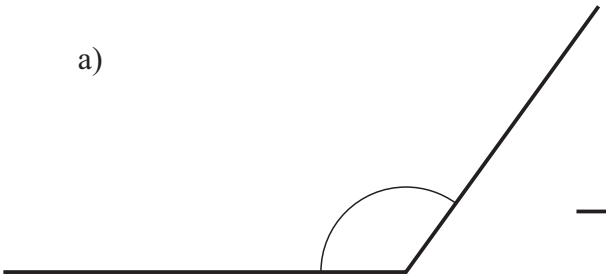
e)



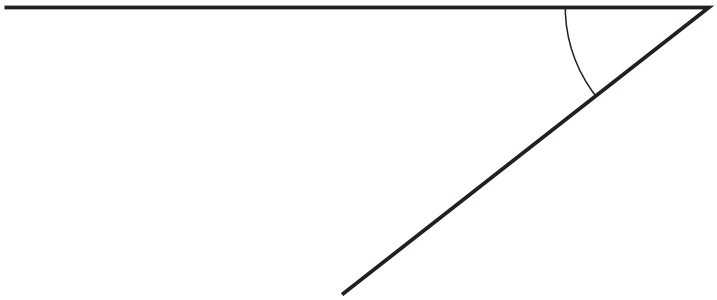
Names of Angles

1) Write the name of each angle, below.

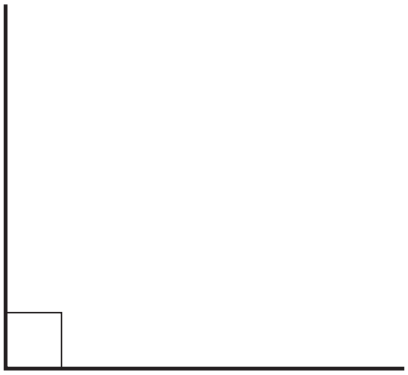
a)



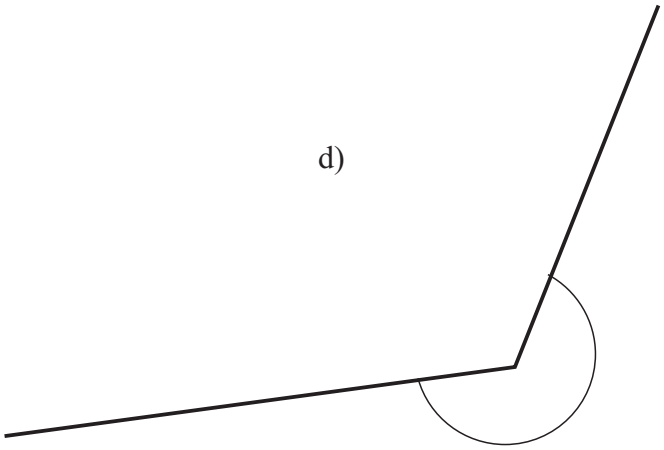
b)



c)



d)



2) Draw a triangle which contains:

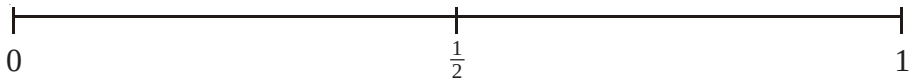
a) Three acute angles.

b) One obtuse angle and two acute angles.

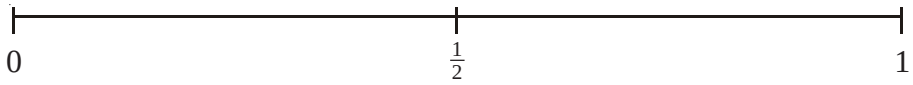
c) A right angle.

The Probability Scale

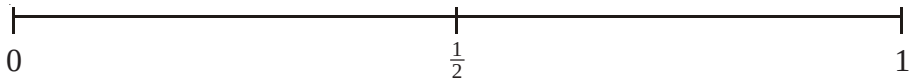
1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.



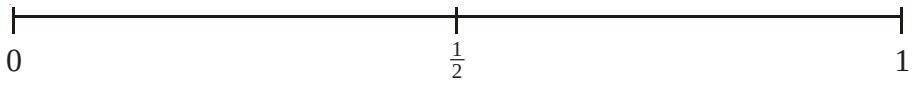
b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.



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



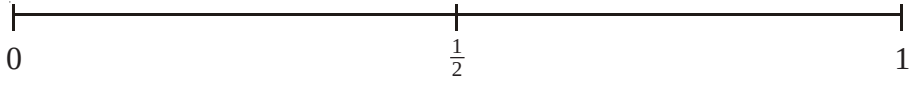
d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.



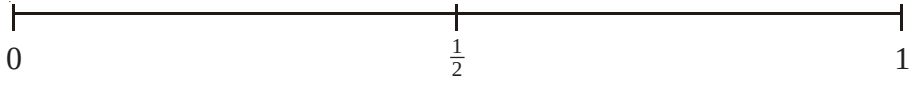
2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

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

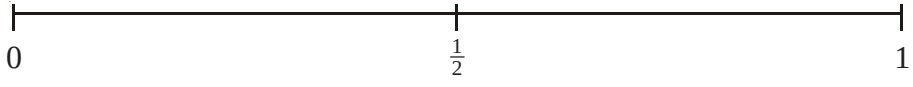
a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.



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

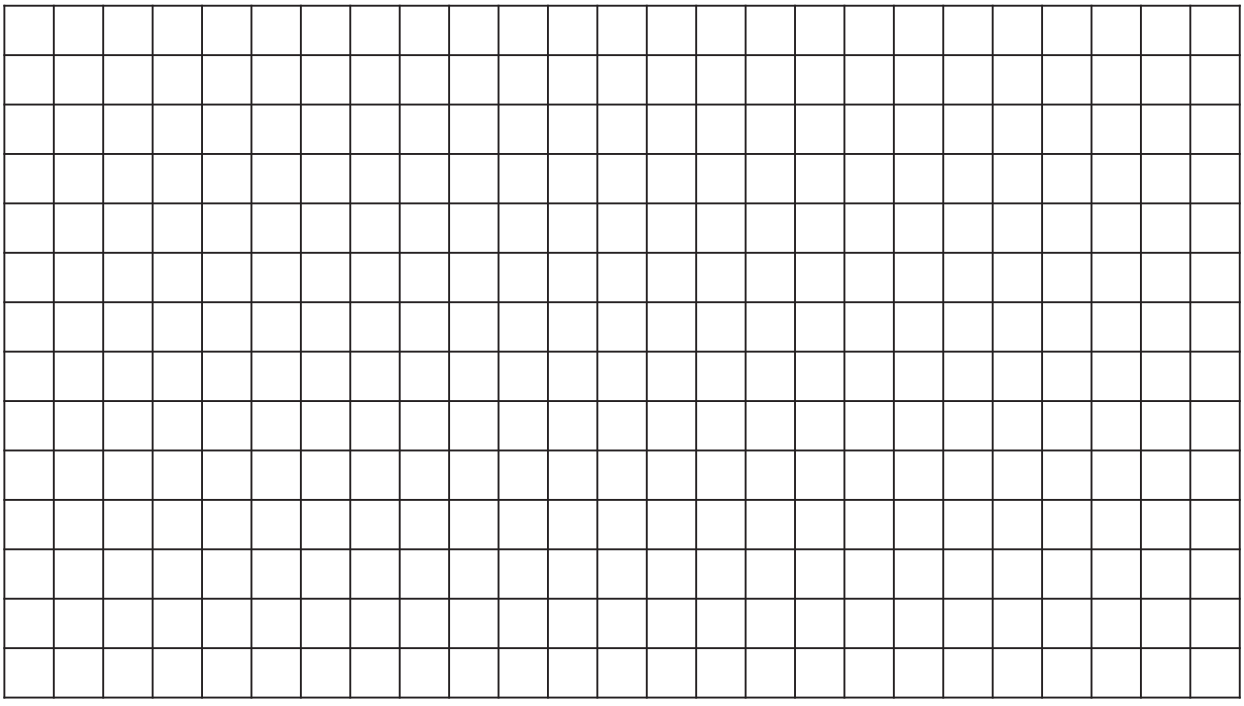
Thursday 40 mins

Friday 20 mins

Saturday 50 mins

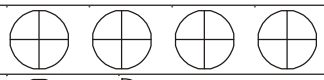
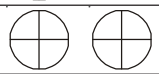
Sunday 40 mins

Draw a bar chart to show this information.



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.

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

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

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?

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.

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

b) $46 - 13 = 33 \longrightarrow \square \quad \square = 46$

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

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

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

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?

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.

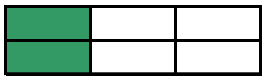
c) Which planet has a temperature 30°C lower than Saturn?

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

Introduction to Fractions

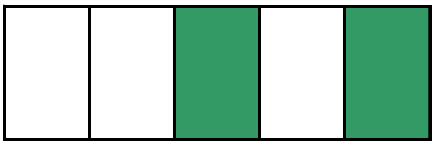
1) What fraction of each of the following shapes is shaded?

a)

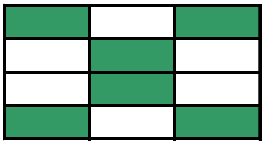


b)

c)

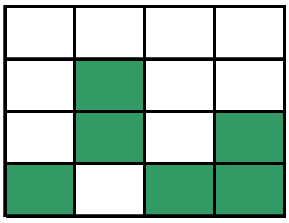


d)



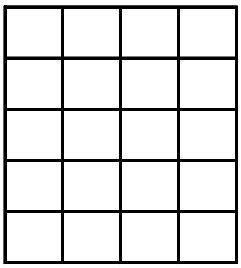
e)

f)

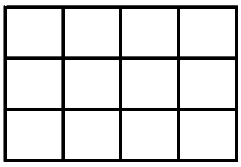


2) Shade the given fraction in the following grids.

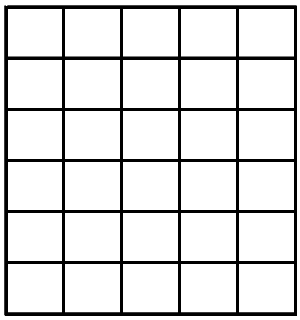
$\frac{3}{5}$



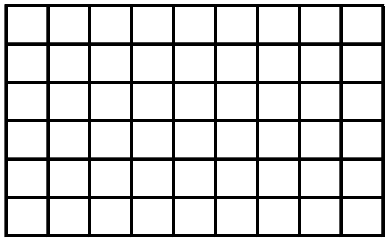
$\frac{1}{4}$

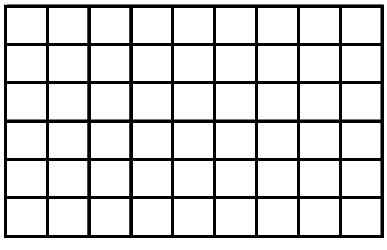


$\frac{4}{6}$



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

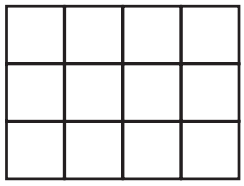
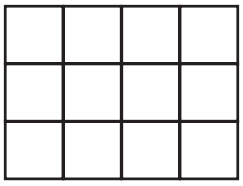
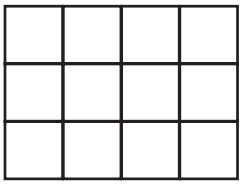




Equivalent Fractions

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

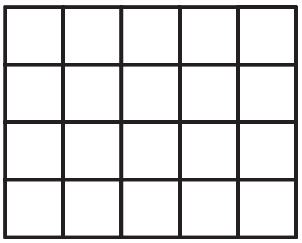
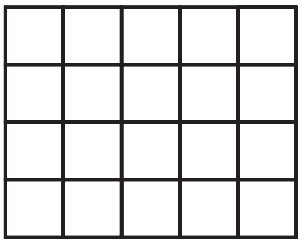
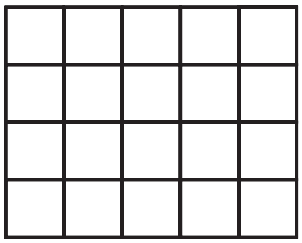
a) Shade the grids to show these fractions.

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

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 $\frac{25}{56}$?

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) $\frac{72}{96}$

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?

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

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

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 =

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) 5842

   g) 9875

   h) 13758

2) Round these numbers to the nearest 100:

   a) 78

   b) 223

   c) 549

   d) 1450

   e) 1382

   f) 4537

   g) 9193

   h) 17625

3) Round these numbers to the nearest 1000:

   a) 850

   b) 1455

   c) 3230

   d) 7500

   e) 8455

   f) 9690

   g) 12390

   h) 28910

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.

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 - 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 - 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

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

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	

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

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?

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.

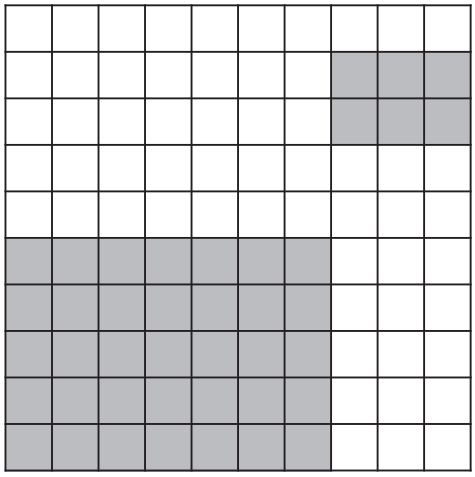
a) Work out how much caster sugar he uses.

Sid makes a pineapple sorbet.
He uses 2 lemons.

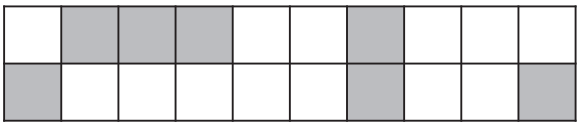
b) Work out how many people he makes pineapple sorbet for.

Introduction to Percentages

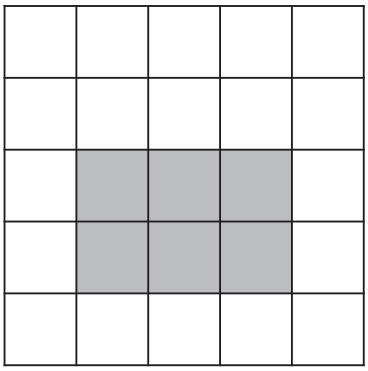
1) What percentage of this grid is shaded?



2) What percentage of this grid is shaded?

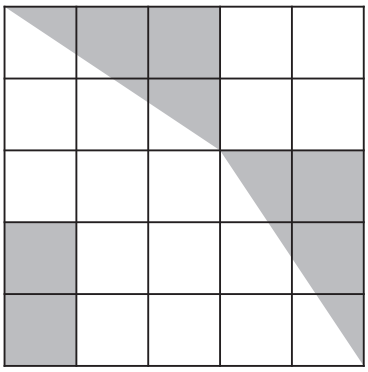


3) a) What percentage of this grid is shaded?



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

4) What percentage of this grid is shaded?



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.

Introduction to Proportion

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.

8) 1 person can cut a large area of grass in 5 hours.
How long would it take 2 people to cut the grass?

9) 5 people take 12 hours to build a wall.
How long would it take 3 people to build the wall?

10) 9 people can paint a bridge in 5 hours.
How long would it take 2 people to paint the bridge?

Properties of Solids

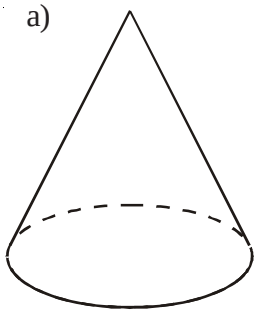
1) Draw a sketch of each of the following solids:

   a) A cube.

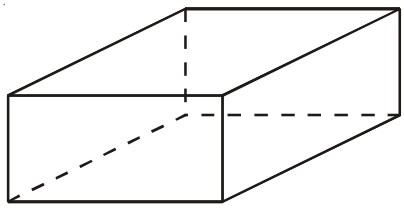
   b) A cylinder.

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

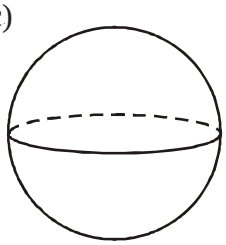
a)



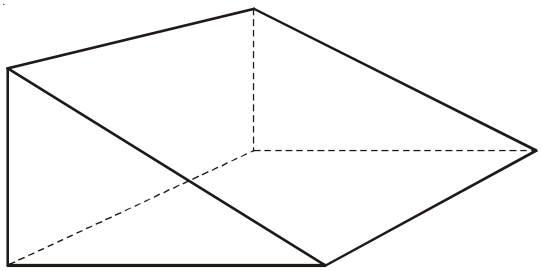
b)



c)



3) Look at this solid.



   a) What is its name?

   b) How many vertices does it have?

   c) How many edges are there?

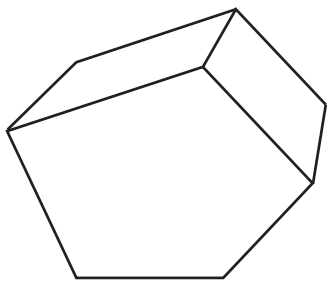
   d) How many faces does it have?

4) This is a picture of a pentagonal prism.

   a) How many faces does it have?

   b) How many edges does it have?

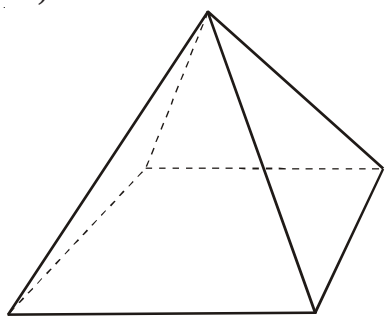
   c) How many vertices does it have?



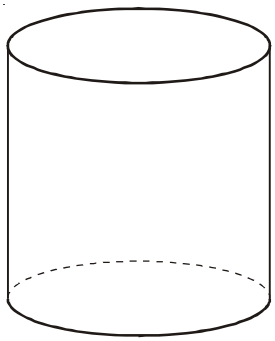
Nets

1) Sketch nets of these solids.

a)

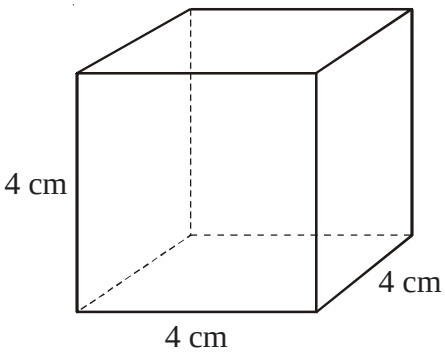


b)

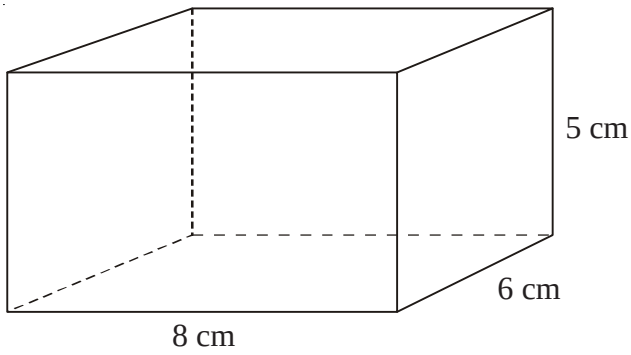


2) On squared paper draw accurate nets of these solids.

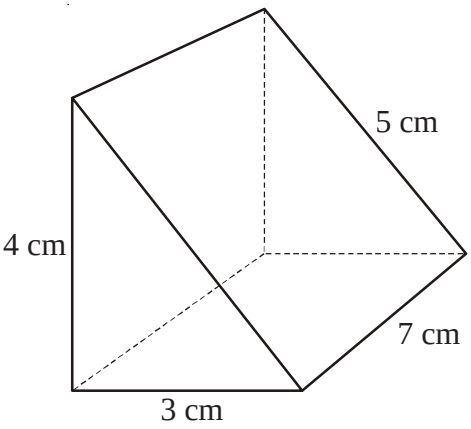
a) **Cube**



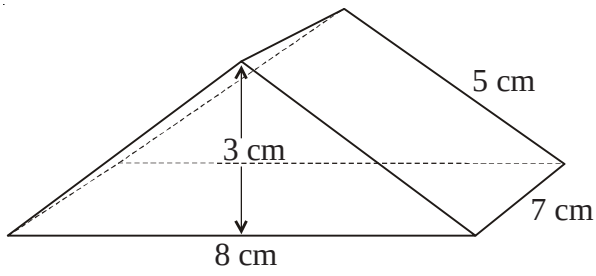
b) **Cuboid**



c) **Right-angled triangular prism**

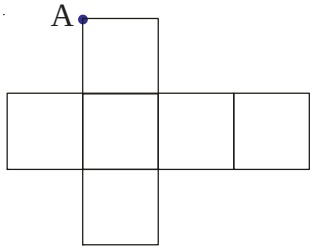


d) **Triangular prism**

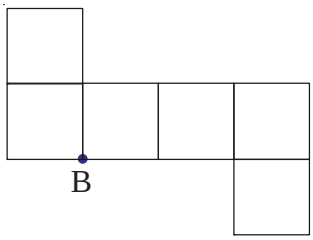


3) The two nets, below, are folded to make cubes.
Two other vertices will meet at the the dot, A. Mark them with As.
One other vertex will meet the dot B. Mark it with B.

a)

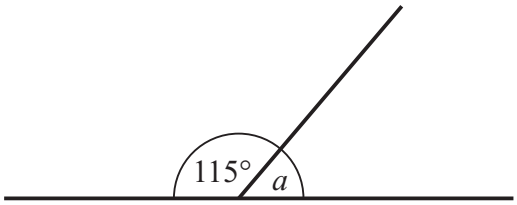


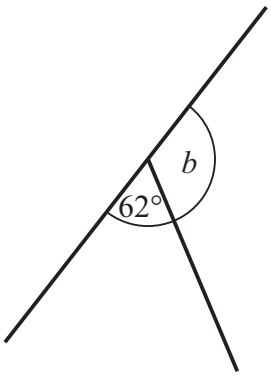
b)

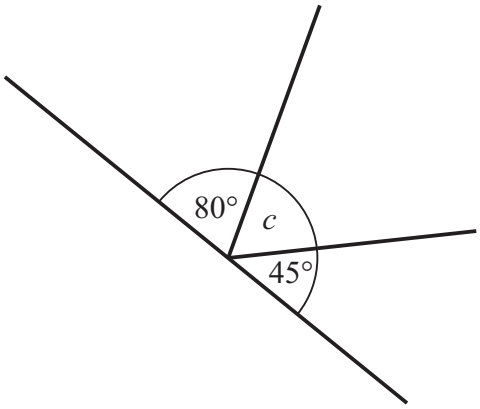


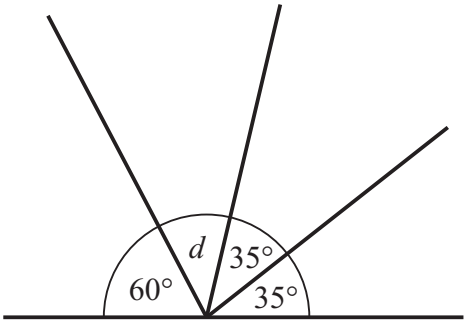
Angles on a Line and at a Point

1) Work out the values of the unknown angles.

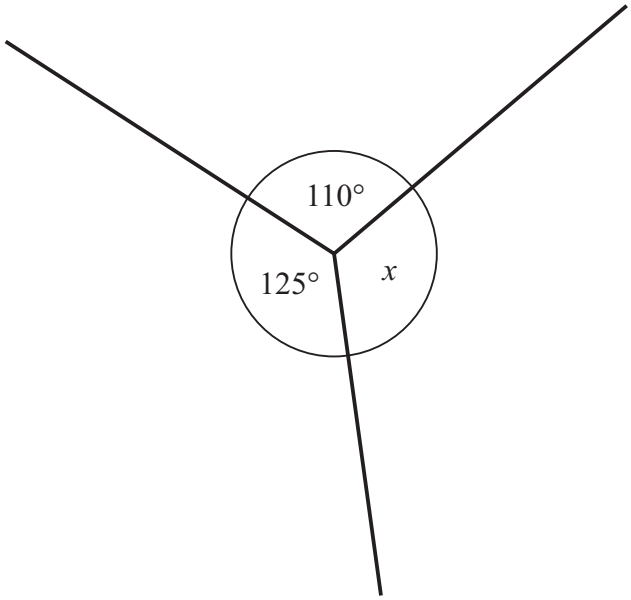


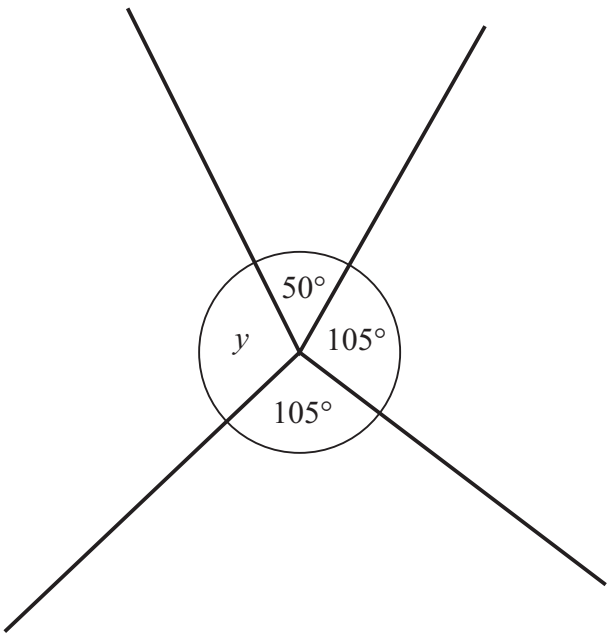






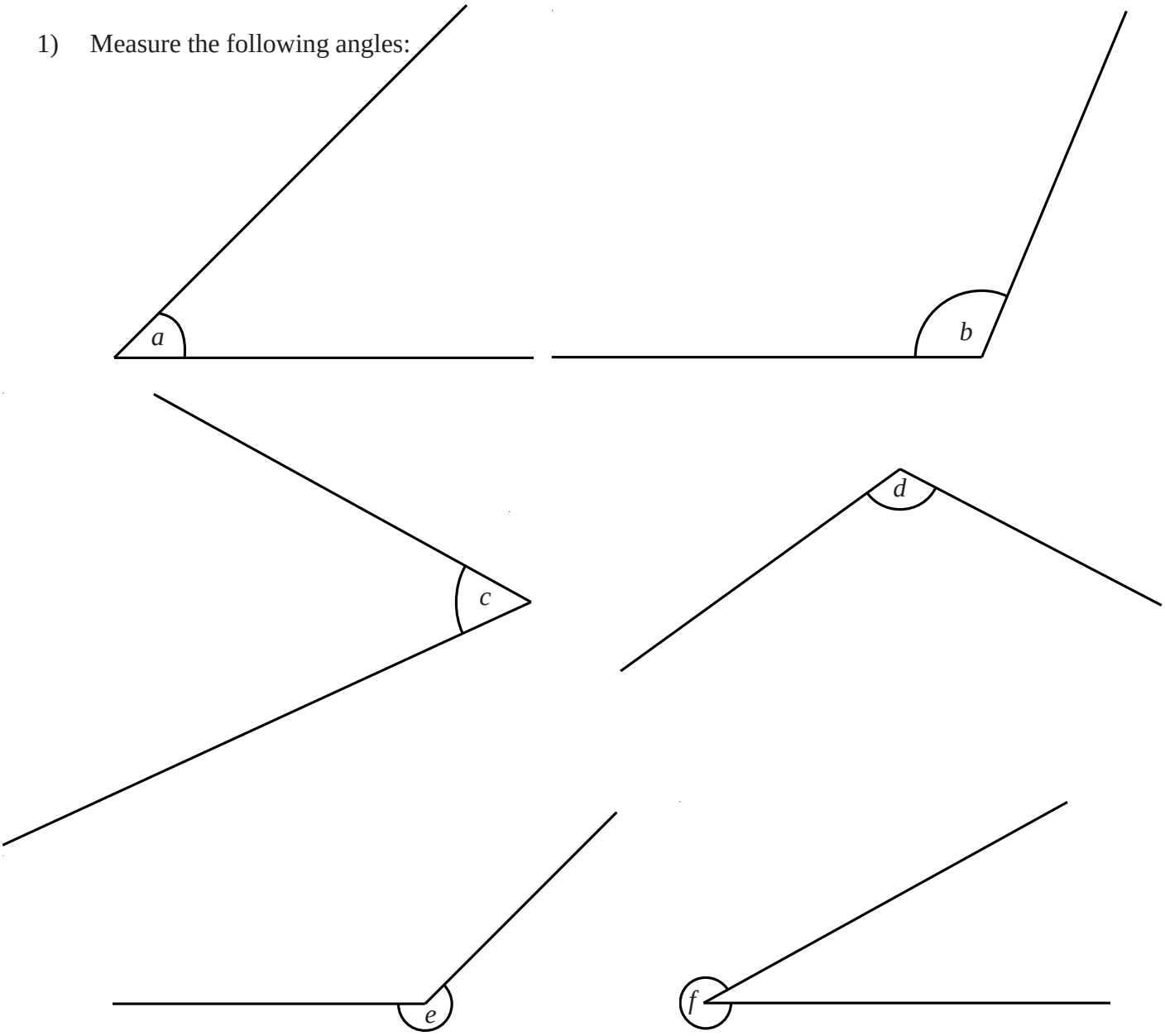
2) Work out the values of the unknown angles.





Measuring and Drawing Angles

1) Measure the following angles:

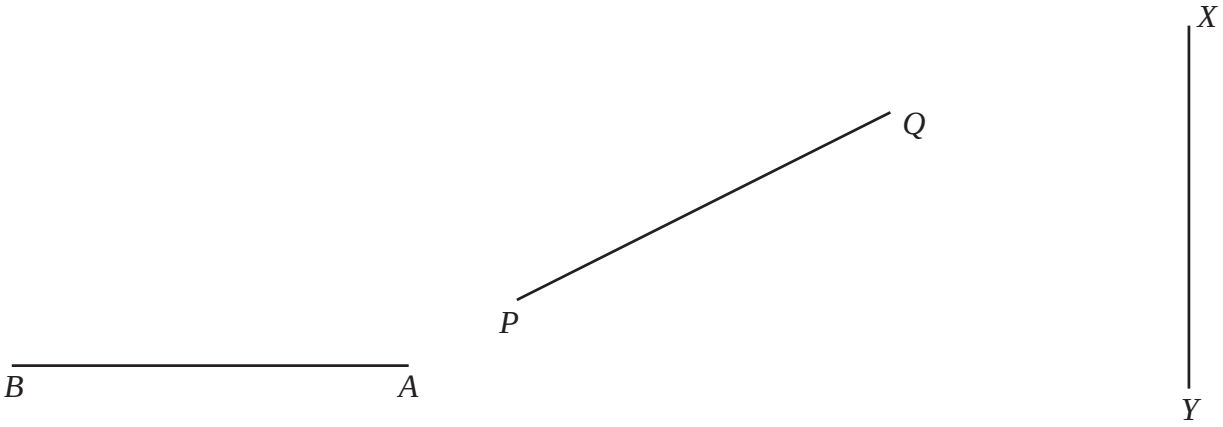


2) Draw the following angles:

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*.

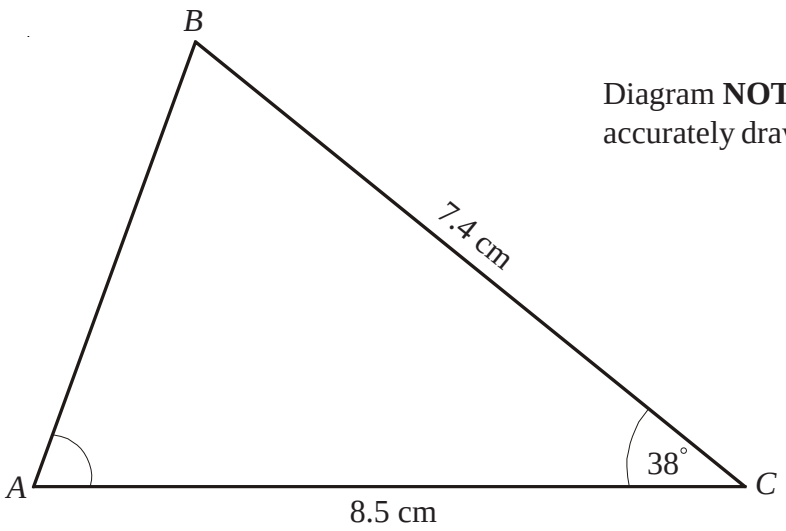


Diagram **NOT** accurately drawn

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*.

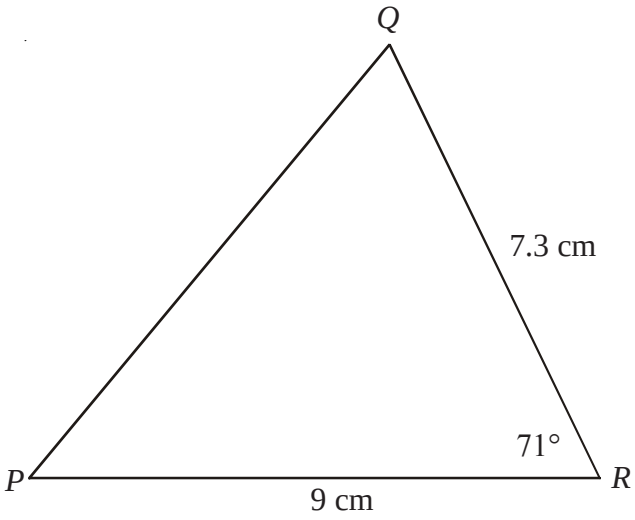


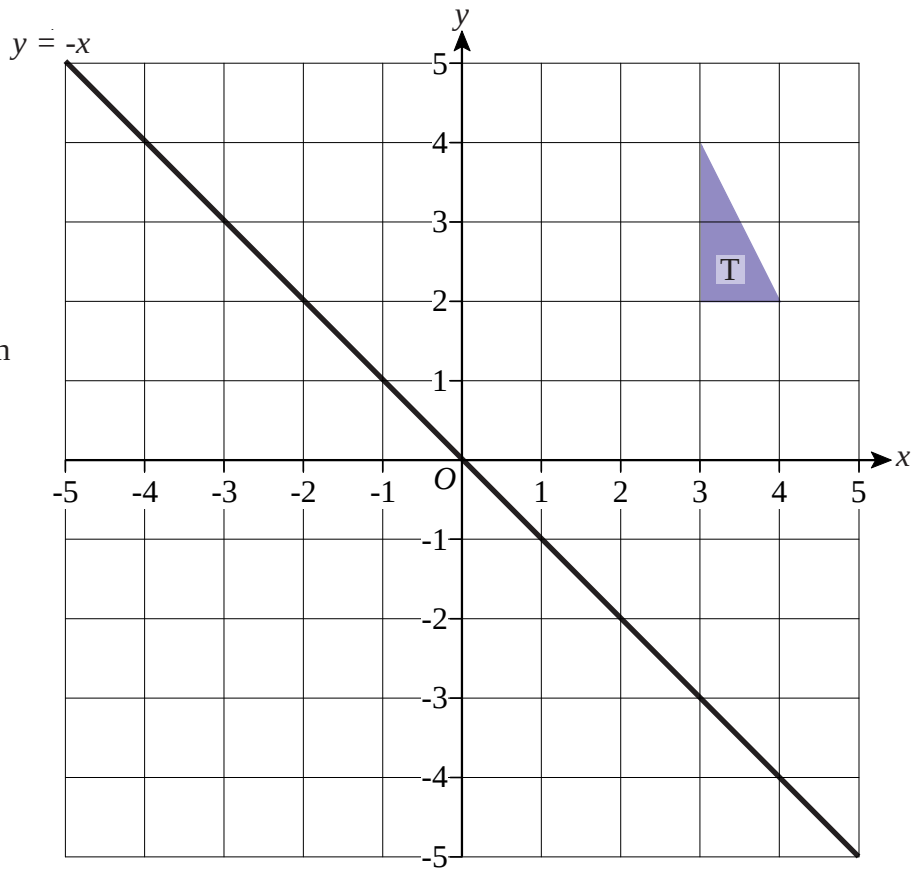
Diagram **NOT** accurately drawn

Make an accurate drawing of triangle *PQR*.

Reflections

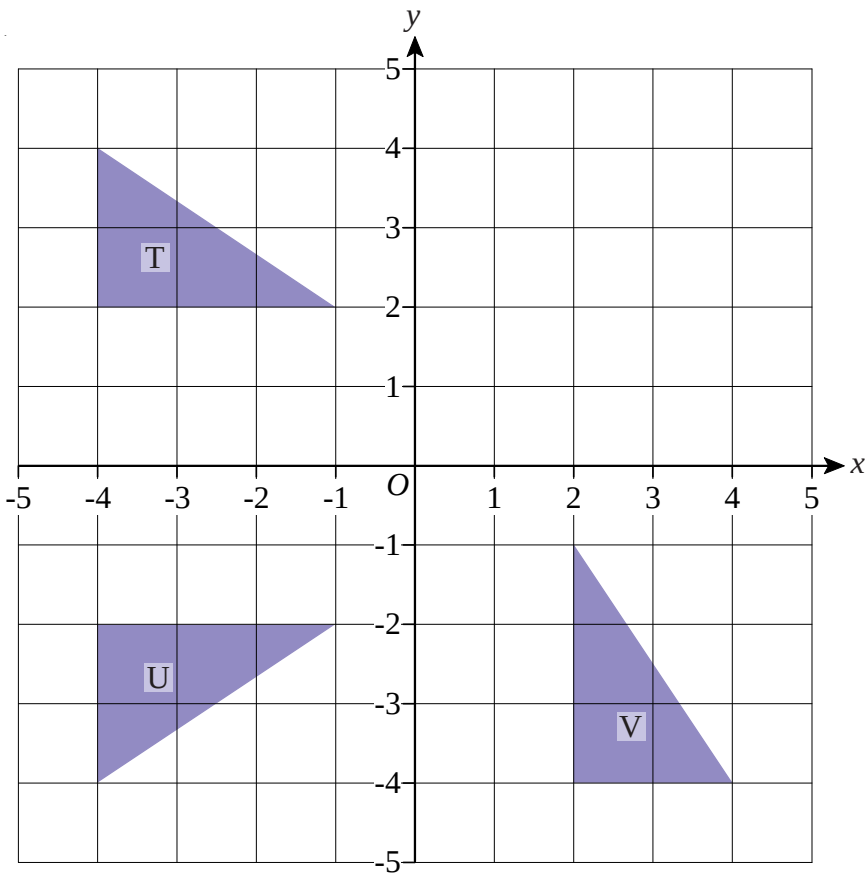
1) a) Reflect triangle T in the *x* axis.
Label your new triangle U.

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.

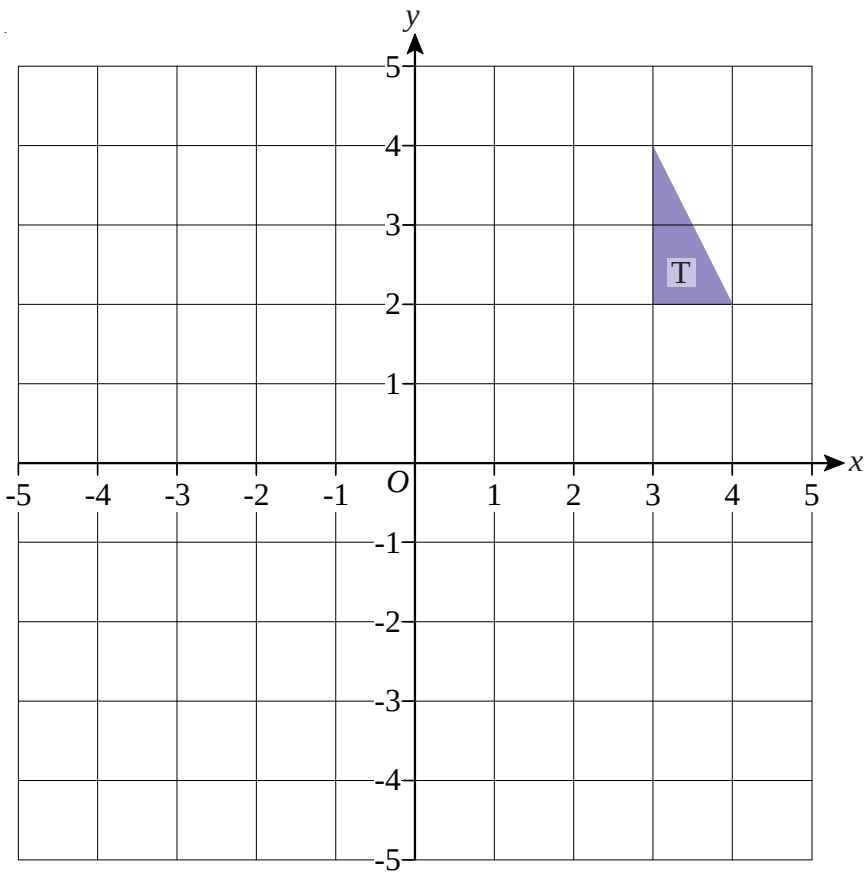
b) Describe fully the single transformation which maps triangle T to triangle V.



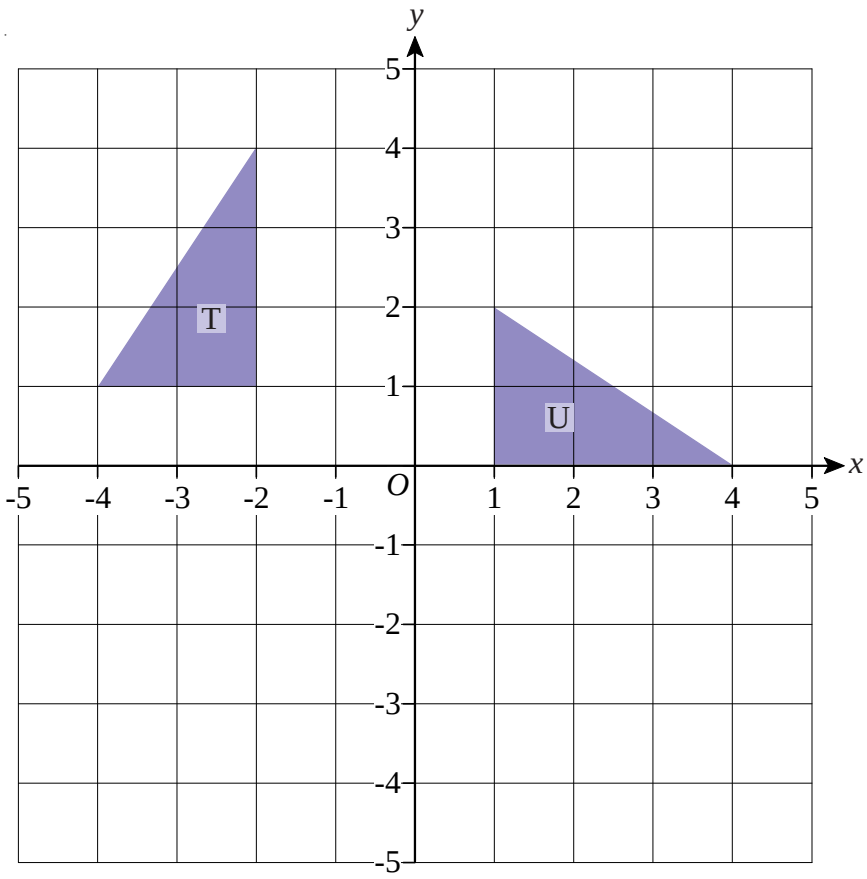
Rotations

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.



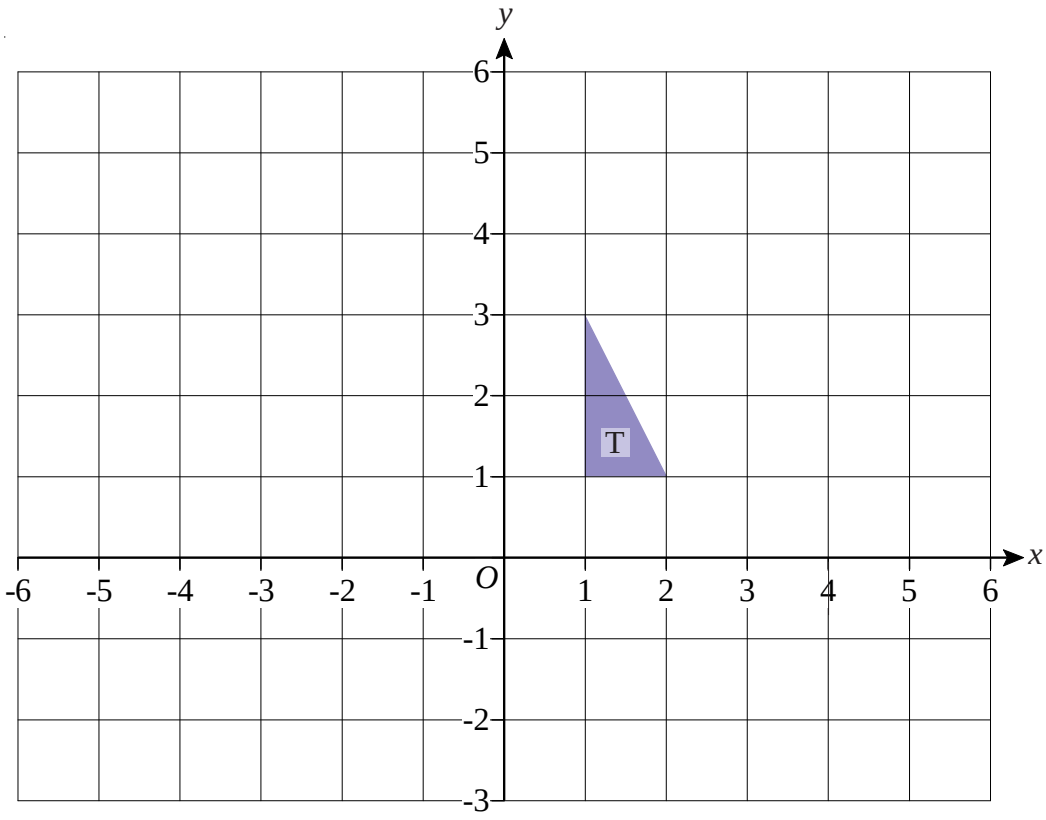
2) Describe fully the single transformation which maps triangle T to triangle U.



Translations

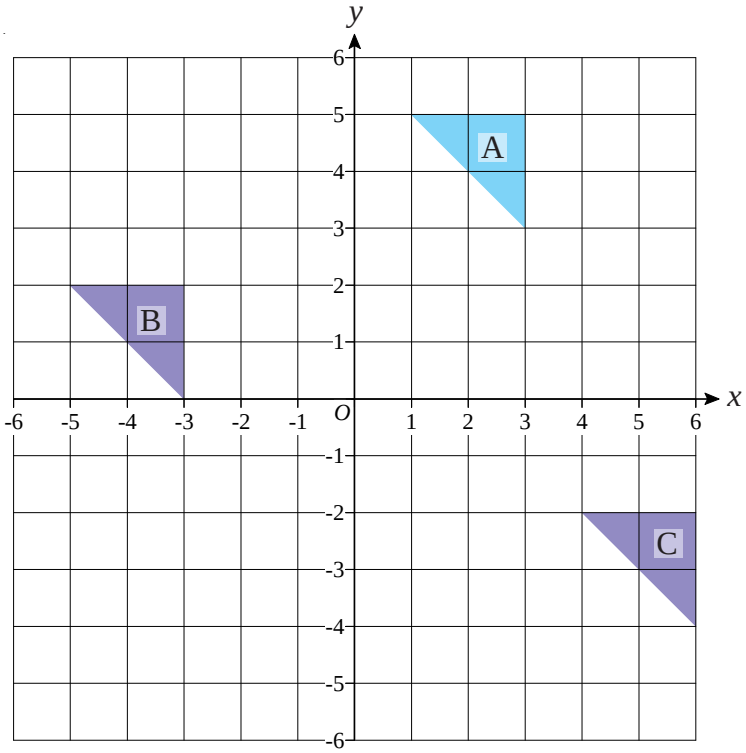
1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U.

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



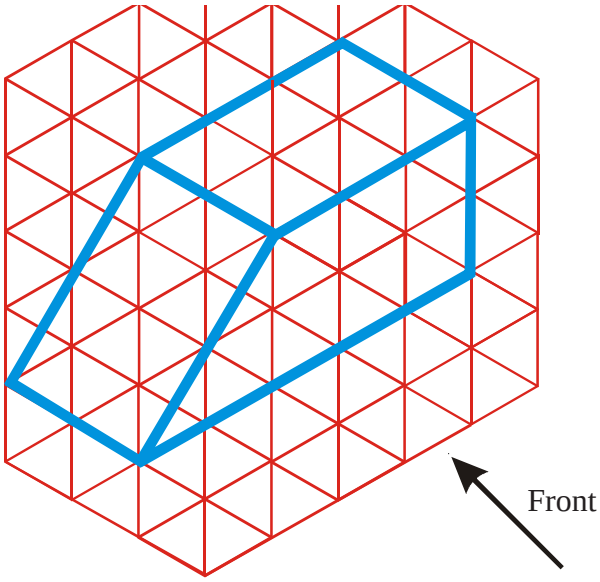
2) a) Describe fully the single transformation which maps triangle A to triangle B.

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

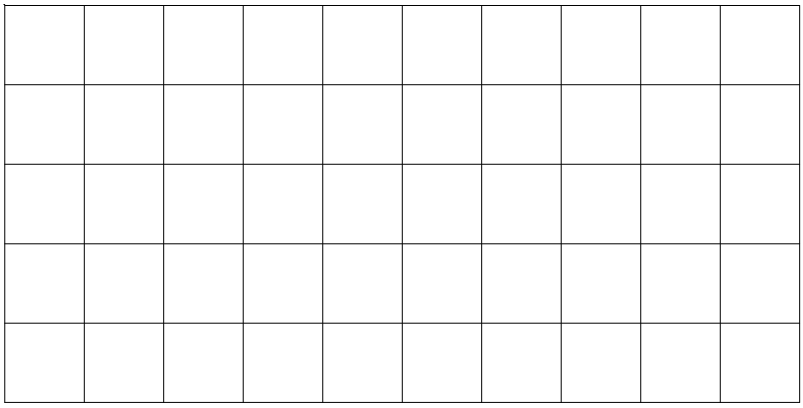


Plans and Elevations

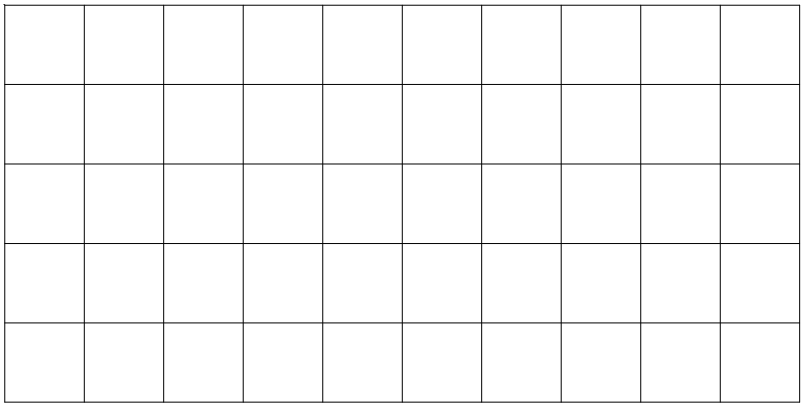
1) The diagram shows a prism drawn on an isometric grid.



a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.

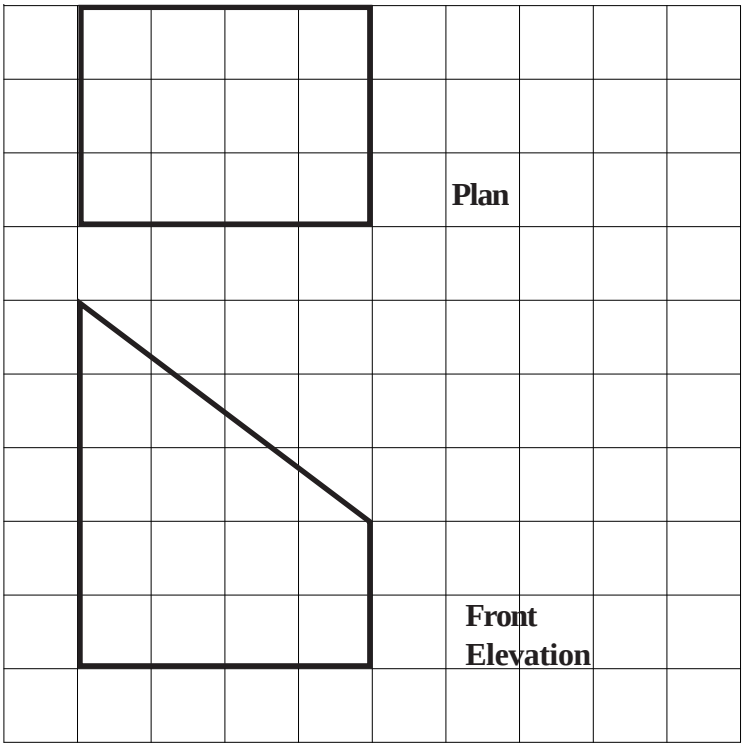


b) On the grid below draw a plan of the prism.

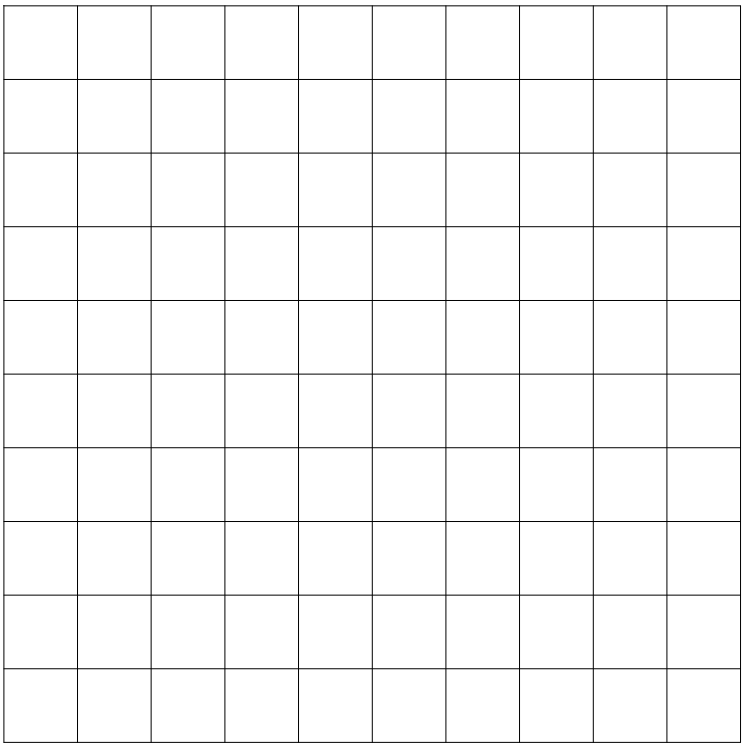


Plans and Elevations

1) Here is the plan and front elevation of a prism.
The front elevation shows the cross section of the prism.

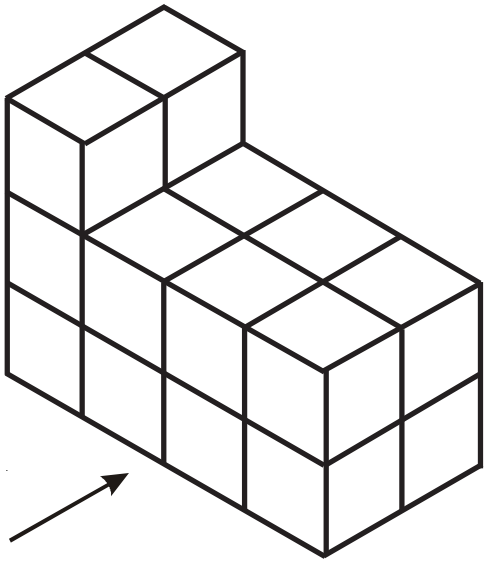


On the grid below, draw the side elevation of the prism.



Plans and Elevations

1) The diagram shows a solid prism made from centimetre cubes.

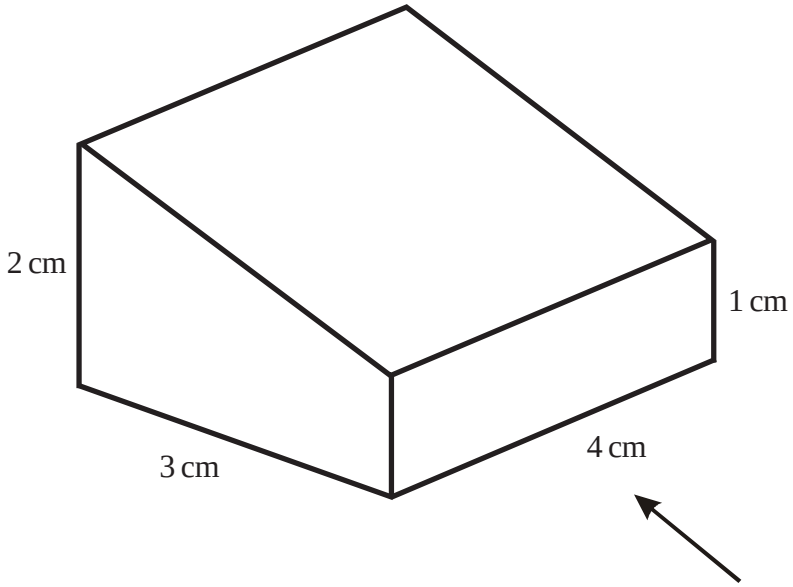


a) On the centimetre square grid, draw the front elevation of the solid prism from the direction shown by the arrow.

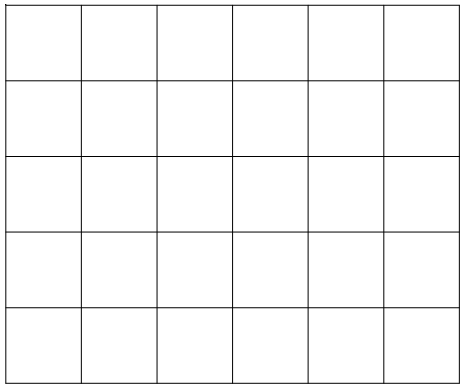
b) On the centimetre square grid below, draw the plan of the solid prism.

Plans and Elevations

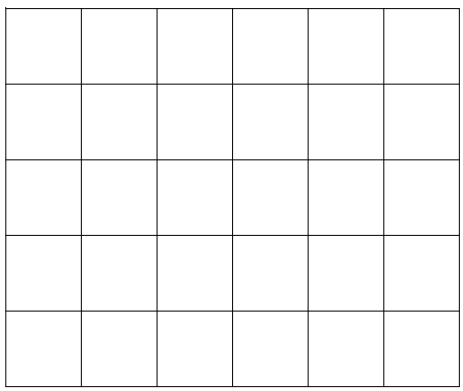
1) The diagram shows a solid prism.



a) On the grid below, draw the front elevation of the prism from the direction of the arrow.



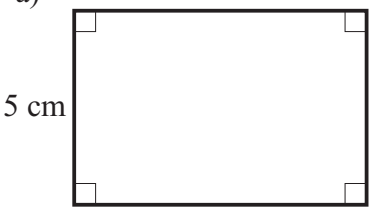
b) On the grid below, draw the plan of the prism.



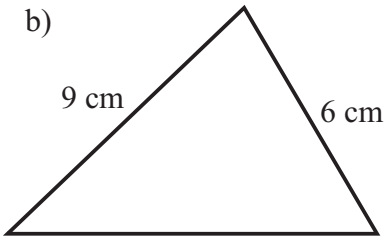
Perimeters

1) Find the perimeters of the following two shapes.

a)



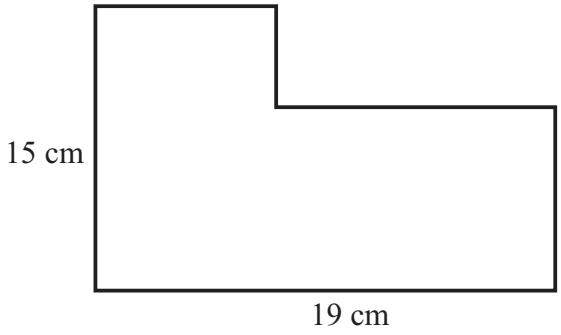
b)



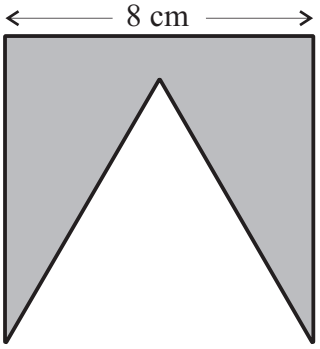
2) The length of a rectangle is 9 cm.
The total perimeter is 30 cm.

Calculate the length of the width of the rectangle.

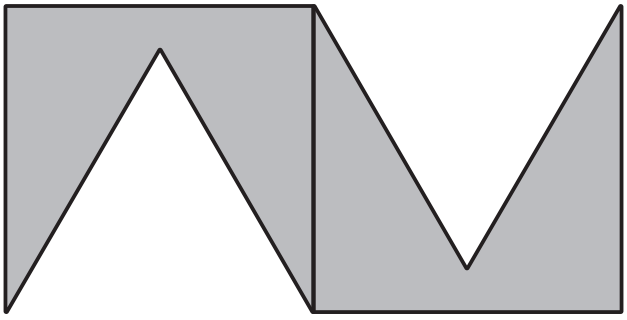
3) Work out the perimeter of this L shape.



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.

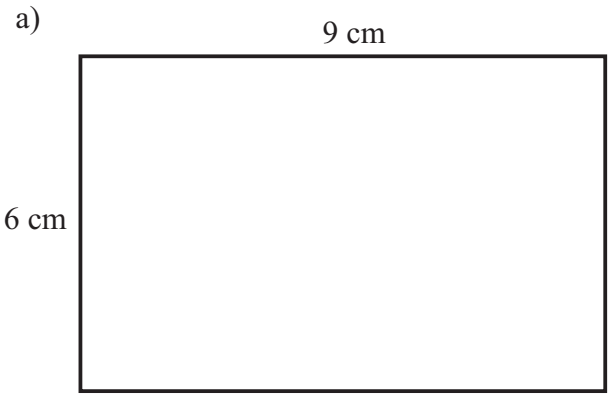


Work out the perimeter of this new shape.

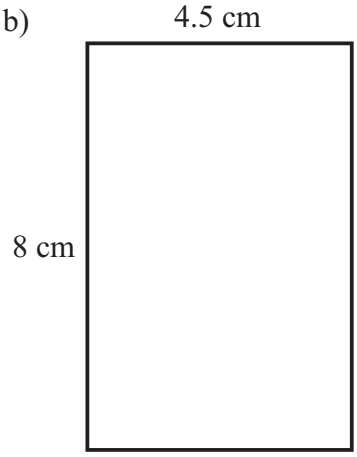
Area of a Rectangle

1) Find the areas of these two rectangles.

a)

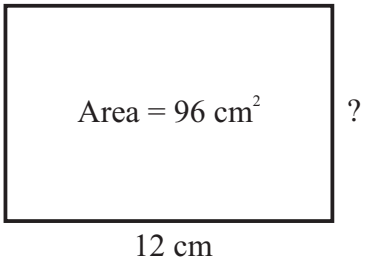


b)

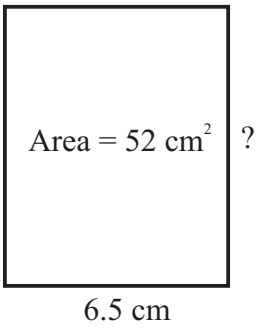


2) Find the size of the missing sides in these two rectangles.

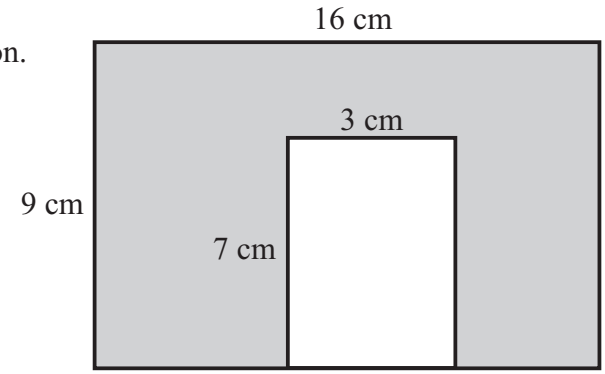
a)



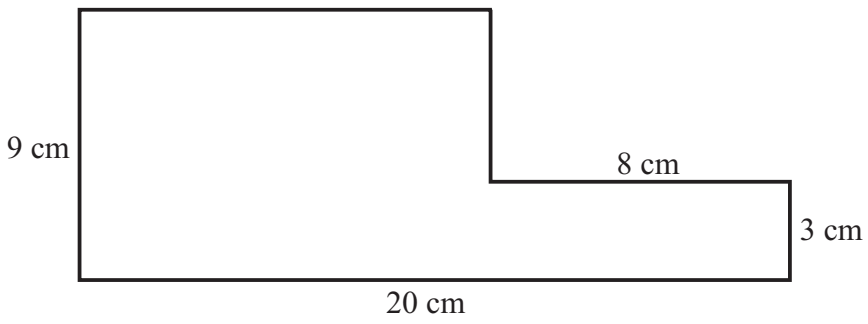
b)



3) Find the area of the shaded section.



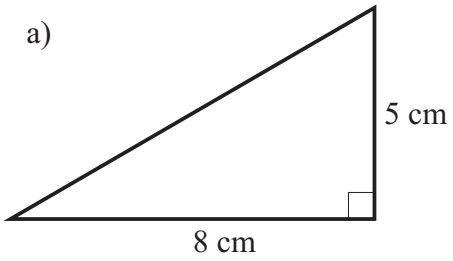
4) Find the area of the L shape.



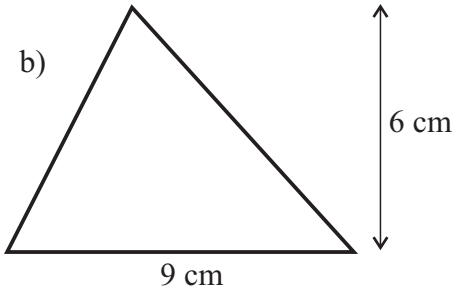
Area of a Triangle

1) Find the areas of the following two triangles.

a)

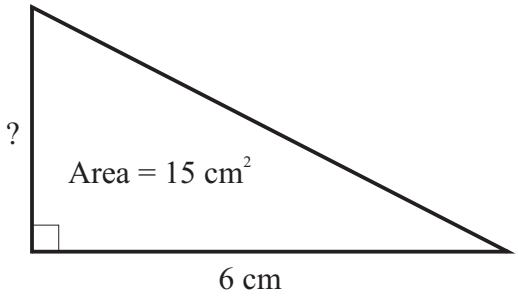


b)

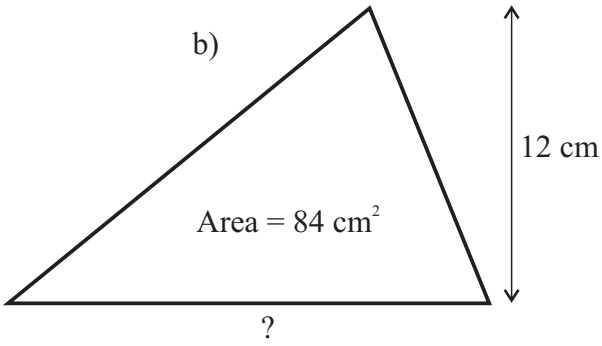


2) Find the missing lengths.

a)

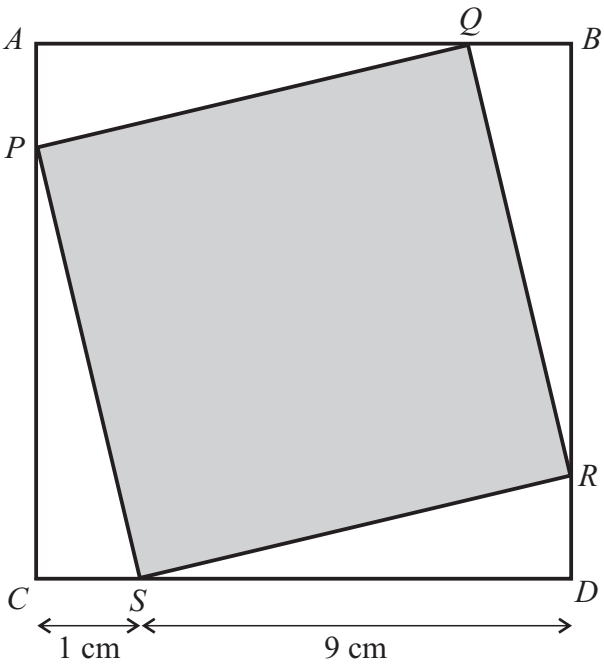


b)



3) *ABCD* is a square.

PQRS is a square.

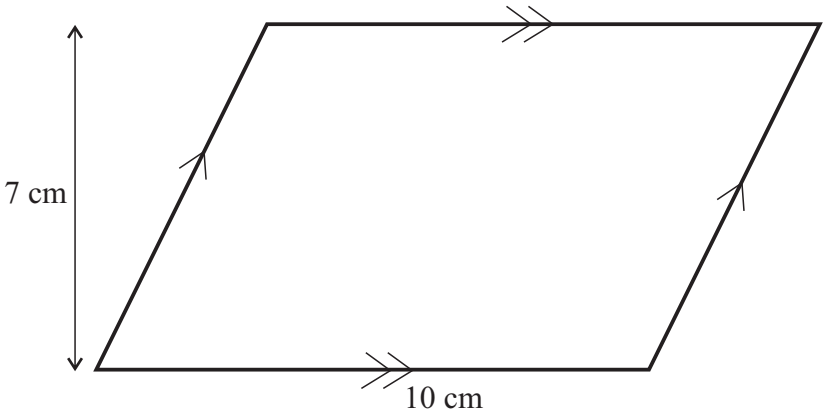


Find the area of the shaded square, *PQRS*.

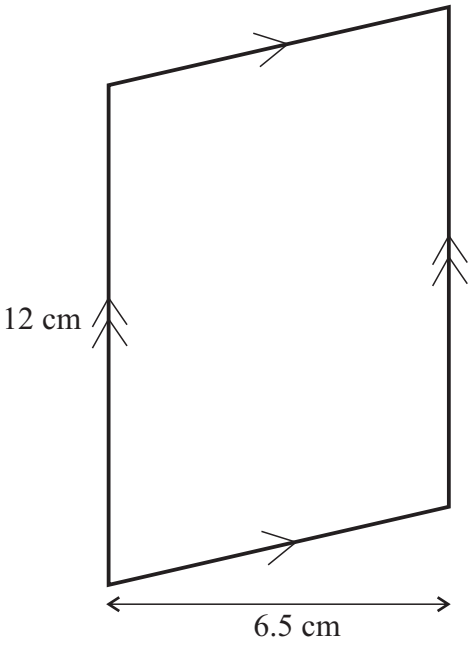
Area of a Parallelogram

1) Find the area of each of these parallelograms.

a)

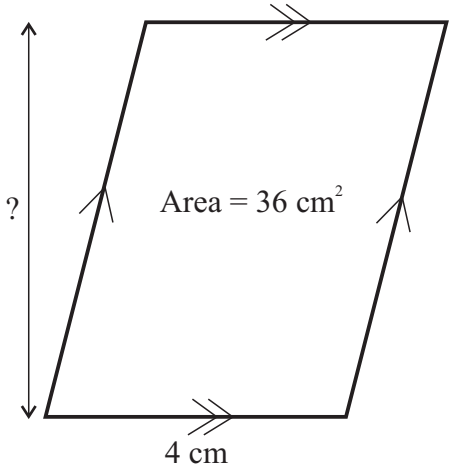


b)

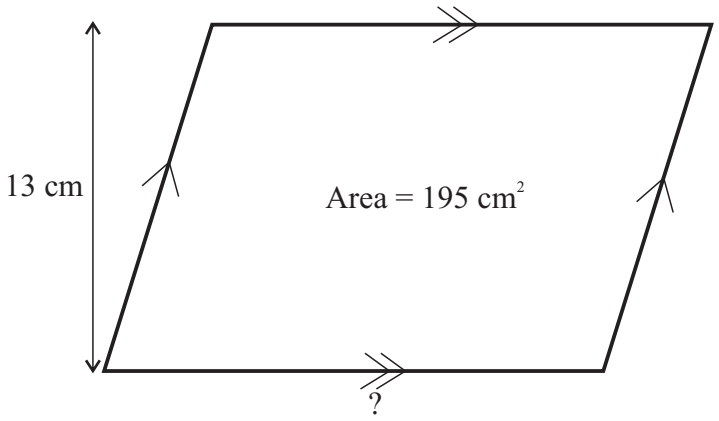


2) Find the missing lengths in these two parallelograms.

a)

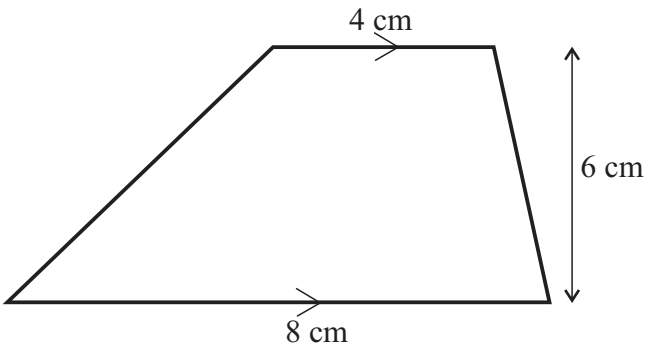


b)

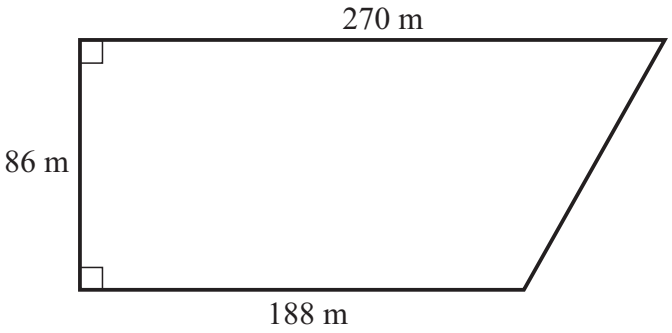


Area of a Trapezium

1) Find the area of this trapezium.

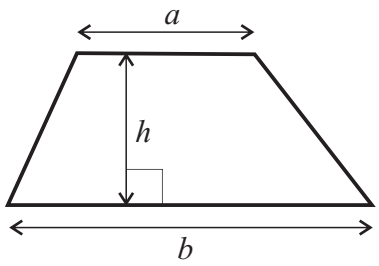


2) The diagram shows a field.



Work out the area of the field.

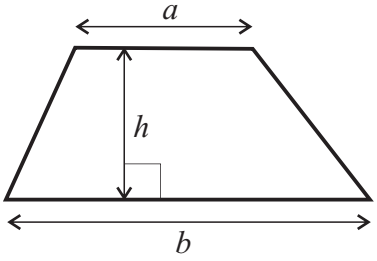
3) In the trapezium, $a = 6.6$ cm, $b = 8.4$ cm and $h = 3.6$ cm.



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.



Frequency Trees

100 people underwent an operation at a hospital.

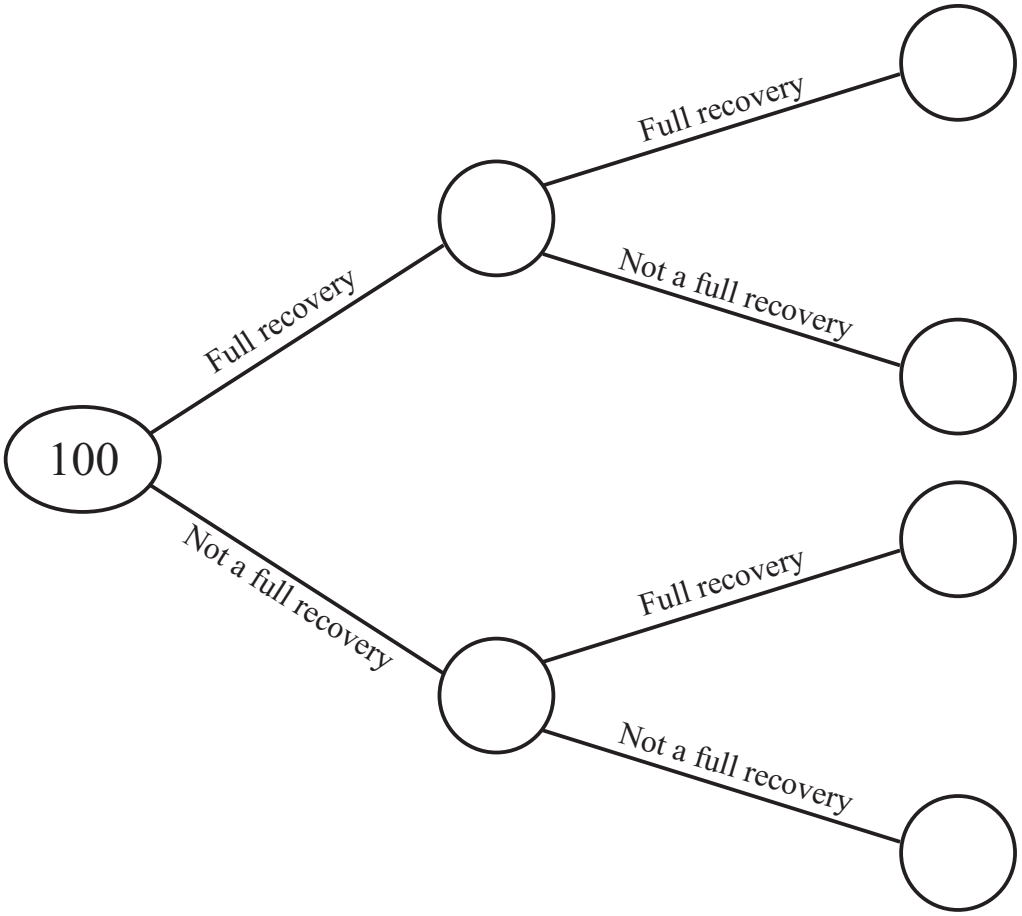
Before the operation, based on their medical notes, it was predicted whether each person would make a full recovery or not.

It was predicted that 85 people would make a full recovery.

It was later found that 6 of the people expected to fully recover, didn't.

Altogether, 87 people made a full recovery.

Complete the frequency tree.



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?

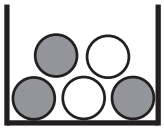
   b) List them all.

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?

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?

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.

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.

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.

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.

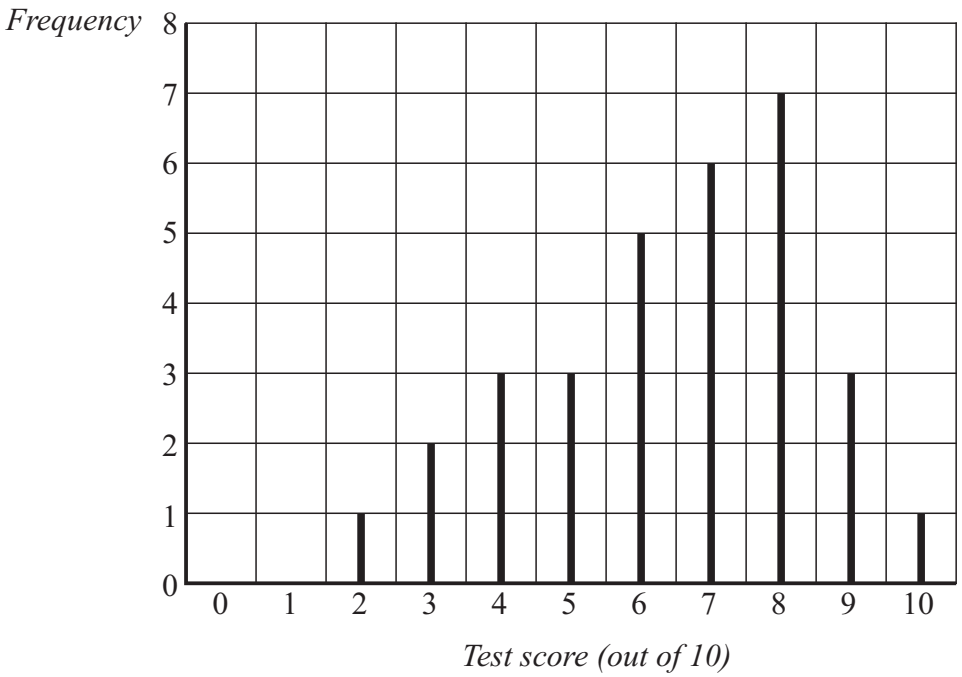
The weight of the crackers in some packs of bicuits.

2) Write a short statement which explains what continuous data is.

3) Write a short statement which explains what discrete data is.

Vertical Line Charts

1) The line chart shows the test scores of pupils in class 10A.

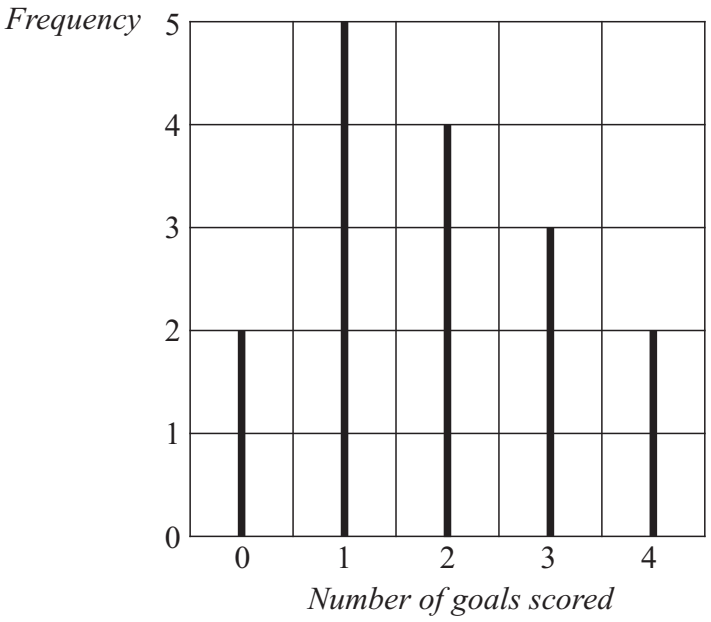


a) How many pupils sat the test in class 10A?

b) What was the modal test score?

c) What was the median test score?

2) The line chart shows the number of goals scored by a football team in their last 16 games.



a) How many goals did they score altogether?

b) What was the median number of goals scored?

Frequency Tables and Diagrams

1) 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

Draw a frequency diagram 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?

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.

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

Listing Strategies

1) A restaurant has the simple menu, as shown.

Meg chooses a starter, a main course and a dessert.

List all the possible combinations that Meg could choose.

Starter
Soup
Melon
Main Course
Chicken
Steak
Vegetarian
Dessert
Ice Cream
Trifle

2)

4	7	1

a) Make a list of all the two-digit numbers that can be made with these three cards.

b) Make a list of all the three-digit numbers that can be made with these three cards.

3) Phil has three different coins.

He has: a £2 coin

a £1 coin

a 50p coin

a) If he chooses exactly two coins, what amounts of money can he make?

b) If he chooses one or two coins, what amounts of money can he make?

c) If he chooses one, two or three coins, what amounts of money can he make?

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.

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.

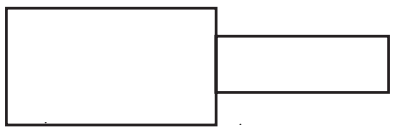
What fraction of his pocket money did he have left?

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.



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?

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) $1\frac{2}{7} \times 3\frac{1}{3}$

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

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) $\dfrac{3+9\times 8}{1+6\times 4}$

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?

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.

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.

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.

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.

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.

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

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

$2^2 + 3^2 + 5^2 + 7^2 + 11^2 + 13^2 + 17^2$

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) $6 \times 4.1 \times 10^3$

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) $\frac{5}{8}$

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%

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 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?

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 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?

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?

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

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 $\dfrac{7.18 \times 19.7}{0.47}$

Using Place Value

1) Using the information that

$4.7 \times 34 = 159.8$

write down the value of

a) 47×34

b) 4.7×3.4

c) $159.8 \div 47$

2) Using the information that

$324 \times 48 = 15552$

write down the value of

a) 3.24×4.8

b) 0.324×0.48

c) $15552 \div 4.8$

3) Using the information that

$73 \times 234 = 17082$

write down the value of

a) 730×234

b) 73×2.34

4) Using the information that

$27 \times 5.6 = 151.2$

write down the value of

a) 27×56

b) 2.7×0.56

c) $151.2 \div 56$

5) Using the information that

$719 \times 35 = 25165$

write down the value of

a) 71.9×3.5

b) 0.719×0.35

c) $25165 \div 7.19$

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) $2xy(x + y^2)$

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) $3x^2y^2 + 9xy$

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.

Straight Line Graphs

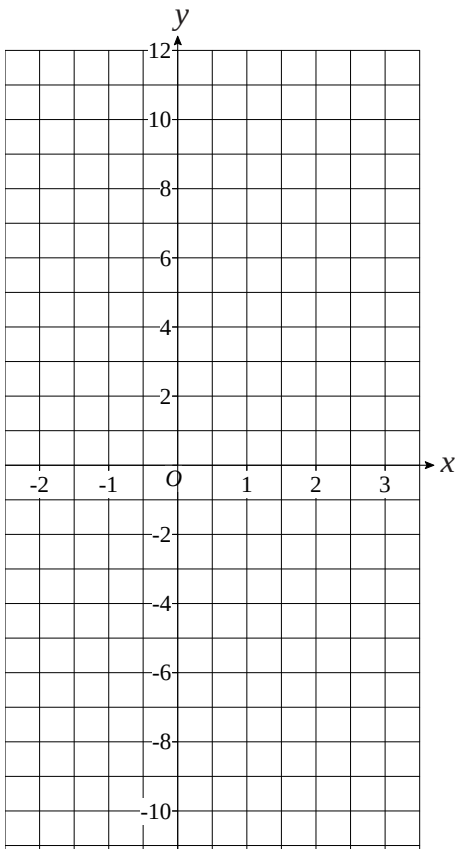
1) a) Complete the table of values for $y = 4x - 2$

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 $x = 2.5$

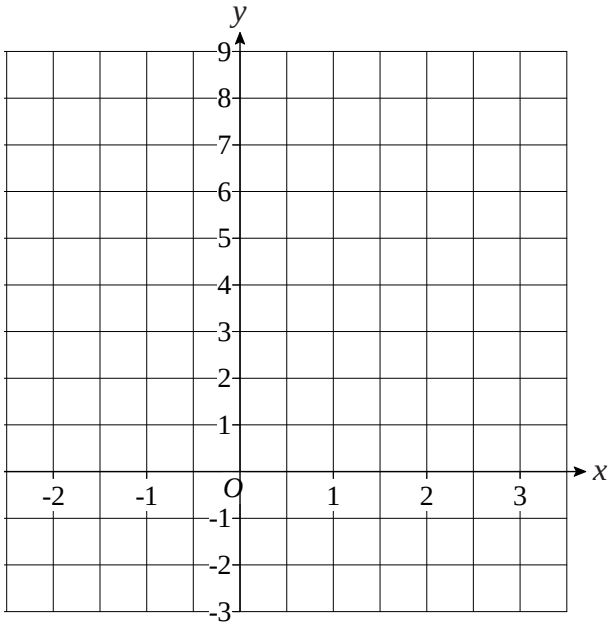
d) Use the graph to find the value of x when $y = -8$



2) a) Complete the table of values for $y = 2x + 2$

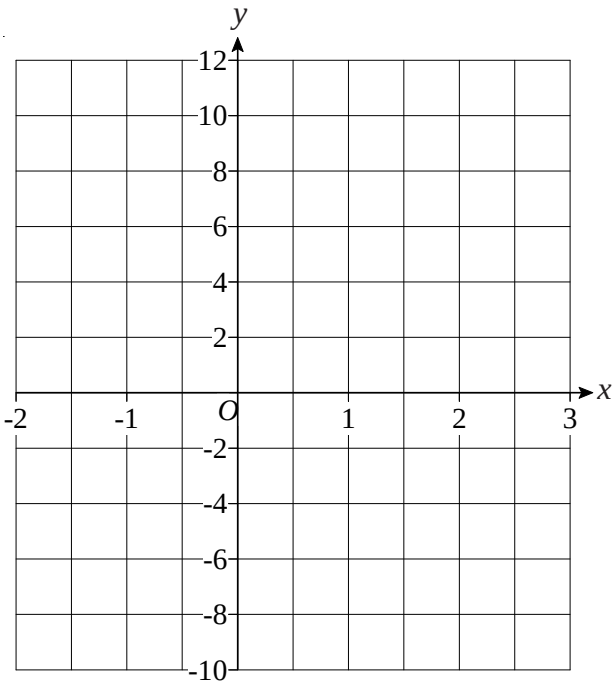
x	-2	-1	0	1	2	3
y		0	2			

b) On the grid, draw the graph of $y = 2x + 2$.



Straight Line Graphs

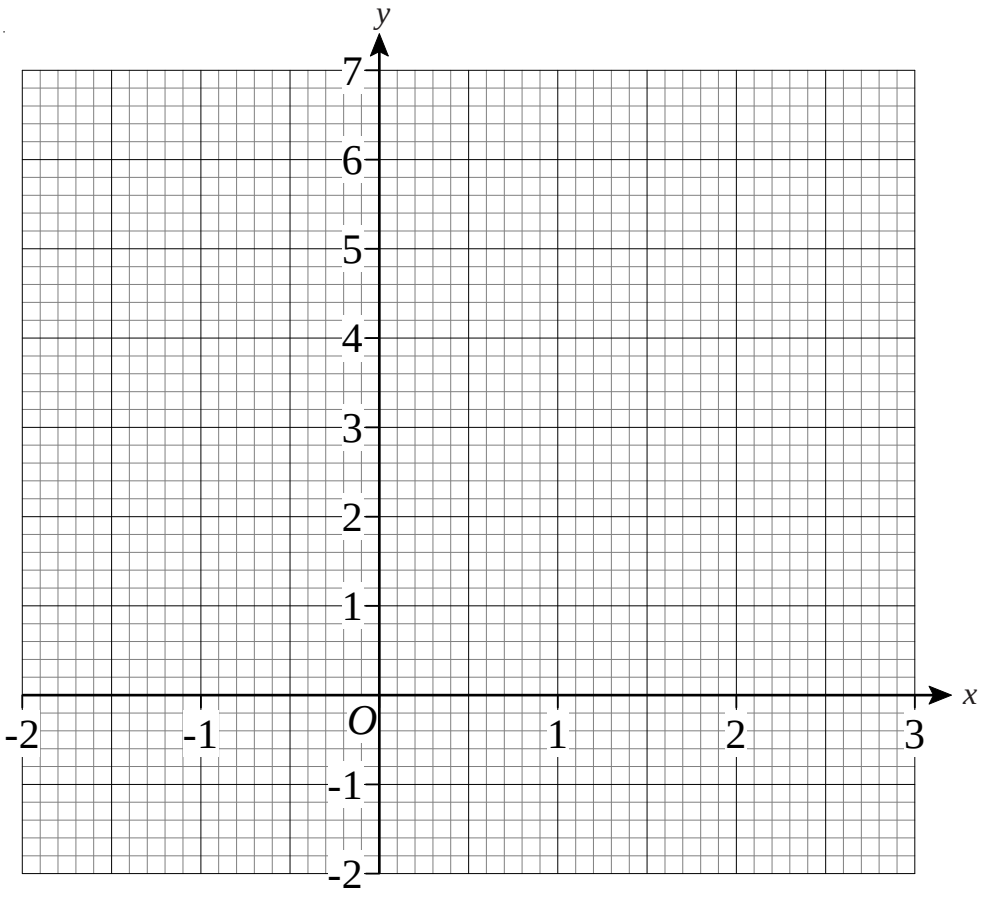
1) On the grid, draw the graph of $y = 2x - 4$



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

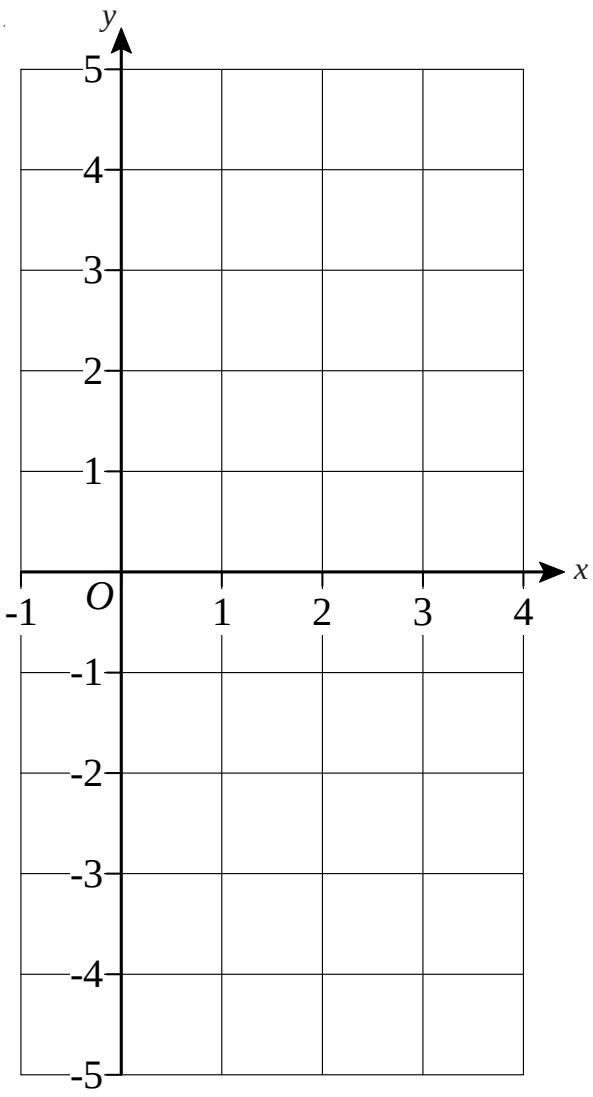
1) a) Complete the table of values for $y = 2x - 3$

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	

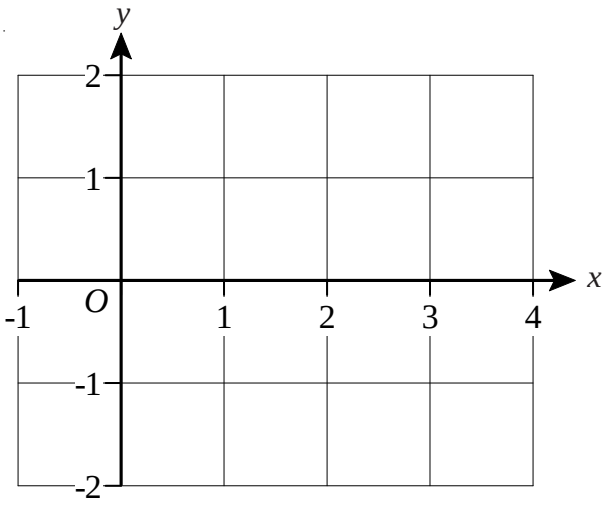
b) Using the axes on the right, again, draw the graph of $y = 2 - x$

---

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y				0		

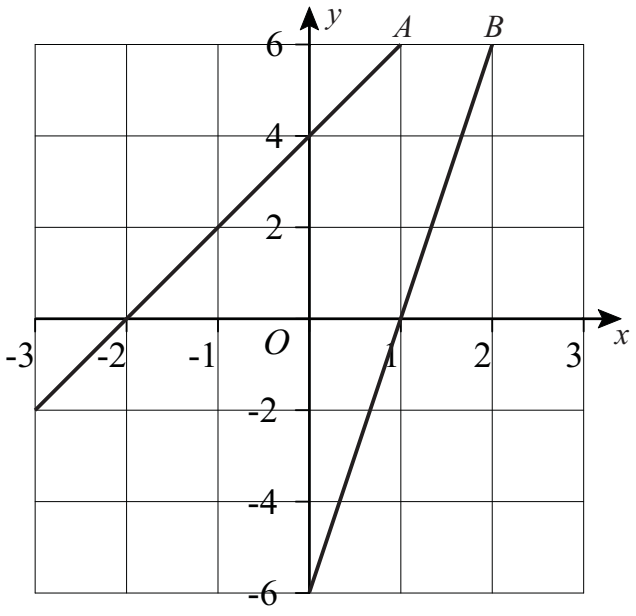
b) Draw the graph of $y = \frac{1}{2}x - 1$

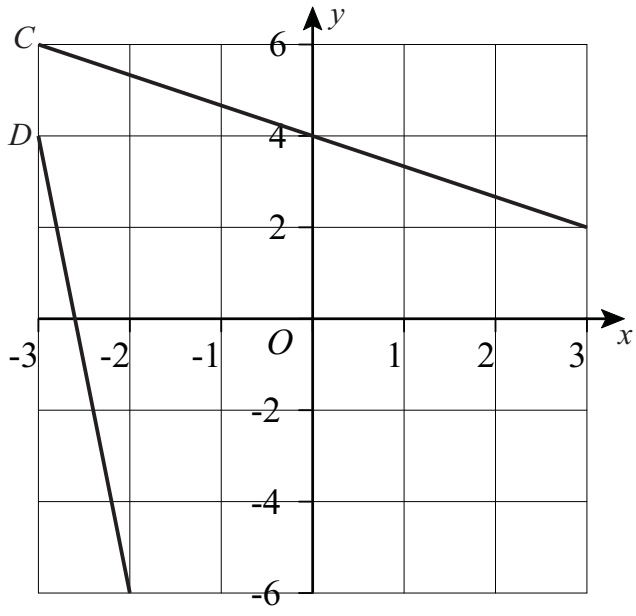


c) Use your graph to find the value of y when $x = 3.5$

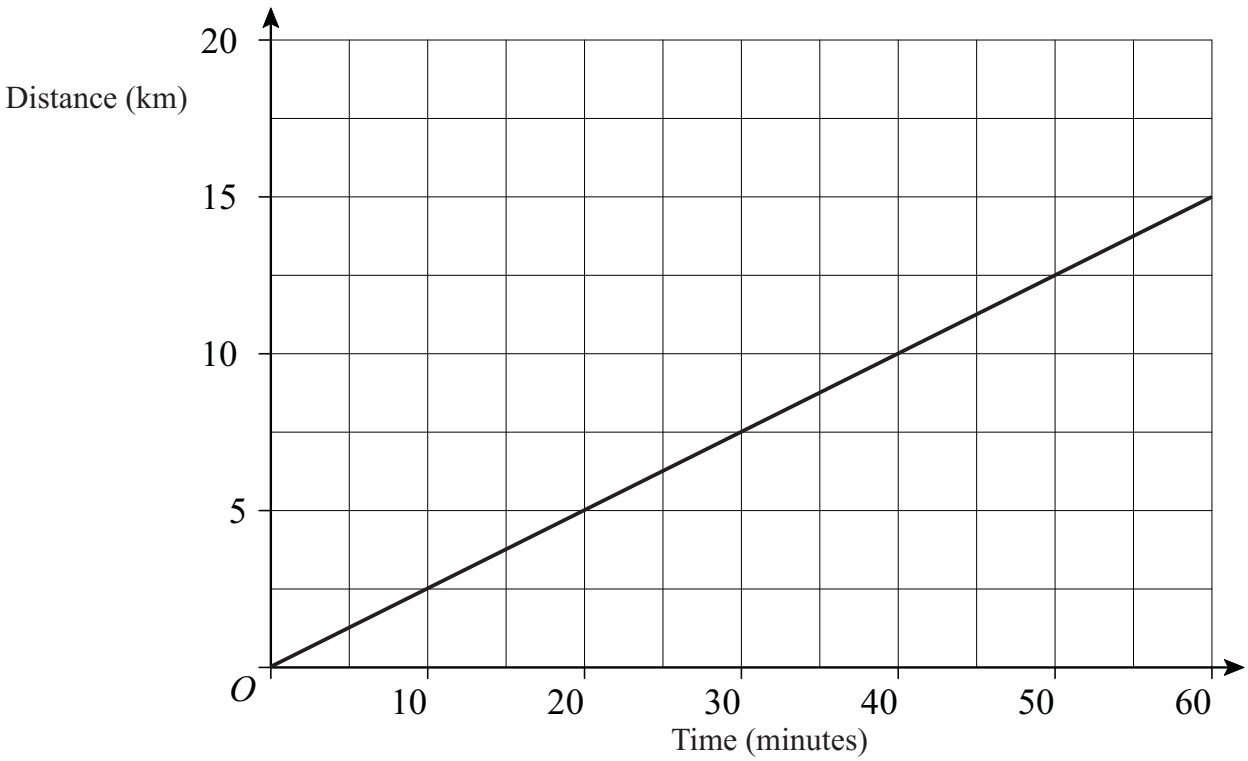
The Gradient of a Line

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.

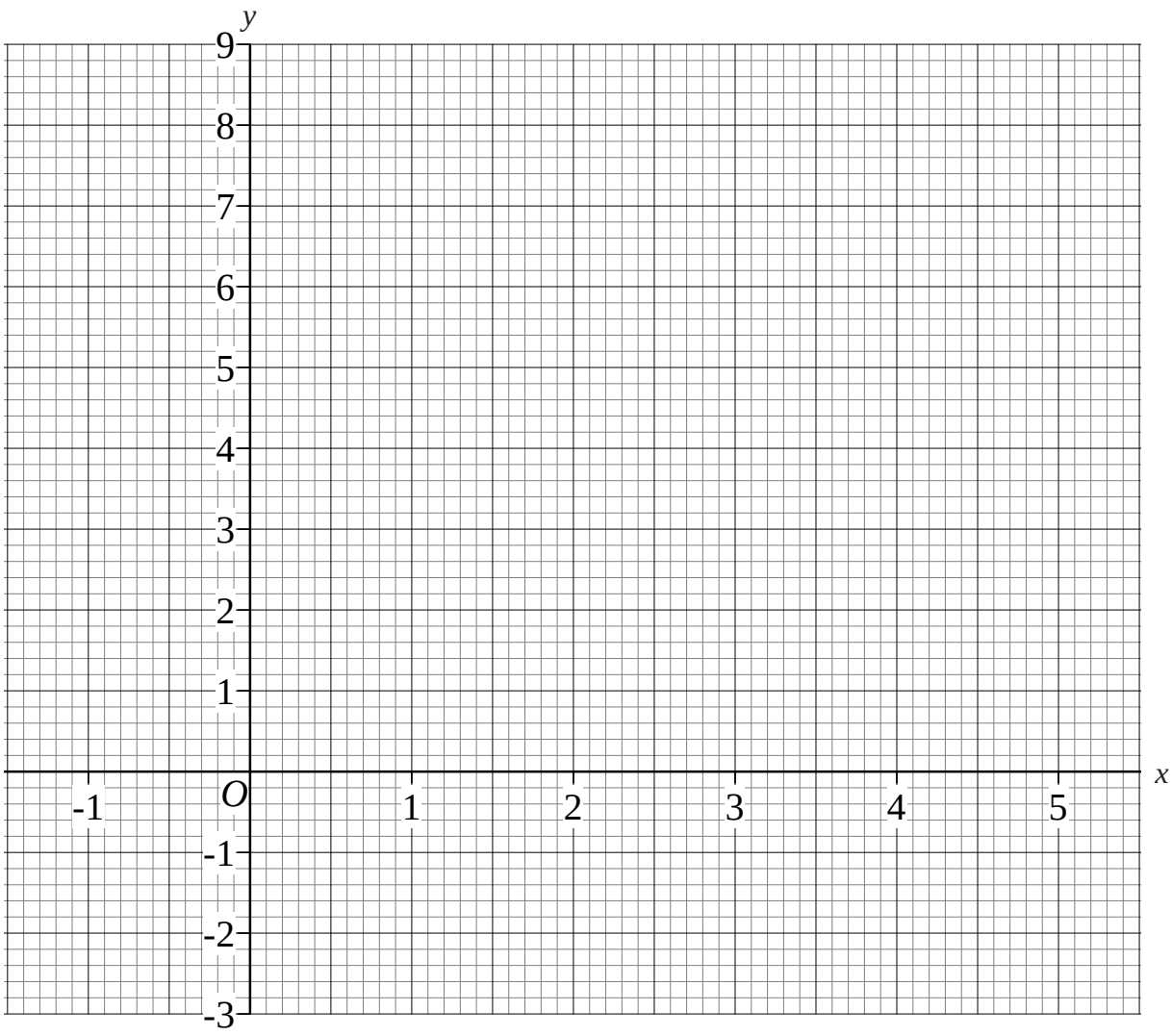
b) What does the gradient show?

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 $y = x^2 - 4x + 3$

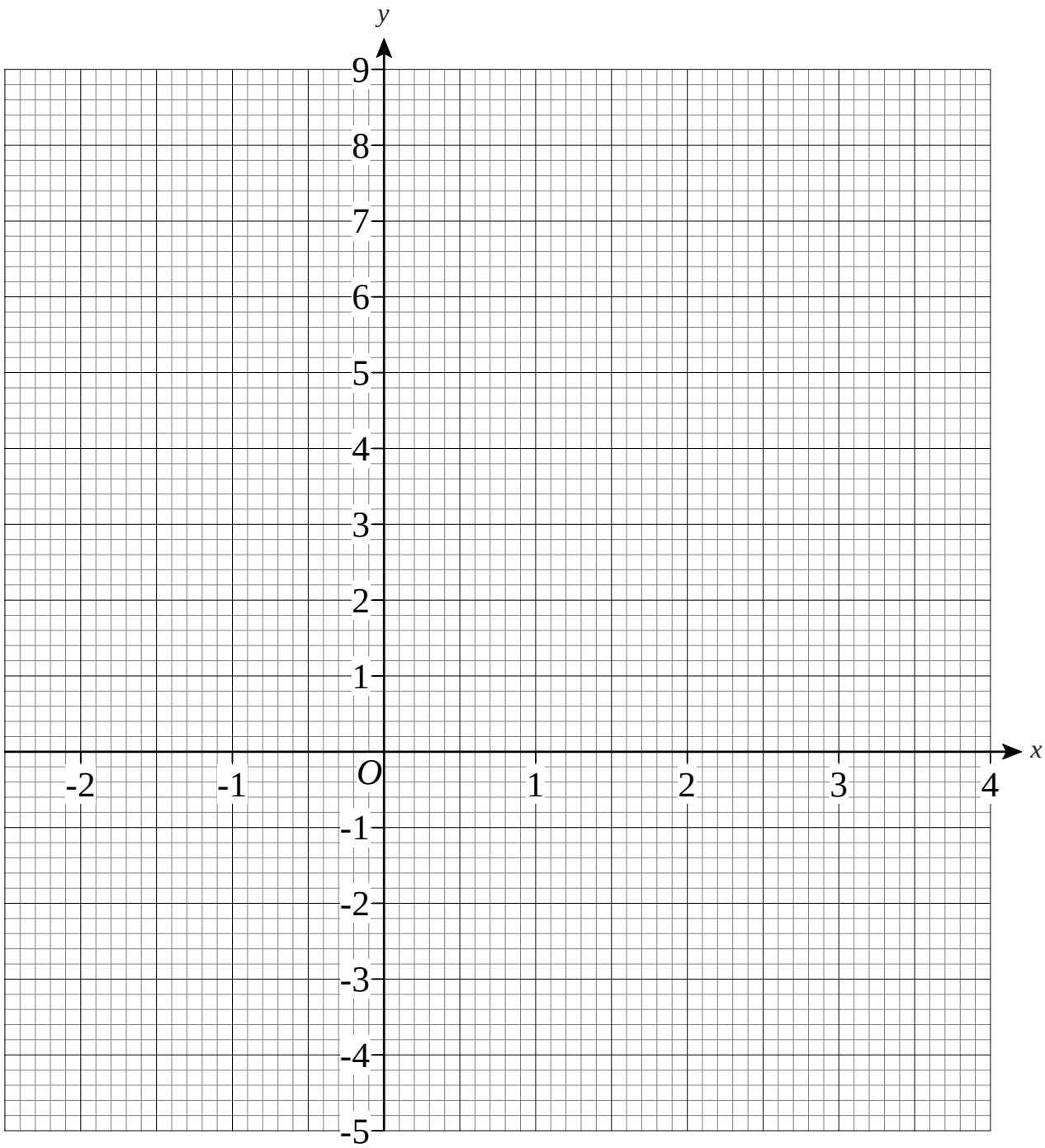


Drawing Quadratic Graphs

1) 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 $y = x^2 - 3x - 2$



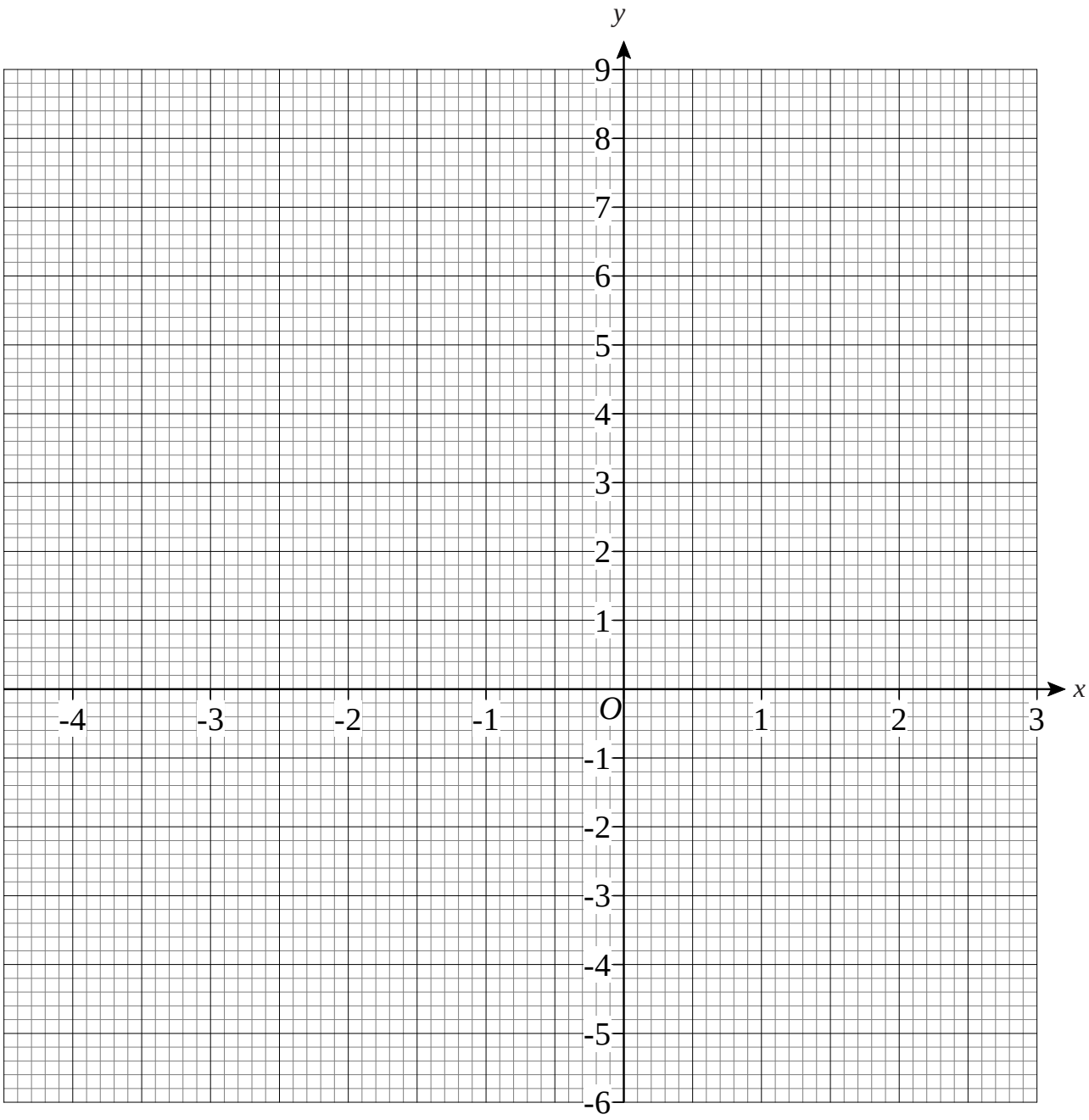
c) Use your graph to estimate the values of x when $y = -1$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = x^2 + x - 4$

x	-4	-3	-2	-1	0	1	2	3
y	8		-2	-4				8

b) On the grid, draw the graph of $y = x^2 + x - 4$

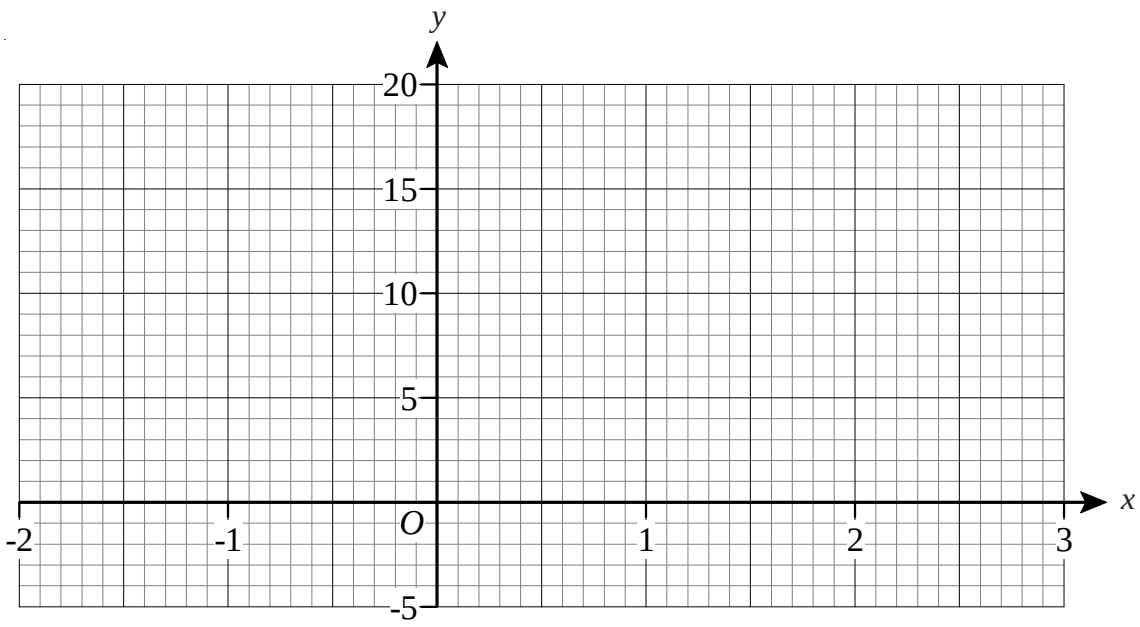


Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

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 $x = -1.5$

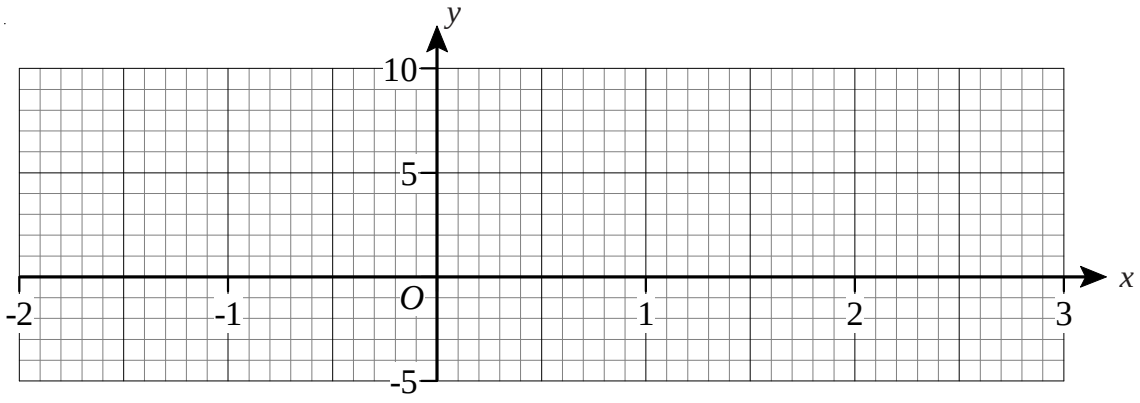
d) Use the graph to find the values of x when $y = 4$

---

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

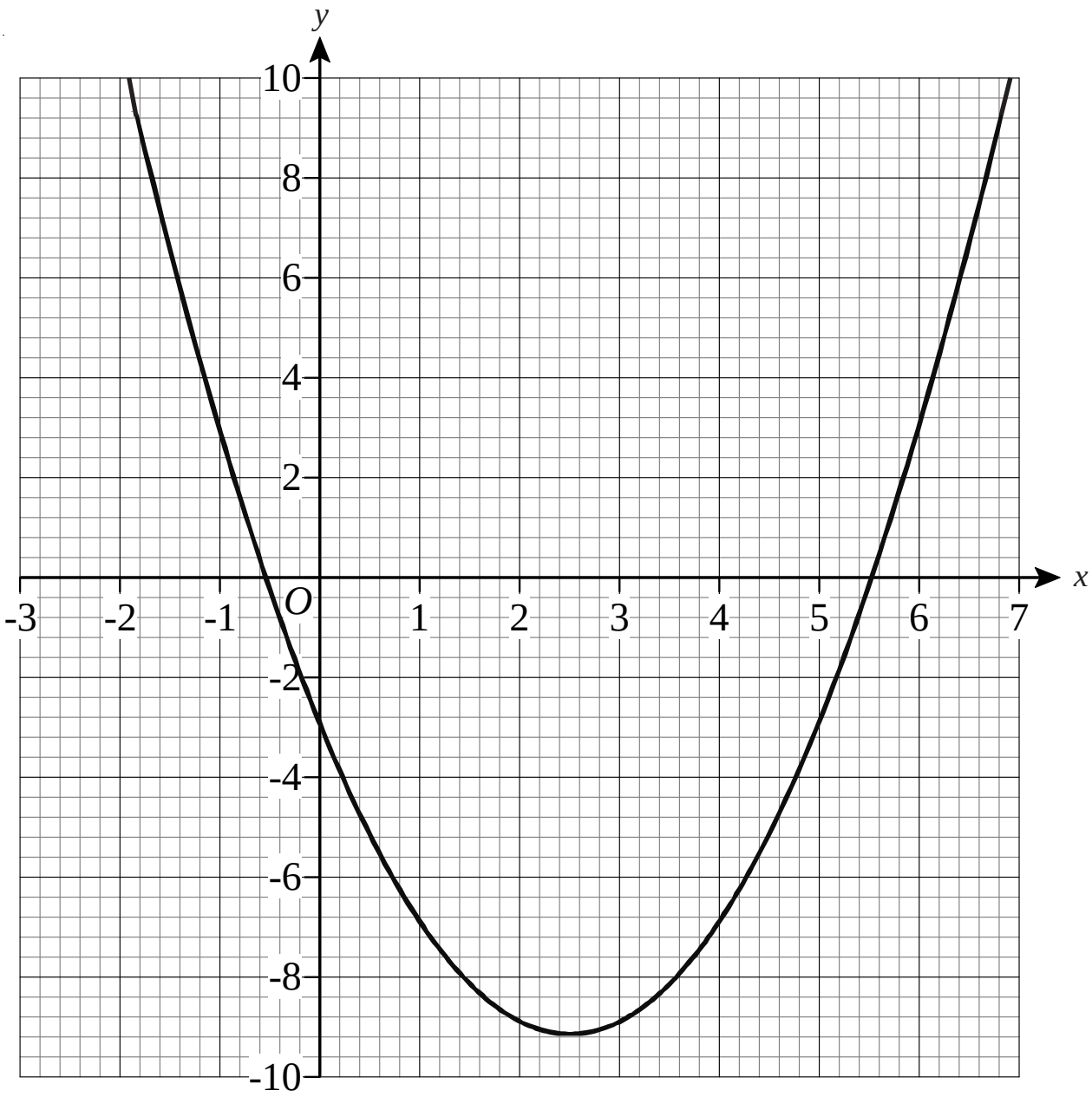


c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$

Drawing Quadratic Graphs

1) 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

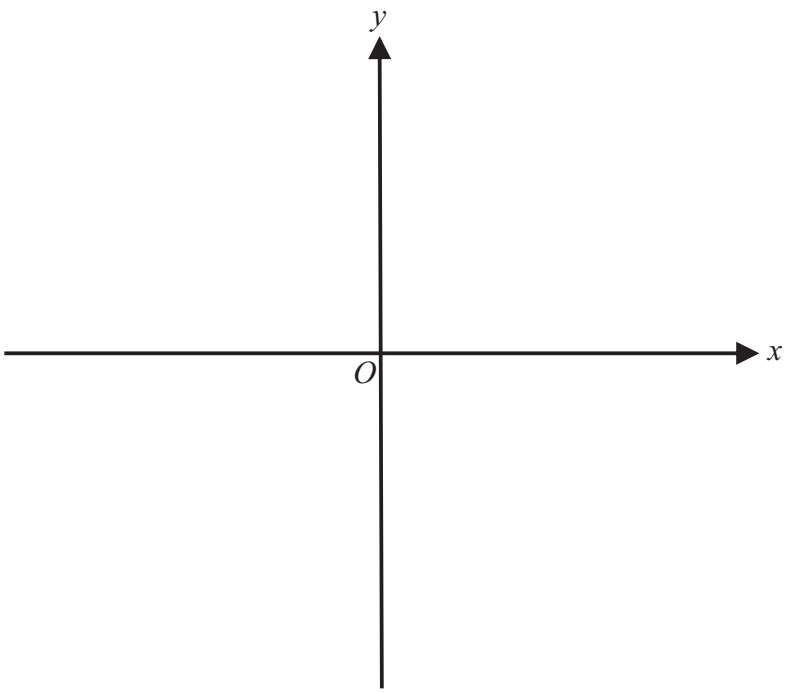
$y = x^2 - 5x - 3$

$y = x - 4$

Sketching Functions

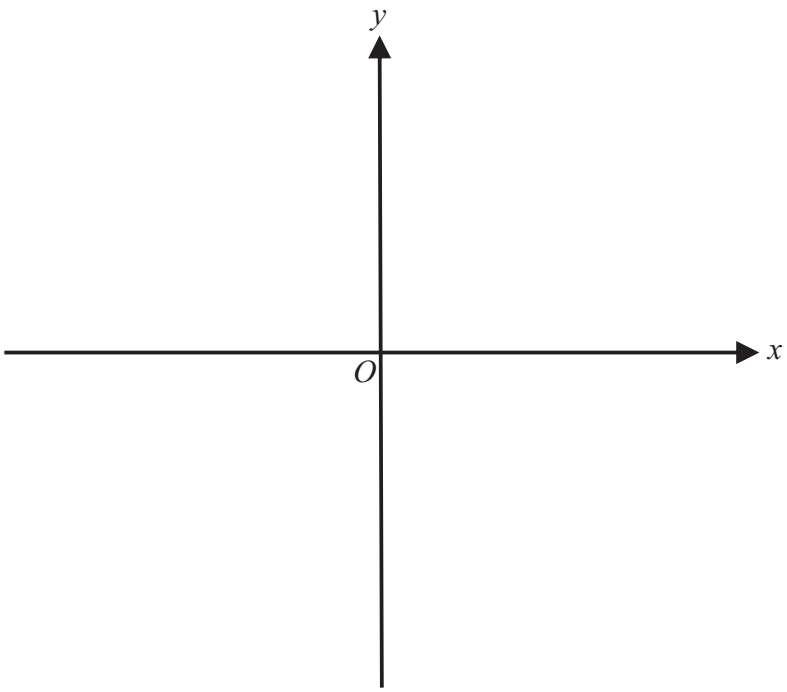
1) a) Sketch the graph of $y = 3x - 4$ on the axes, showing clearly where it crosses the y-axis.

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.



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) $2(\frac{5x}{3} - 1) = 8$

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 $2(5q^2 + 1) = c$

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.

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.

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.

2) The *n*th 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 *n*th term of this sequence.

b) An expression for the *n*th 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 *n*th 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) 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 $999^2 + 1001^2$

Special Sequences

1) What is the term to term rule for each sequence, below?

a) 1, 4, 16, 64, 256

b) 6, 12, 24, 48, 96

c) 80, 40, 20, 10, 5

d) 48, 12, 3, 0.75, 0.1875

2) a) What is the special name for this sequence?

1, 4, 9, 16, 25

b) What would be the 10th term of the sequence?

c) What is the *n*th term of the sequence?

3) By comparing the following sequences with the sequence of square numbers, find the *n*th term for each one.

a) 4, 7, 12, 19, 28

b) -1, 2, 7, 14, 23

c) 3, 12, 27, 48, 75

4) a) What is the special name for this sequence?

1, 3, 6, 10, 15

b) What would be the 8th term of the sequence?

c) What is the *n*th term of the sequence?

d) Use the *n*th term to work out the 21st term of the sequence.

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.

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?

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.

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.

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

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.

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?

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

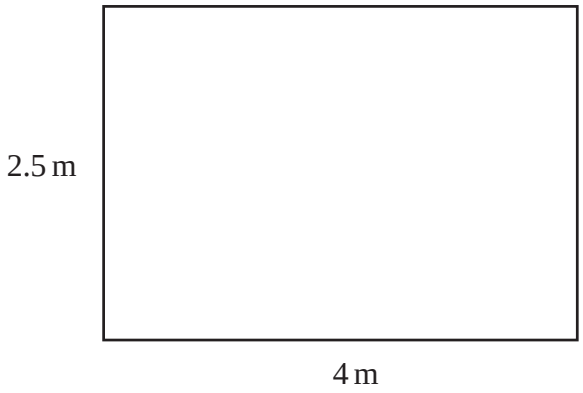
4) Convert 6.5 m^2 into mm^2

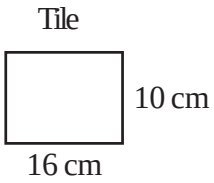
5) Change 2 m^3 into cm^3

6) How many cubic millimetres are there in 3 cubic centimetres?

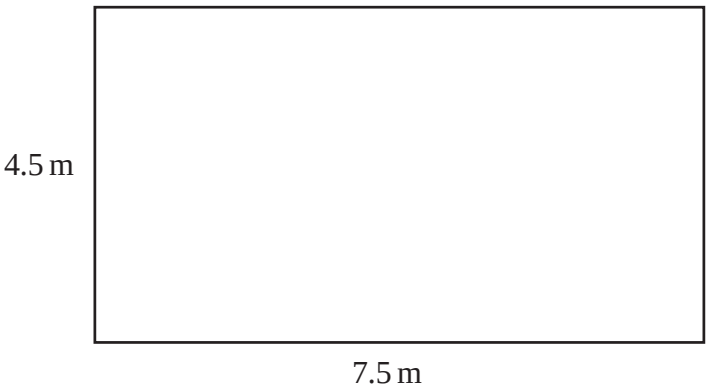
7) Change 7 m^3 into mm^3

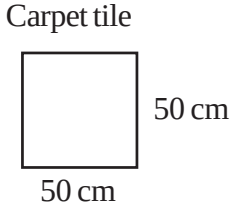
8) A tiler wants to tile a rectangular wall which measures 4 m by 2.5 m.
Each tile measures 16 cm by 10 cm.
How many tiles will he need for the wall?





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?

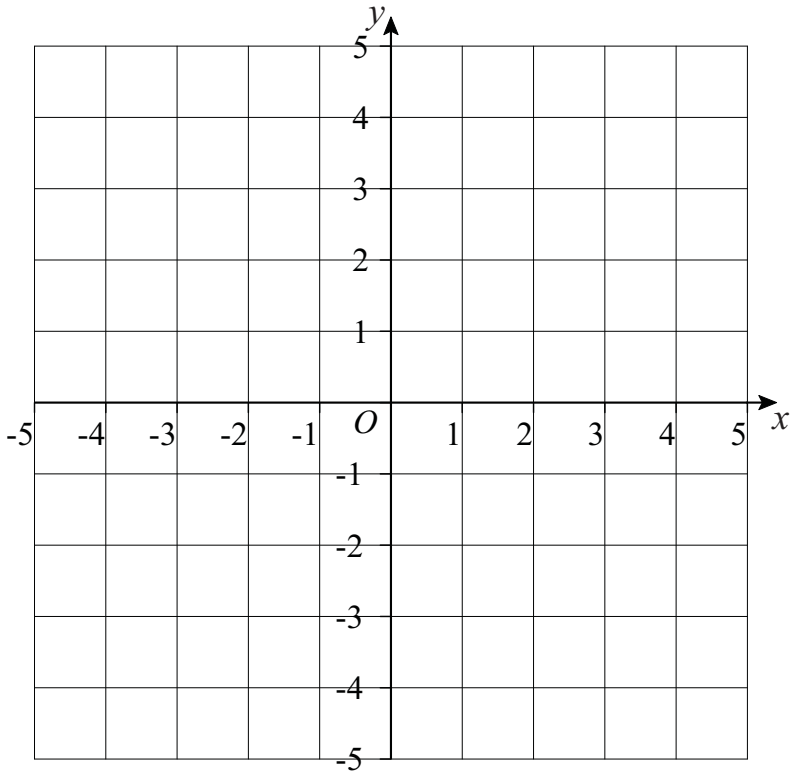




Problems on Coordinate Axes

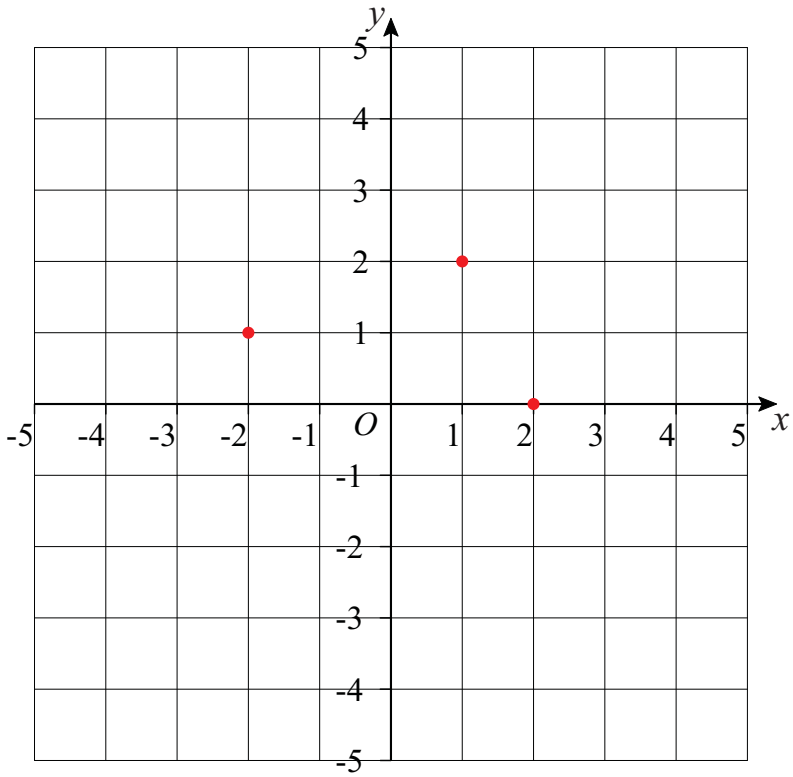
1) The points A (3, 0), B (2, 4) and C (-3, 1) are three corners of a parallelogram.

What are the coordinates of the 4th corner?



2) The diagram shows 3 vertices of a parallelogram.

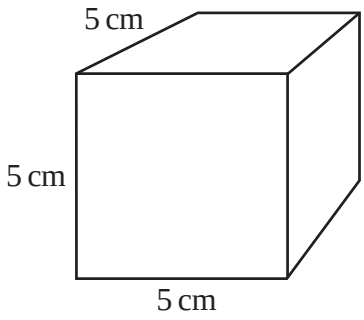
Write down the coordinates of all the possibilities for the 4th vertex.



Surface Area of a Prism - Cuboids

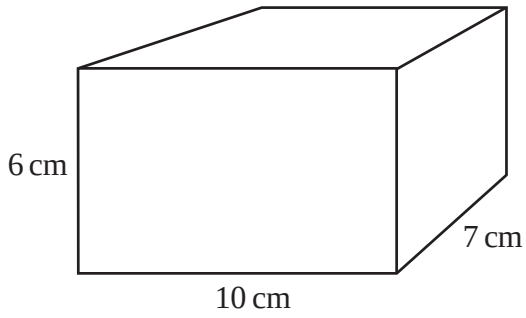
1) A cube has sides of length 5 cm.

Find the total surface area of the cube.



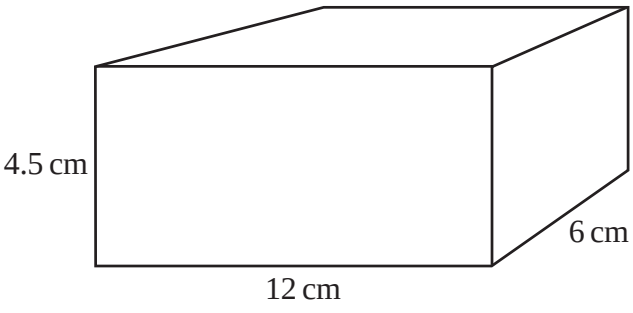
2) A cuboid has sides of length 10 cm, 6cm and 7 cm.

Find the total surface area of the cuboid.



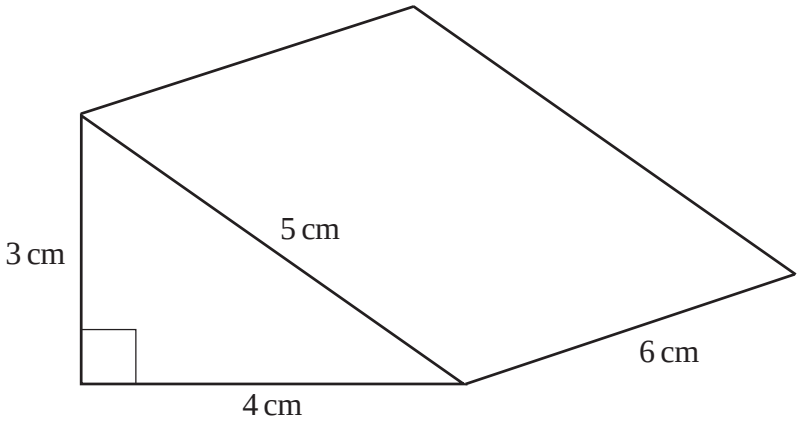
3) A cuboid has sides of length 12 cm, 4.5cm and 6 cm.

Find the total surface area of the cuboid.

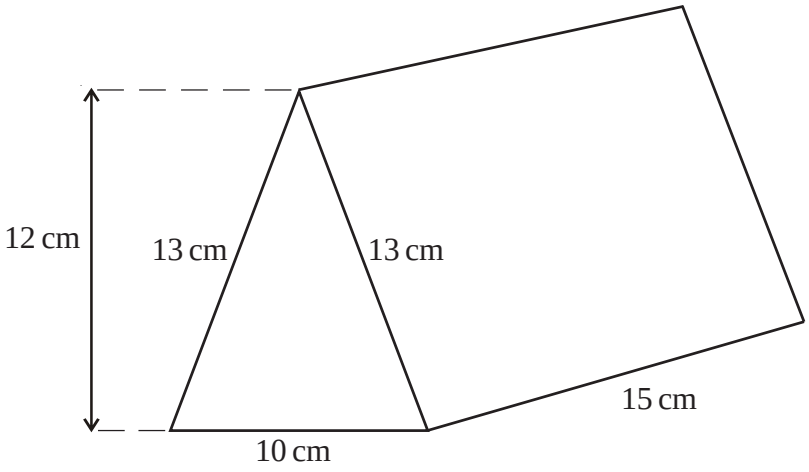


Surface Area of a Prism - Triangular Prisms

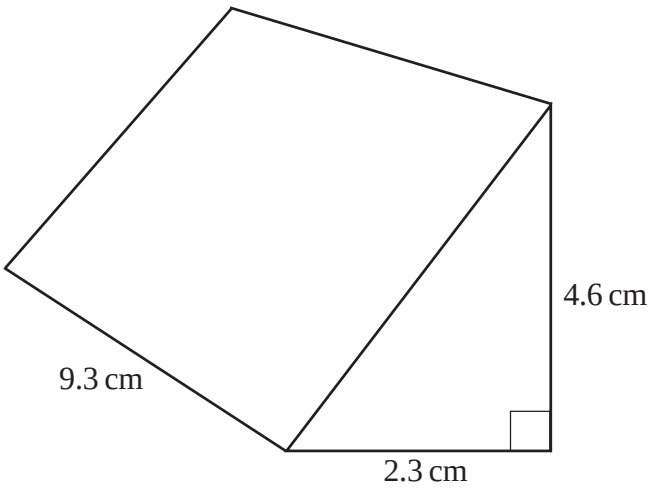
1) Find the surface area of this triangular prism.



2) Find the surface area of this triangular prism.

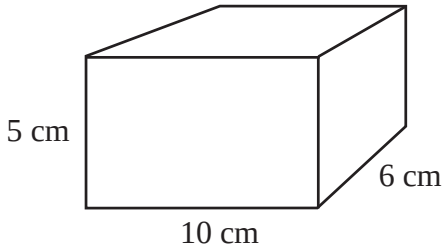


3) With the aid of Pythagoras' Theorem, find the surface area of this triangular prism.
Give your answer correct to 2 significant figures.

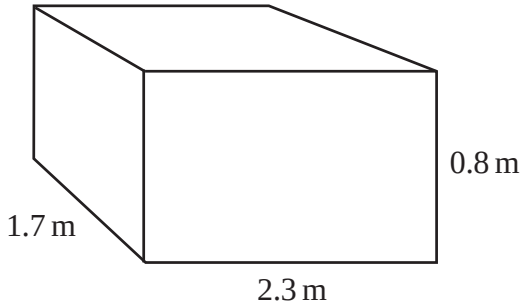


Volume of a Cuboid

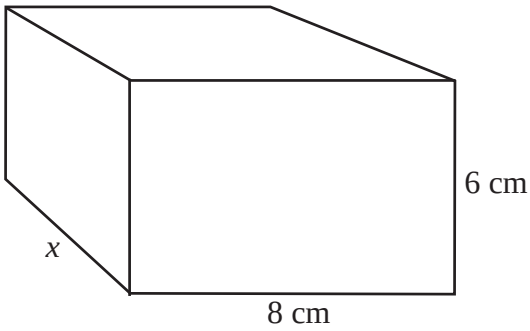
1) Find the volume of this cuboid.



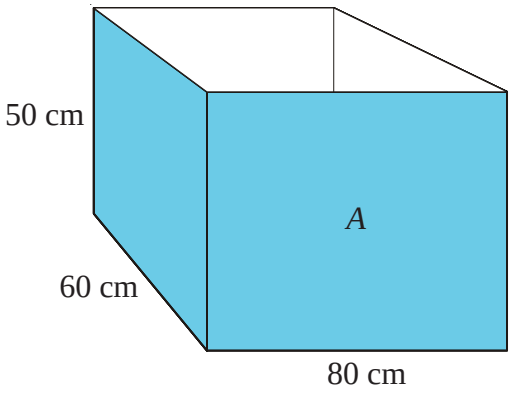
2) Find the volume of this cuboid.

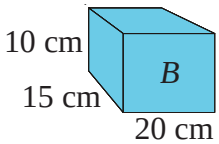


3) The volume of this cuboid is 480 cm^3.
Find the length of the side marked *x*.



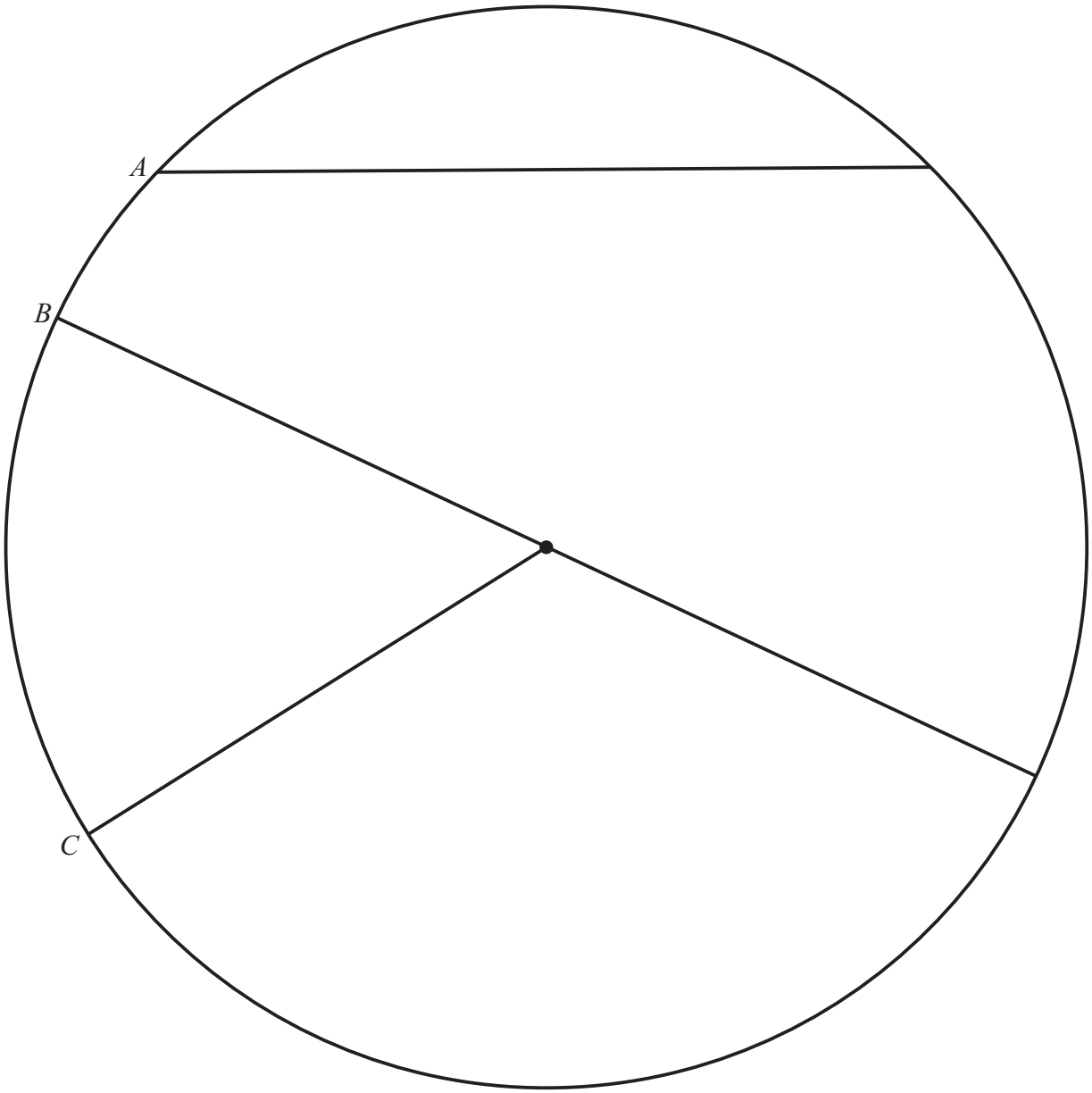
4) Boxes *A* and *B* are both cuboids.
How many of box *B* could be packed into box *A*?





Circle Definitions

1) In the circle, write the correct names for line *A*, *B* and *C*.

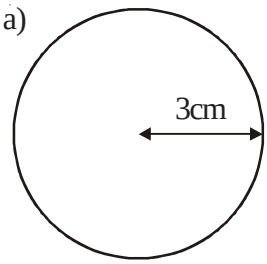


2) What is the special name given to the perimeter of a circle?

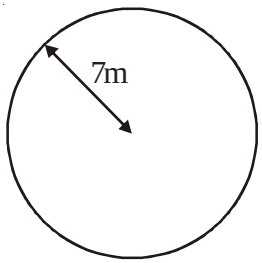
Area of a Circle

1) Find the areas of the following shapes.

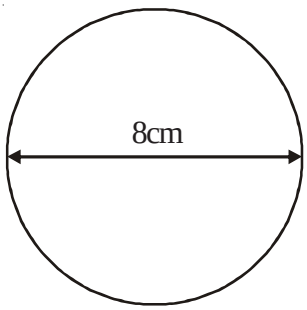
a)



b)

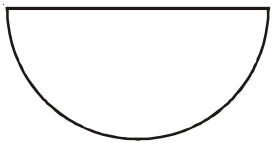


c)

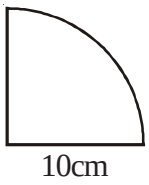


2) Work out the areas of the following shapes.

a)



b)



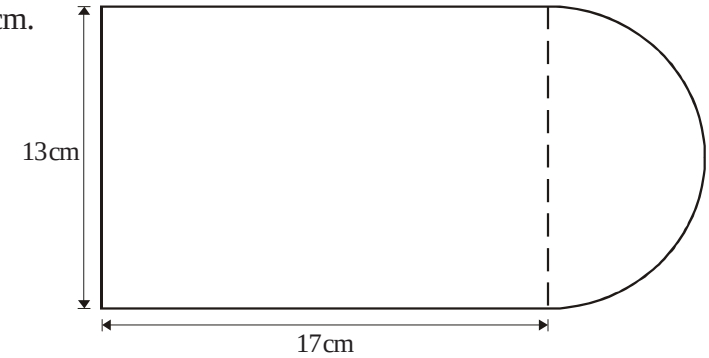
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

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.

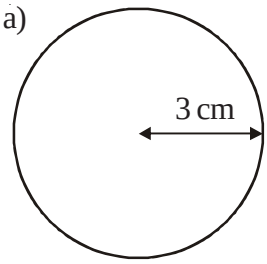
Calculate the area of the shape.
Give your answer correct to
3 significant figures.



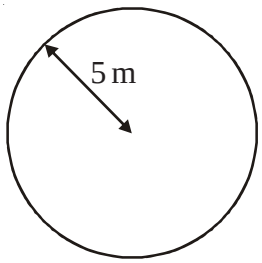
Circumference of a Circle

1) Find the circumference of the following shapes.

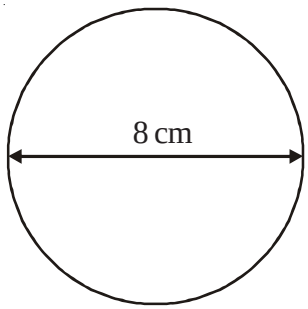
a)



b)

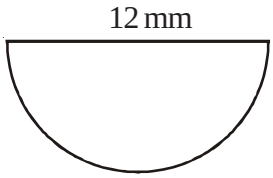


c)

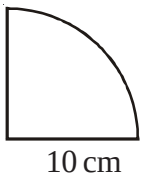


2) Work out the perimeter of the following shapes.

a)



b)



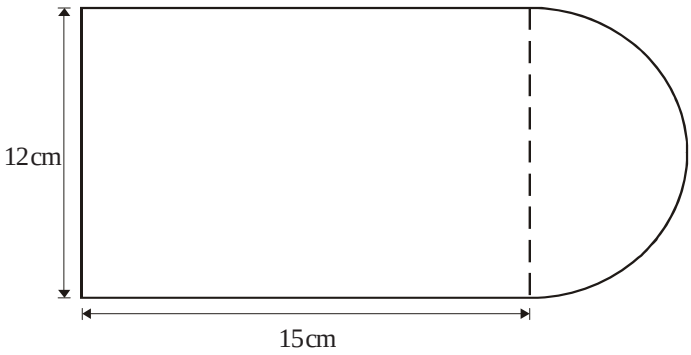
3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.

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

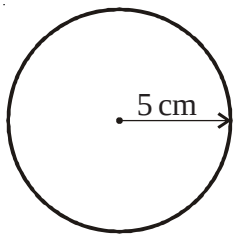
4) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

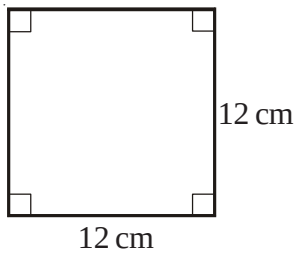
Calculate the perimeter of the shape.
Give your answer correct to
3 significant figures.



Area and Circumference of a Circle

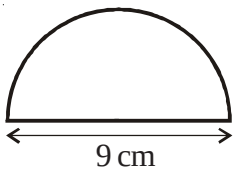
1) A circle has a radius of 5 cm.
A square has sides of length 12 cm.





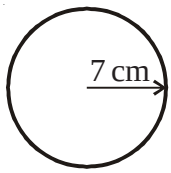
Work out the difference between the area of the circle and the area of the square if you take π to be 3.

2) Here is a tile in the shape of a semi-circle.



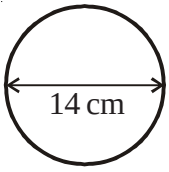
The diameter of the semi-circle is 9 cm.
Work out the perimeter of the tile.
Give your answer correct to two decimal places.

3) A circle has a radius of 7 cm.



Work out the area of the circle.
Give your answer correct to three significant figures.

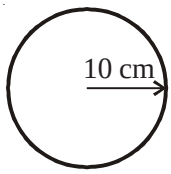
4) A circle has a diameter of 14 cm.



Work out the circumference of the circle.
Give your answer correct to three significant figures.

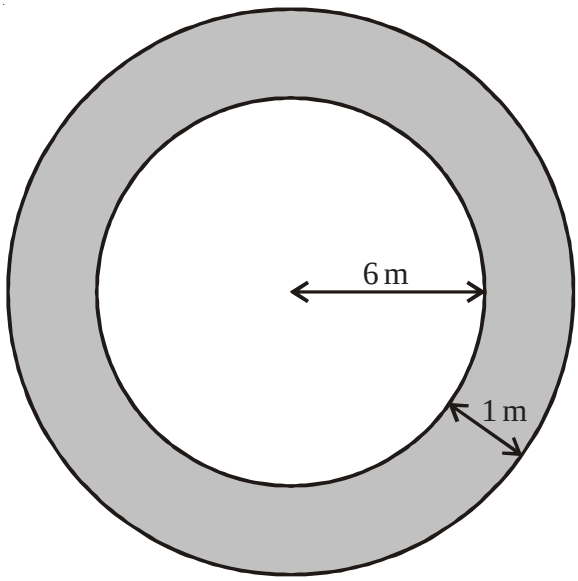
Area and Circumference of a Circle

1) The radius of a circle is 10 cm.



Work out the area of this circle.

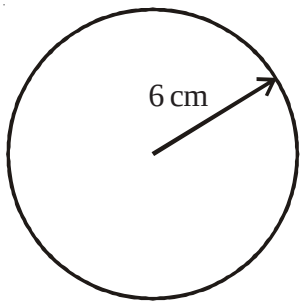
2) The diagram shows a circular pond with a path around it.



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.

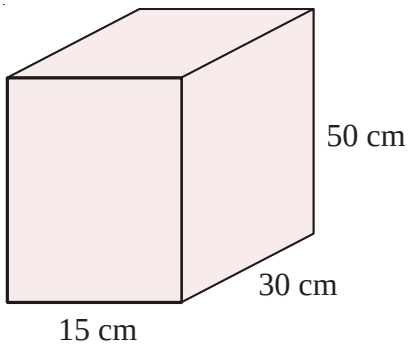
CDs of this size are cut from rectangular sheets of plastic.
Each sheet is 1 metre long and 50 cm wide.

b) Work out the greatest number of CDs which can be cut from one rectangular sheet.

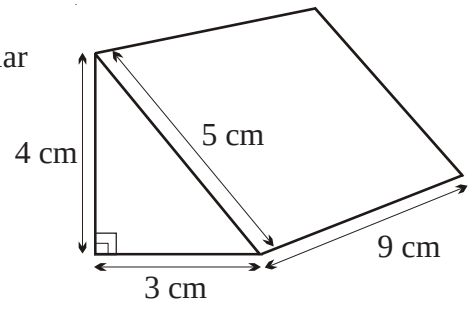
Volume of a Prism

1) The diagram shows a cuboid.

Work out the volume of the cuboid.

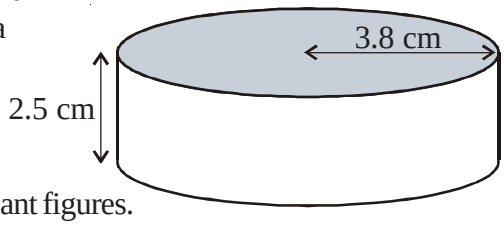


2) Calculate the volume of this triangular prism.



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.

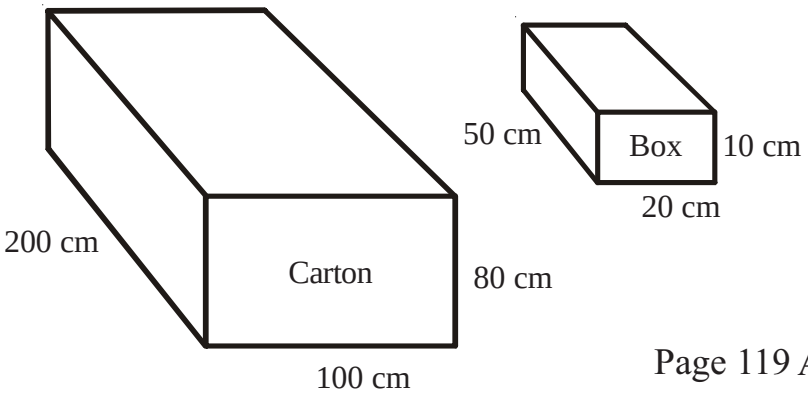
Work out the volume of the puck.
Give your answer correct to 3 significant figures.



4) A cuboid has: a volume of 80cm^3
a length of 5 cm
a width of 2 cm

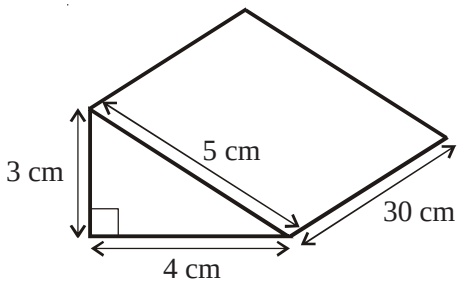
Work out the height of the cuboid.

5) Work out the maximum number of boxes which can fit in the carton.

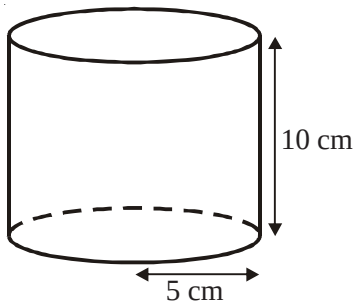


Volume of a Prism

1) Work out the volume of the prism.



2)

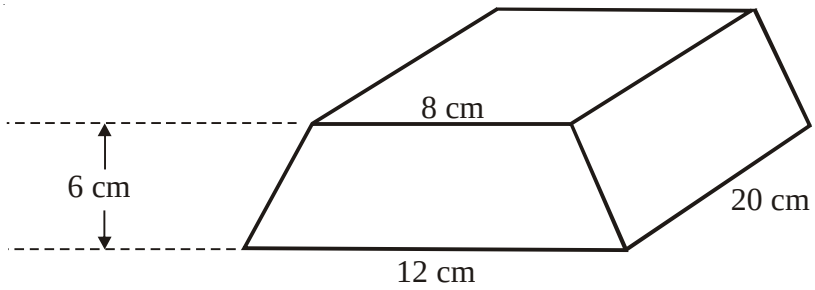


A solid cylinder has a radius of 5 cm and a height of 10 cm.

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.

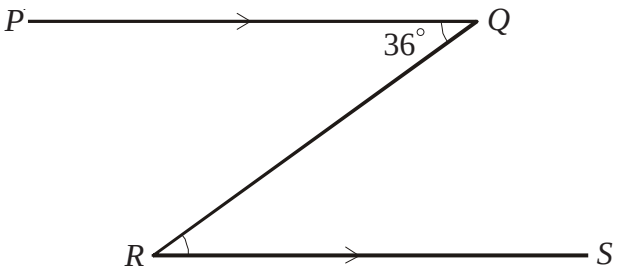
Angles and Parallel Lines

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.

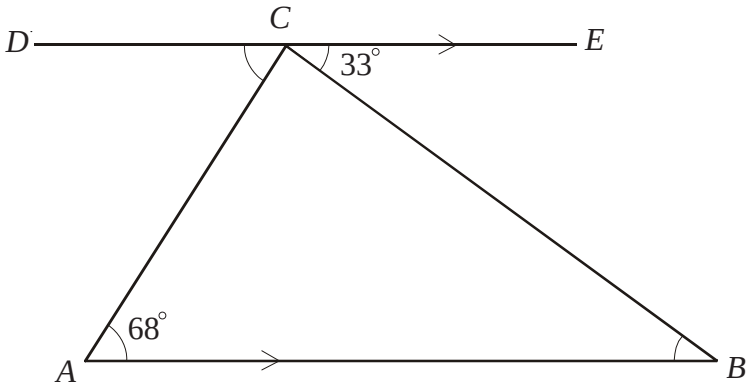


2) Line *DCE* is parallel to line *AB*

a) Find the size of angle *ABC*

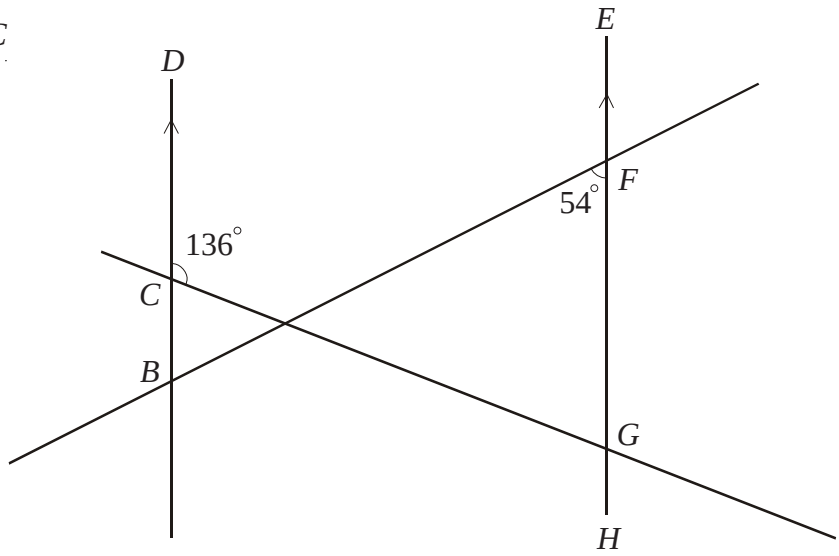
b) Find the size of angle *DCA*

c) Calculate the size of angle *ACB*



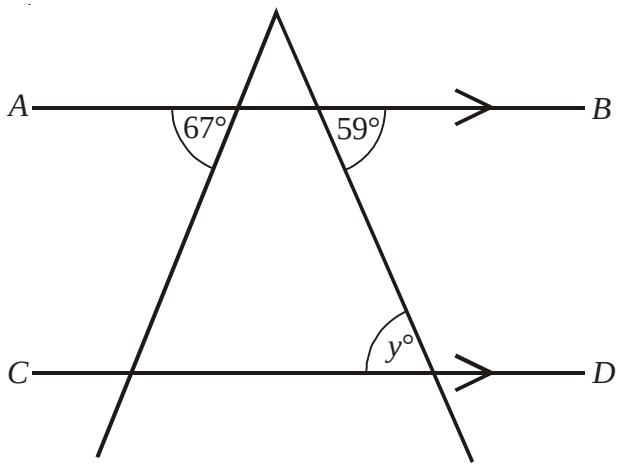
3) a) Find the size of angle *DBF*

b) Find the size of angle *HGC*



Angles and Parallel Lines

1)

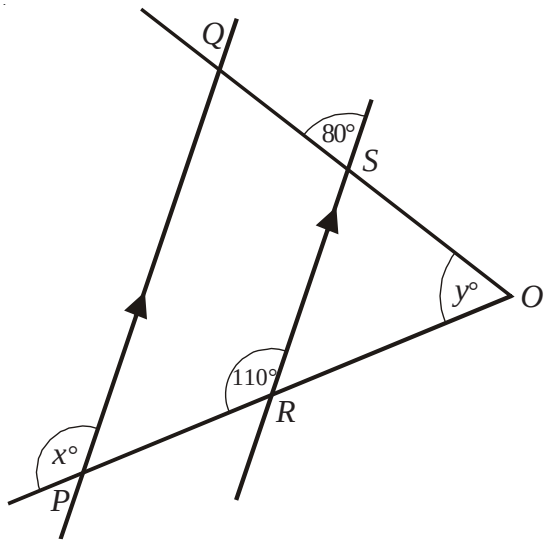


AB is parallel to *CD*.

(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.

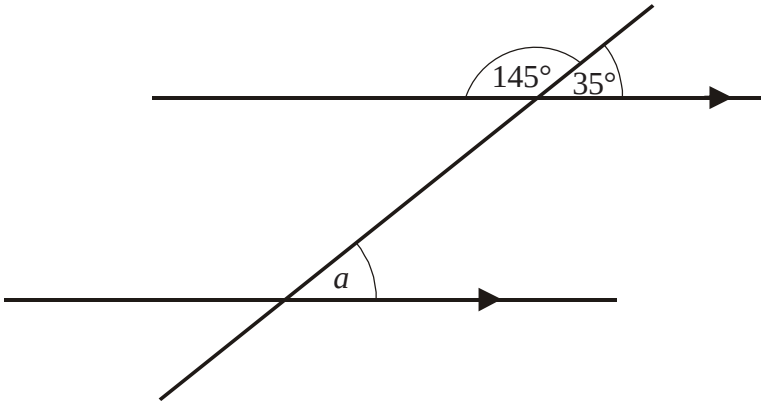
a) (i) Write down the value of *x*.

(ii) Give a reason for your answer.

b) Work out the value of *y*.

Angles and Parallel Lines

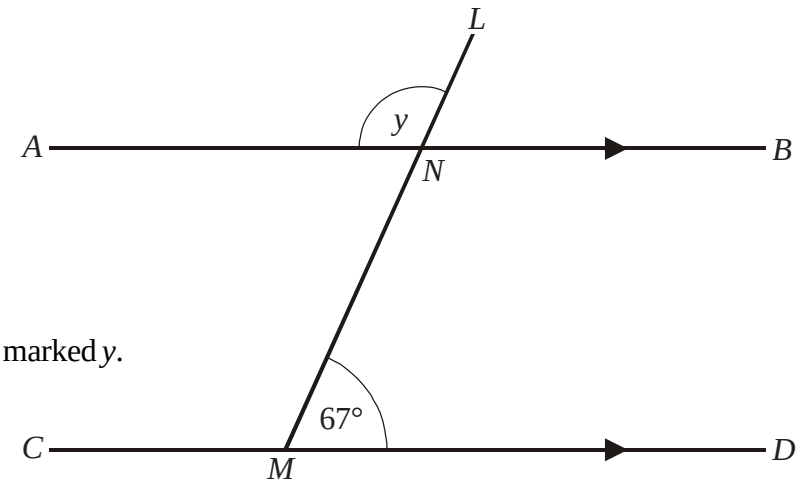
1)



(i) Write down the size of the angle marked *a*.

(ii) Give a reason for your answer.

2)

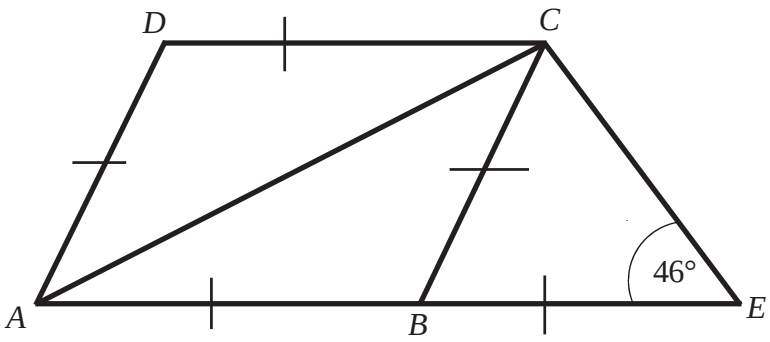


ANB is parallel to *CMD*.
LNM is a straight line.
Angle *LMD* = 67°

(i) Work out the size of the angle marked *y*.

(ii) Give reasons for your answer.

3)

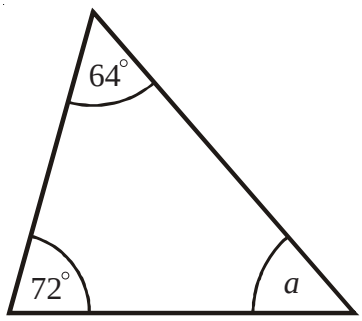


ABCD is a rhombus.
BCE is an isosceles triangle.
ABE is a straight line.

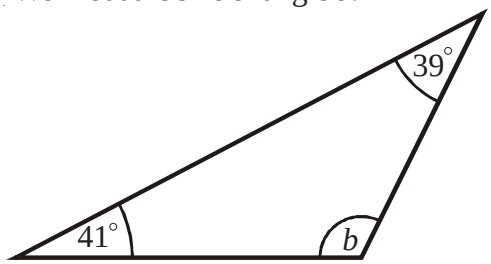
Work out the size of angle *DCA*.

Angles in a Triangle

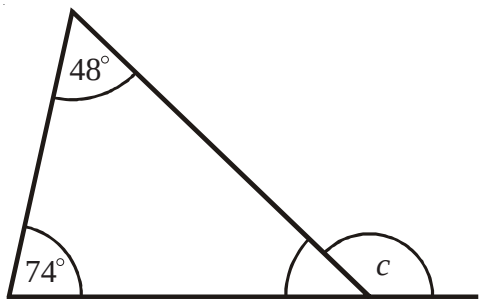
1) Work out the size of angle *a*.



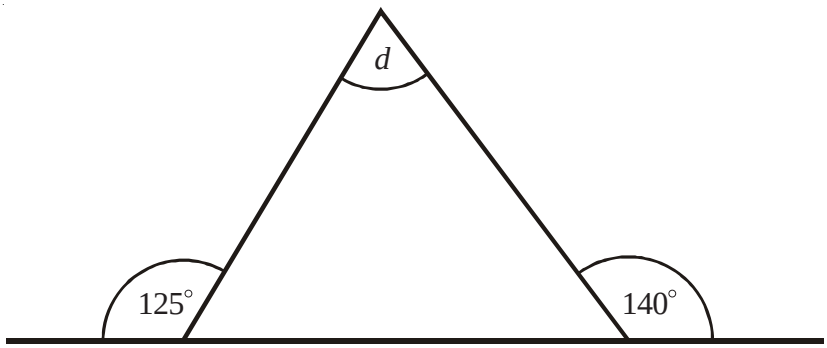
2) Work out the size of angle *b*.



3) Work out the size of angle *c*.



4) Work out the size of angle *d*.



Properties of Special Triangles

1) *ABC* is a triangle.

a) Find the size of angle *A*.

b) Triangle *ABC* is equilateral.
Explain why.

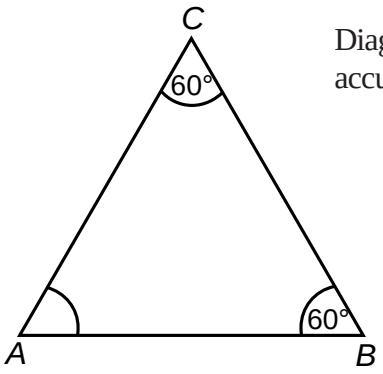


Diagram **NOT** accurately drawn

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.

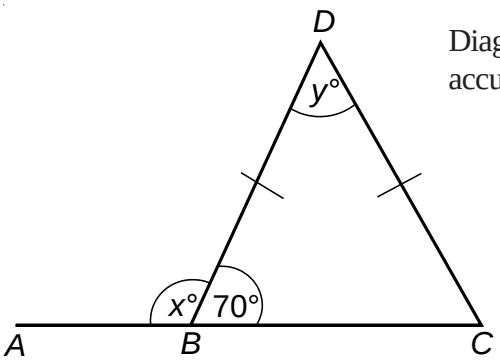


Diagram **NOT** accurately drawn

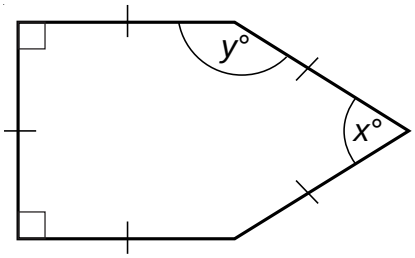
3) The diagram shows a 5-sided shape.
All the sides of the shape are equal in length.

a) (i) Find the value of *x*.

(ii) Give a reason for your answer.

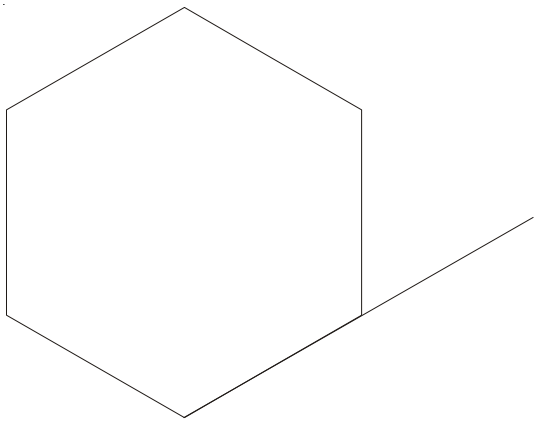
b) (i) Work out the value of *y*.

(ii) Explain your answer.



Angle Sum of Polygons

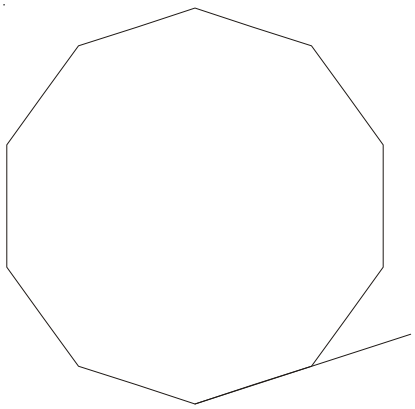
1)



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.

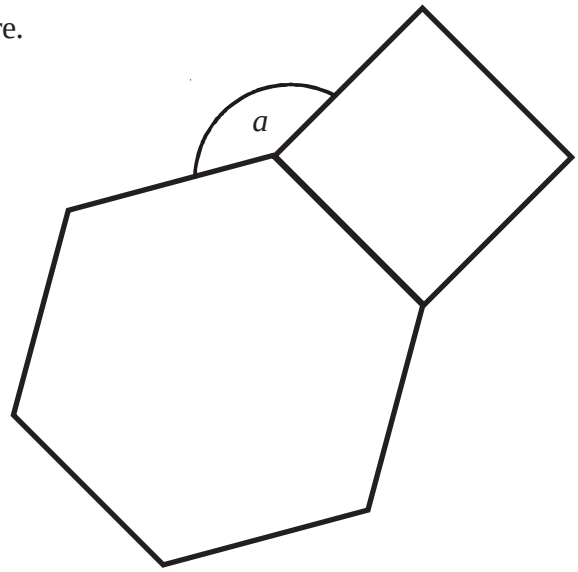
3) The size of each **exterior** angle of a regular polygon is 40°.
Work out the number of sides of the regular polygon.

4) The size of each **interior** angle of a regular polygon is 120°.
Work out the number of sides of the regular polygon.

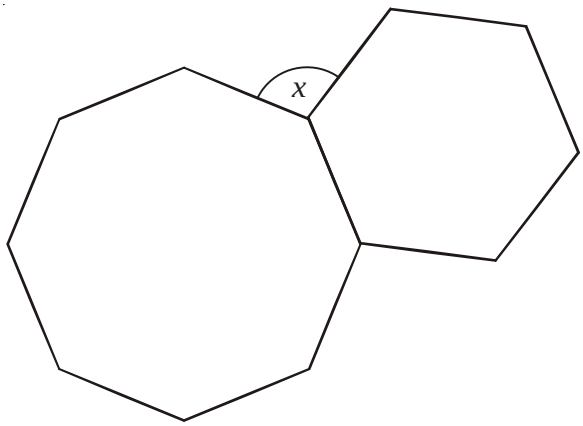
Angle Sum of Polygons

1) The diagram shows a regular hexagon and a square.

Calculate the size of the angle *a*.



2)

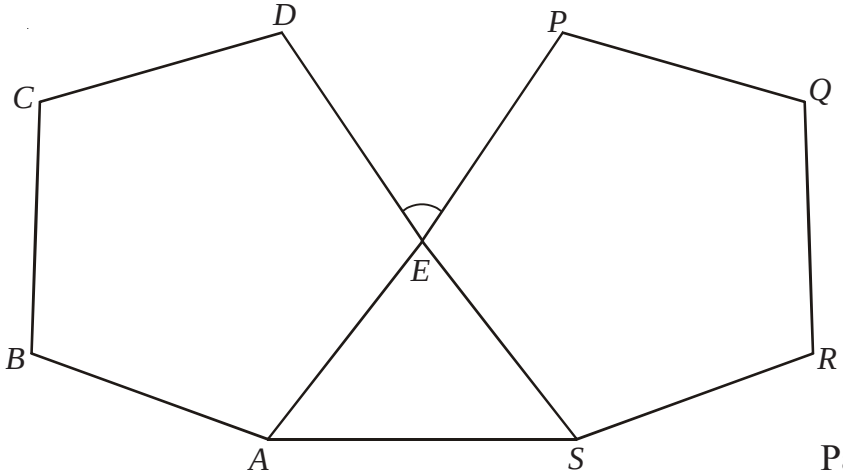


The diagram shows a regular octagon and a regular hexagon.

Work out the size of angle *x*.

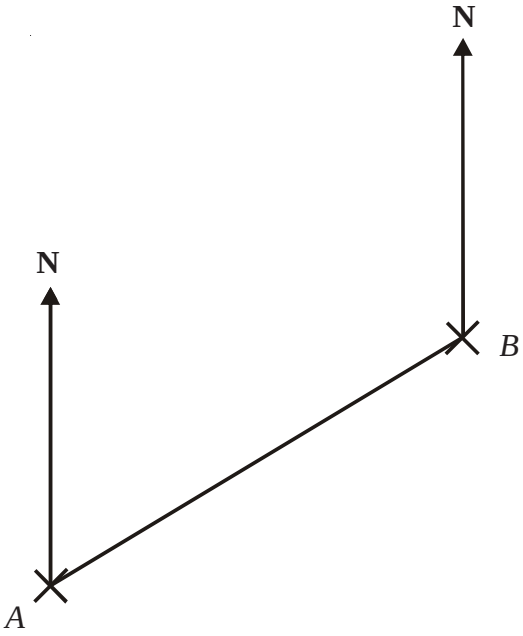
3) *ABCDE* and *PQRSE* are regular pentagons.
AES is an equilateral triangle.

Work out the size of angle *DEP*.



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) 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*

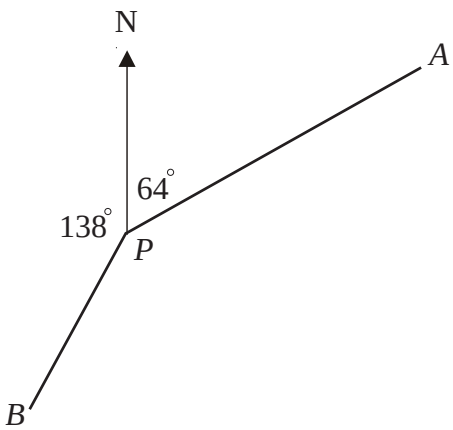


*Diagram **NOT** accurately drawn.*

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?

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.

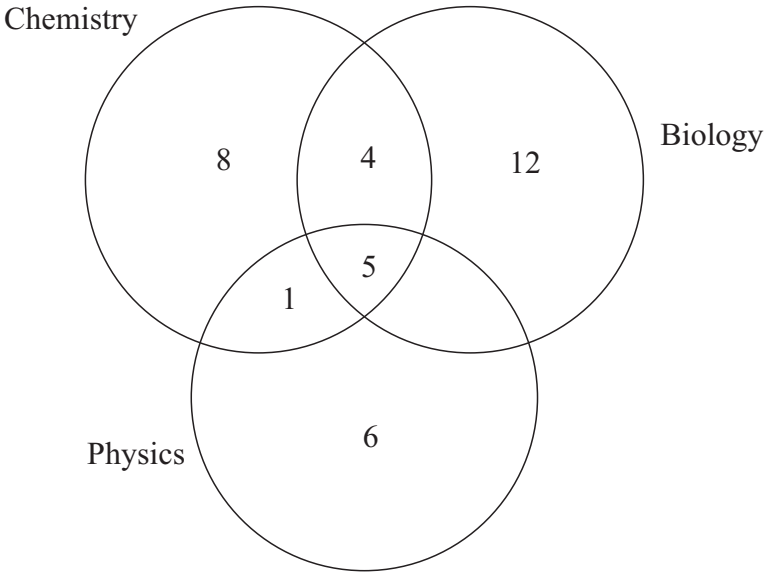
All the cards are placed into a hat and one is taken out at random.

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?

Venn Diagrams

1) The Venn diagram shows the number of students studying one or more of the sciences Chemistry, Biology and Physics.

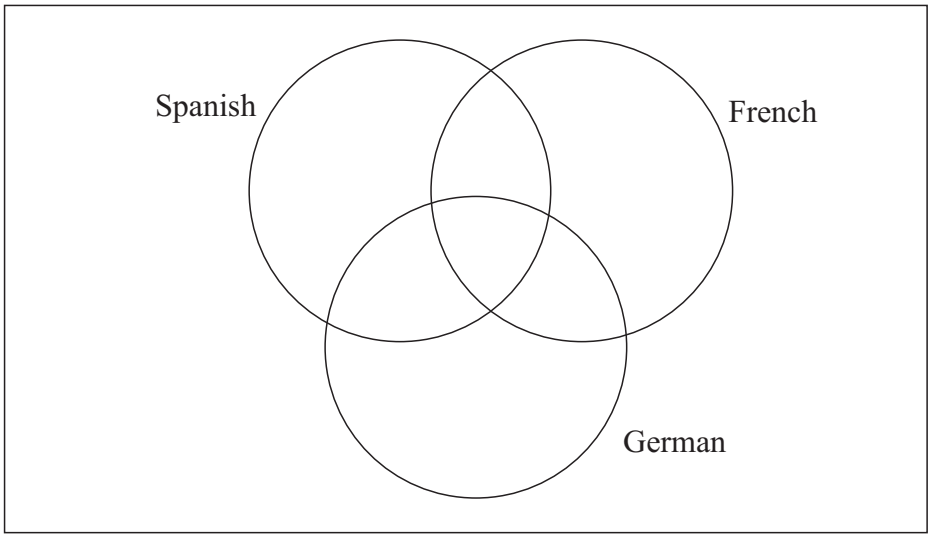


a) How many students are represented in this Venn diagram?

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.

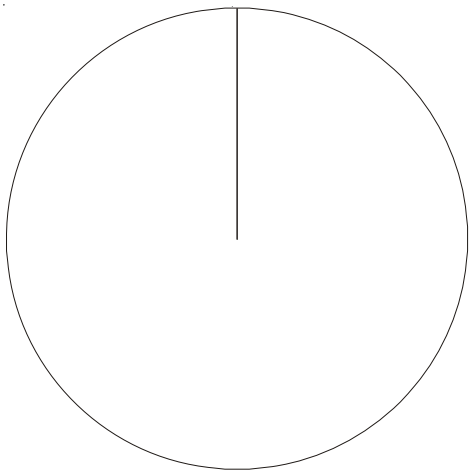


Representing Data

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

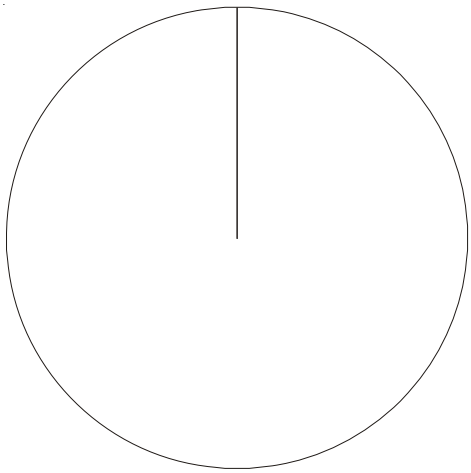
Draw a pie chart to illustrate the information.



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) The stem and leaf diagram, below, shows information about the times, in minutes, it takes a group of people to eat their breakfast.

0	5	7	9		
1	0	0	5	8	8
2	0	2	3	5	7
3	2	5			

Key: 1 | 0 represents 10 minutes.

a) How many people are in the group?

b) How many people spend 15 minutes or more eating their breakfast?

c) Find the median time that it took to eat breakfast.

Scatter Diagrams

1) The scatter graph shows some information about the marks of six students.
It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

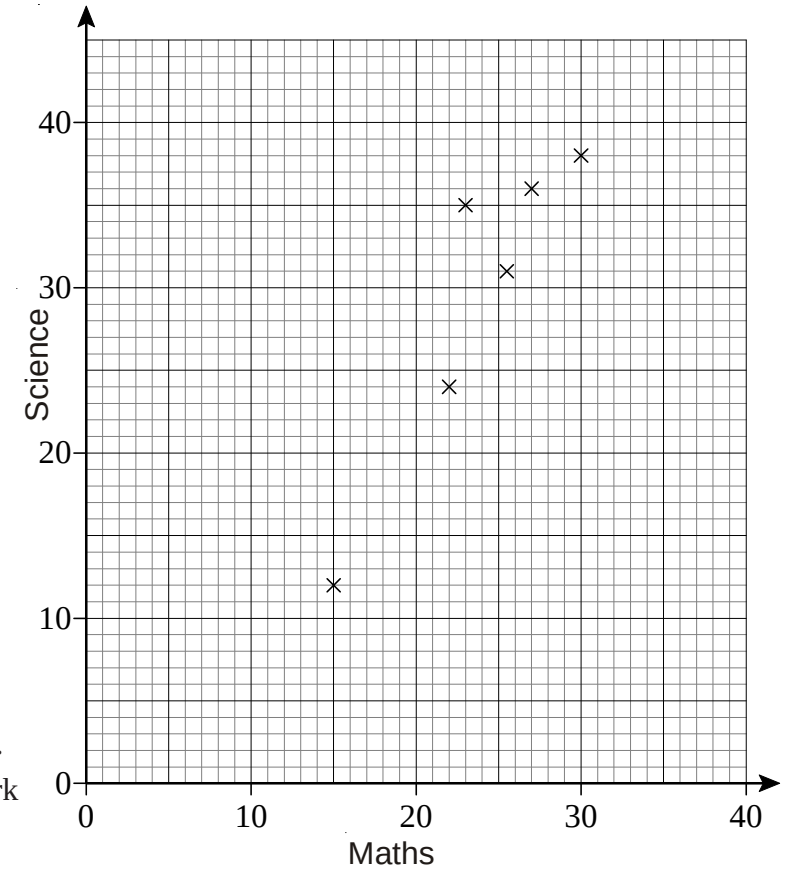
a) On the scatter graph, plot the information from the table.

b) Draw a line of best fit.

c) Describe the correlation between the marks in Maths and the marks in Science.

Another student has a mark of 18 in Science.

d) Use the line of best fit to estimate the mark in Maths of this student.



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2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

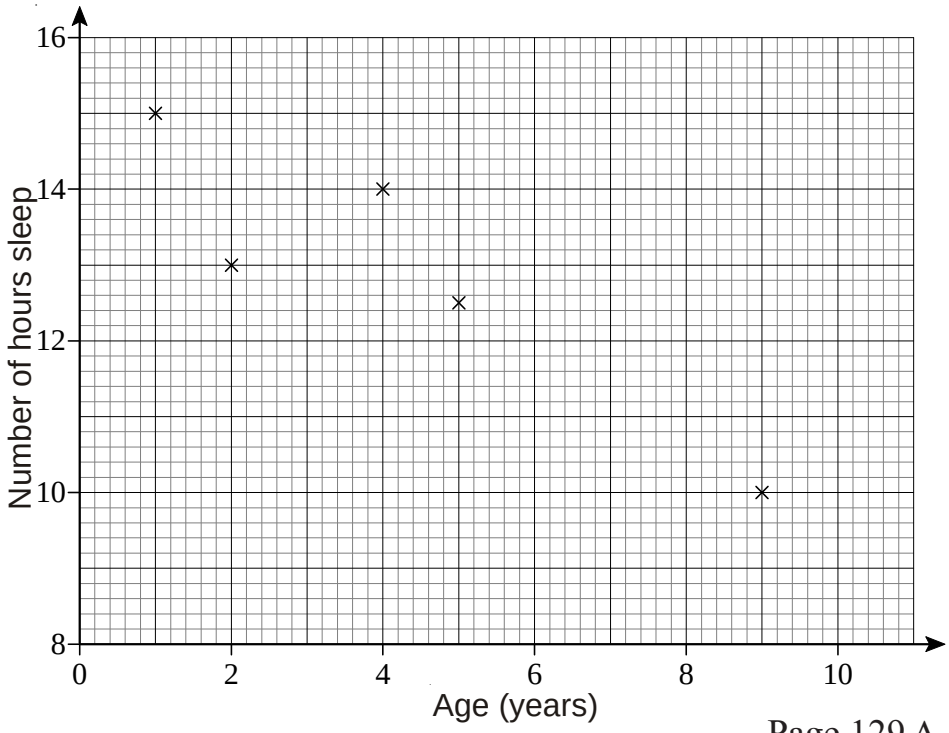
The first five results have been plotted on the scatter diagram.

a) Plot the next five points.

b) Draw a line of best fit.

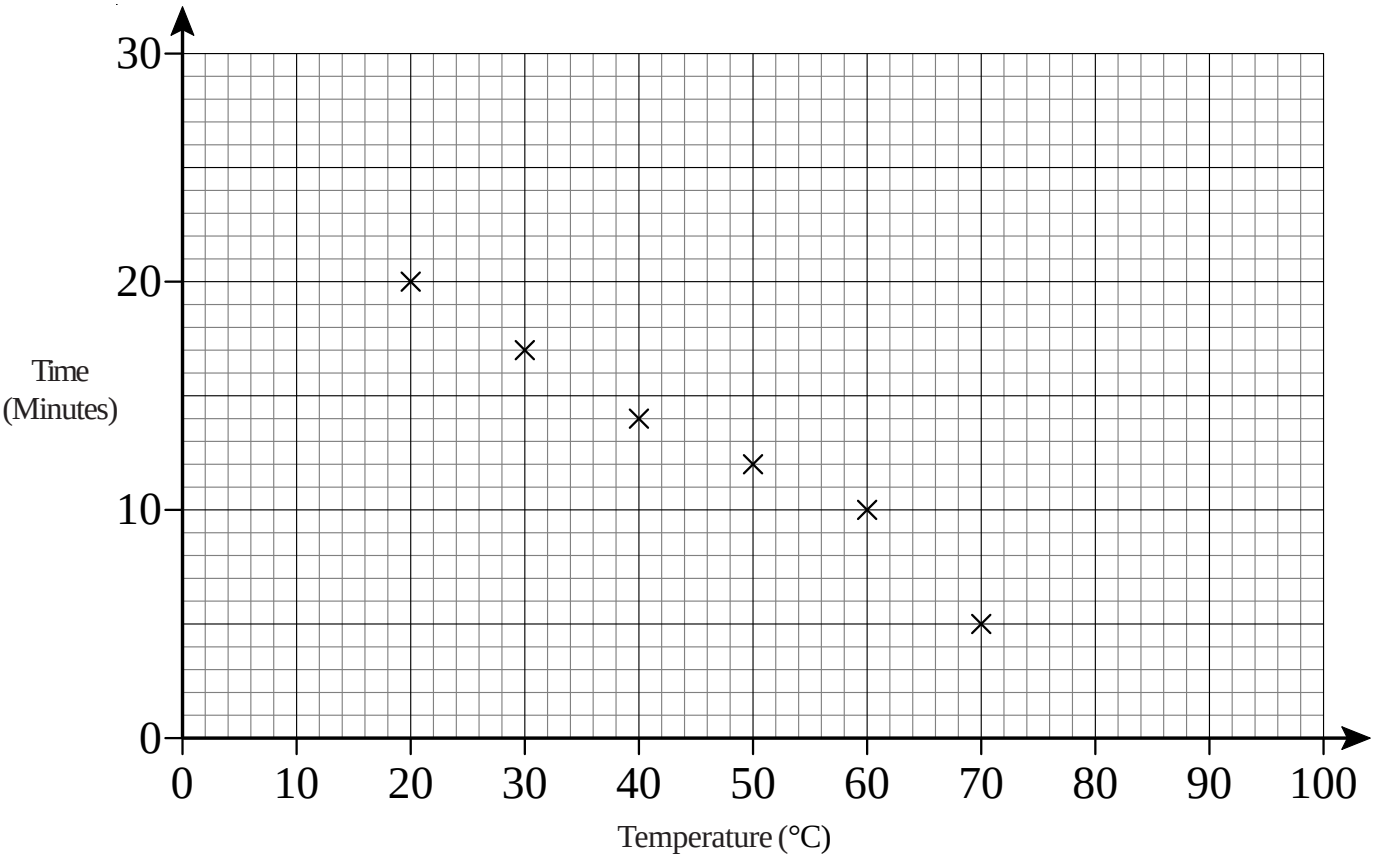
c) Describe the relationship between the age of the children and their number of hours sleep per day.

d) Use your scatter graph to estimate the number of hours sleep for a 3 year old child.



Scatter Diagrams

1) Sue did an experiment to study the times, in minutes, it took 1 cm ice cubes to melt at different temperatures.
Some information about her results is given in the scatter graph.



The table shows the results from two more experiments.

Temperature (°C)	15	55
Time (Minutes)	21	15

a) On the scatter graph, plot the results from the table.

b) Describe the relationship between the temperature and the time it takes a 1 cm ice cube to melt.

c) Find an estimate for the time it takes a 1 cm ice cube to melt when the temperature is 25 °C.

Sue's data cannot be used to predict how long it will take a 1 cm ice cube to melt when the temperature is 100 °C.

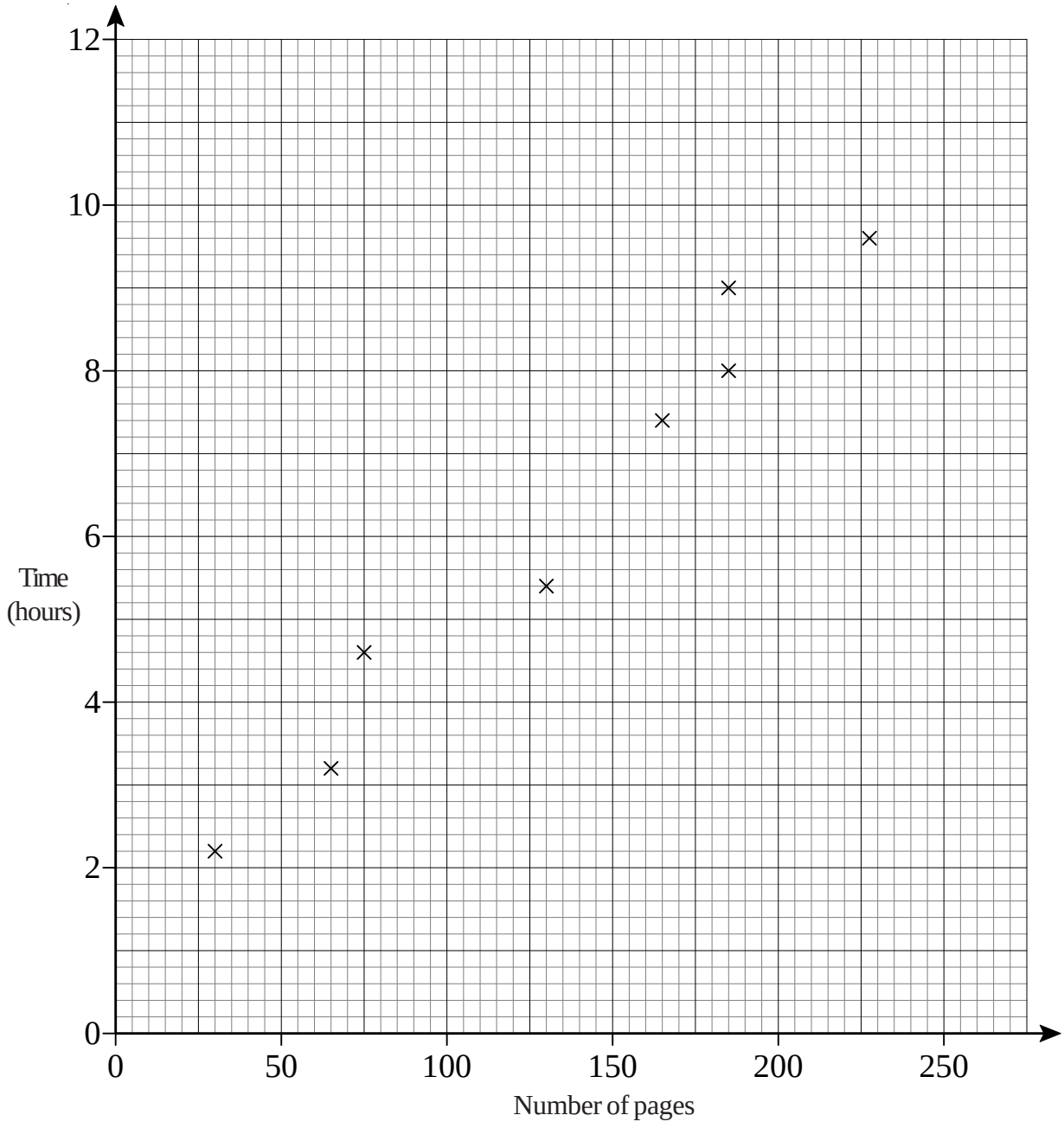
d) Explain why.

Scatter Diagrams

1) Henry reads eight books.

For each book he recorded the number of pages and the time he took to read it.

The scatter graph shows information about his results.



a) Describe the relationship between the number of pages in a book and the time Henry takes to read it.

Henry reads another book.

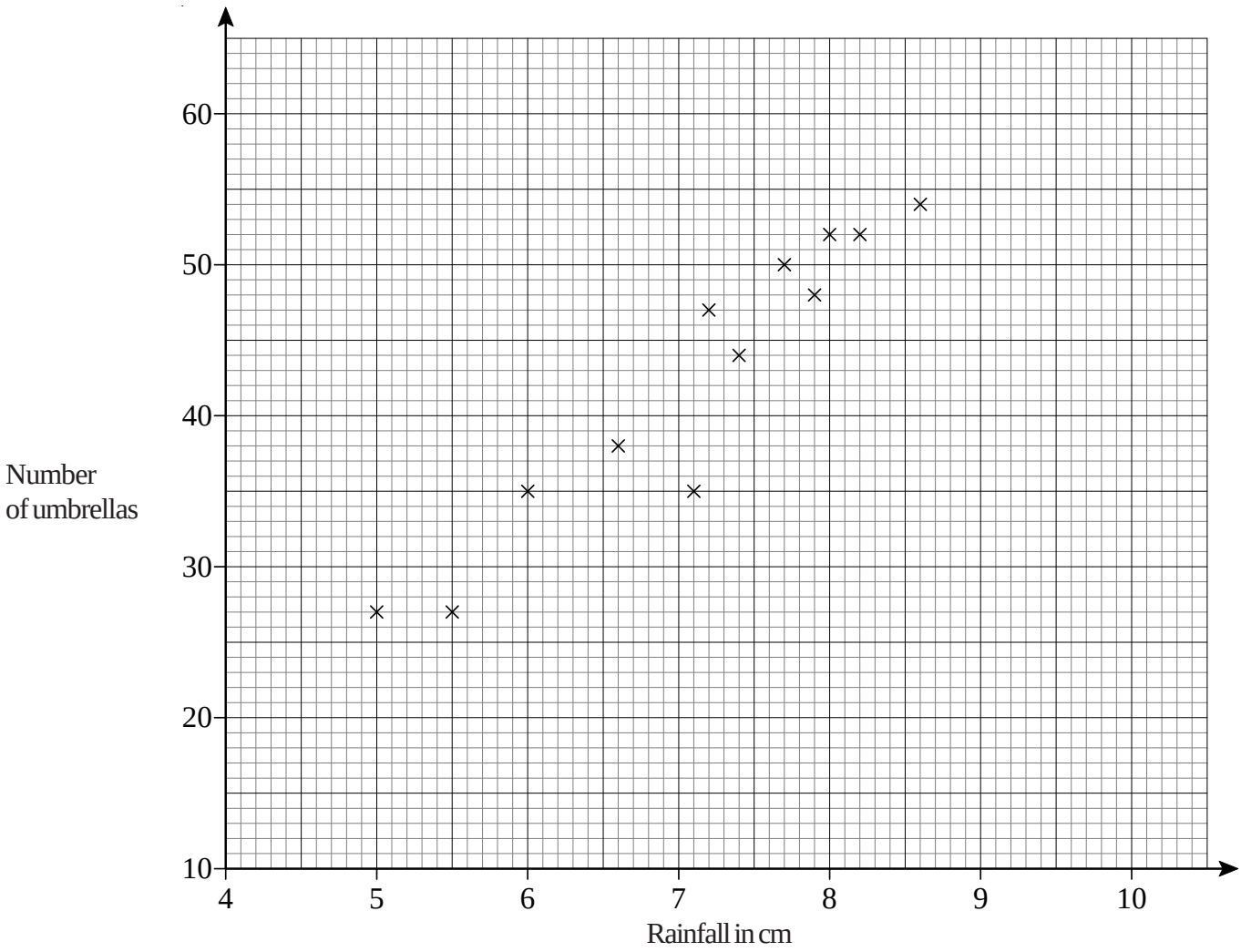
The book has 150 pages.

b) Estimate the time it takes Henry to read it.

Scatter Diagrams

1) Mr Jones sells umbrellas.

The scatter graph shows some information about the number of umbrellas he sold and the rainfall, in cm, each month last year.



In January of this year, the rainfall was 6.2 cm.

During January, Mr Jones sold 32 umbrellas.

a) Show this information on the scatter graph.

b) What type of correlation does this scatter graph show?

In February of this year, Mr Jones sold 40 umbrellas.

c) Estimate the rainfall for February.

Averages From a Table

1) 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.

2) 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.

3) 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.

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) 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 $2x \times 3y$

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.

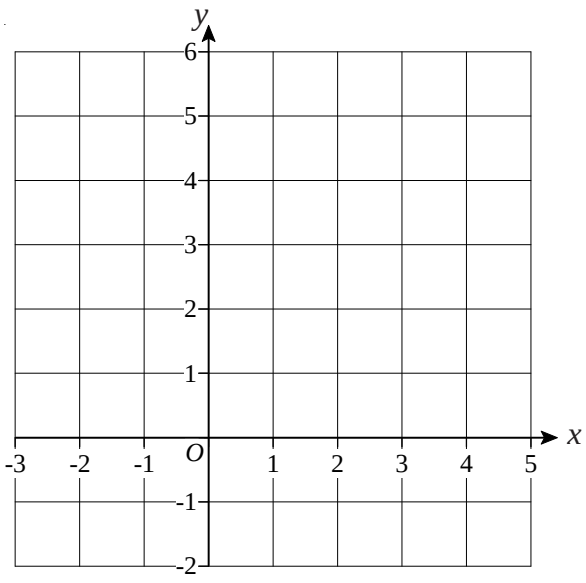
5) A square has sides of length 7 cm, correct to the nearest centimetre.

   a) Calculate the lower bound for the perimeter of the square.

   b) Calculate the upper bound for the area of the square.

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*.

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 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) $(3x – 2y)(x – 5y)$

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 $\frac{4x + 3}{5} = \frac{2x - 1}{2}$

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.

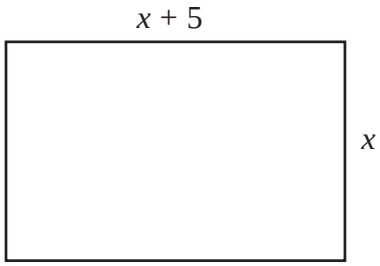
6) Rearrange $y = 3x + 1$ to make x the subject.

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.

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)

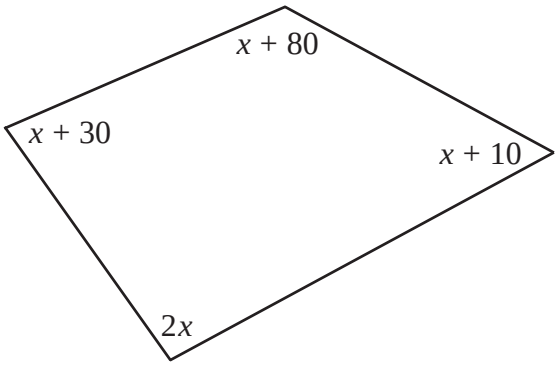


*Diagram **NOT** accurately drawn*

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 £$(x + 3)$

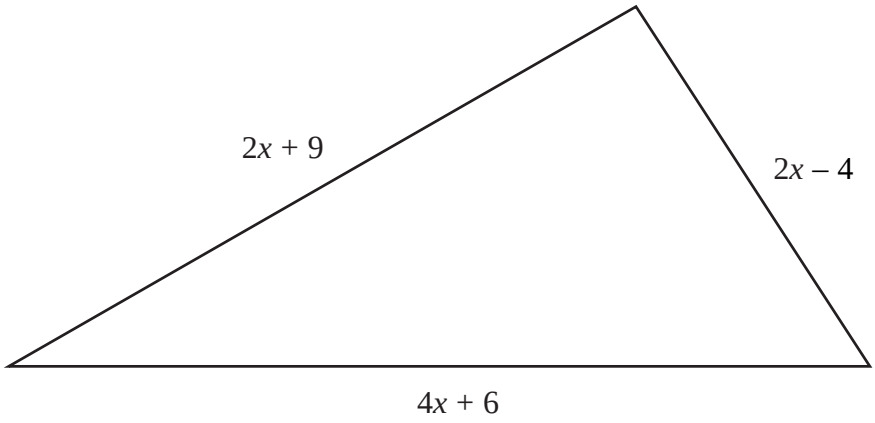
a) Write down an expression, in terms of x, for the total cost, in pounds, of 6 cups and 6 mugs.

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)



In the diagram, all measurements are in centimetres.

The lengths of the sides are

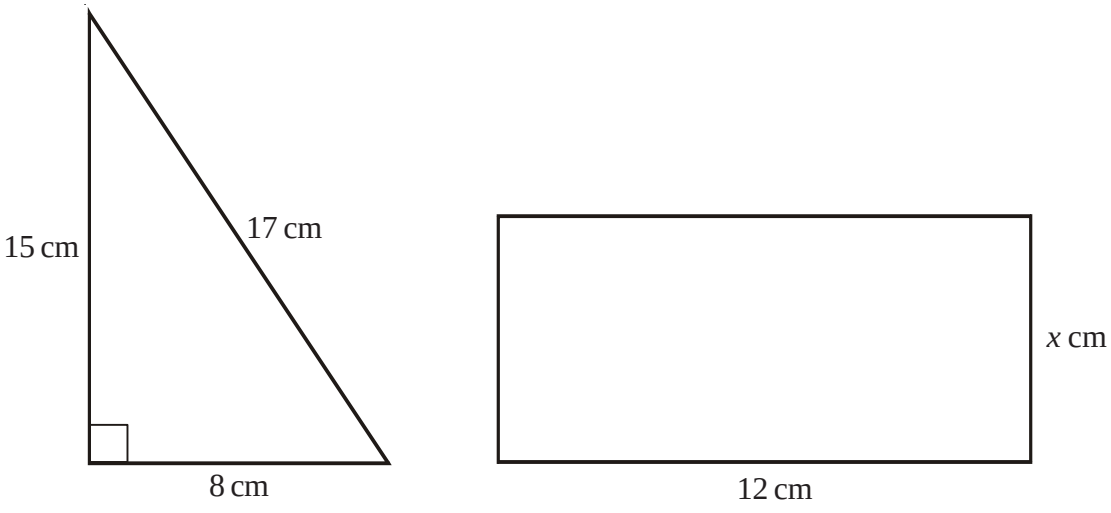
$2x + 9$
$2x - 4$
$4x + 6$

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) 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.

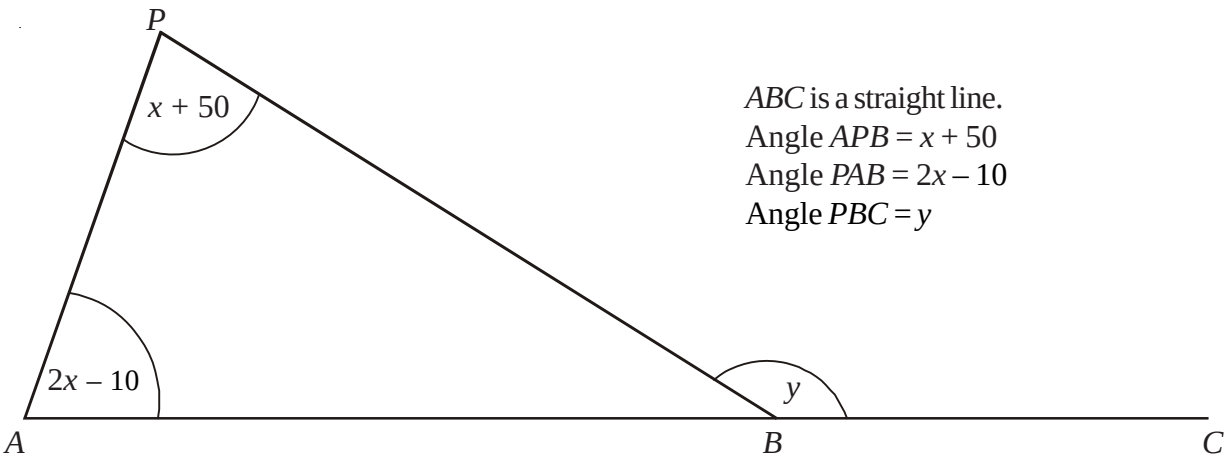
Tony buys p packets of batteries and b boxes of batteries.
Tony buys a total of N batteries.

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

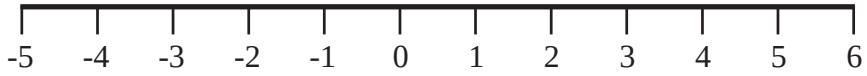
(i) Work out the value of x.

(ii) Work out the size of the largest angle in triangle APB.

Inequalities on a Number Line

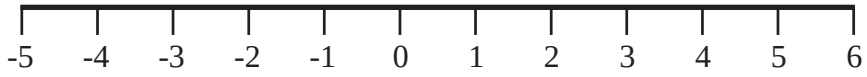
1) Represent this inequality on the number line

$-3 < x \leqslant 2$

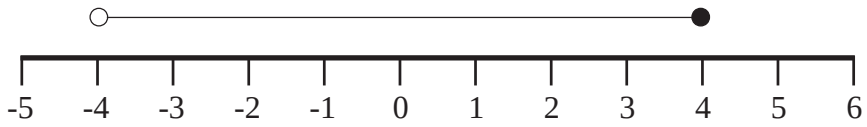


2) Represent this inequality on the number line

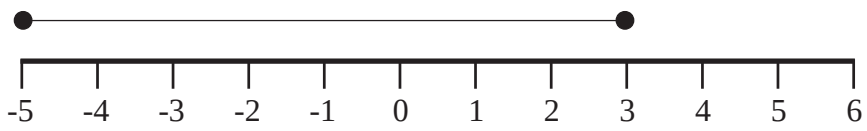
$-1 \leqslant x < 5$



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

$-9 < x < -5$

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 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 $\frac{29 - x}{3} = x + 5$

11) Solve $3x - 10 = x + 30$

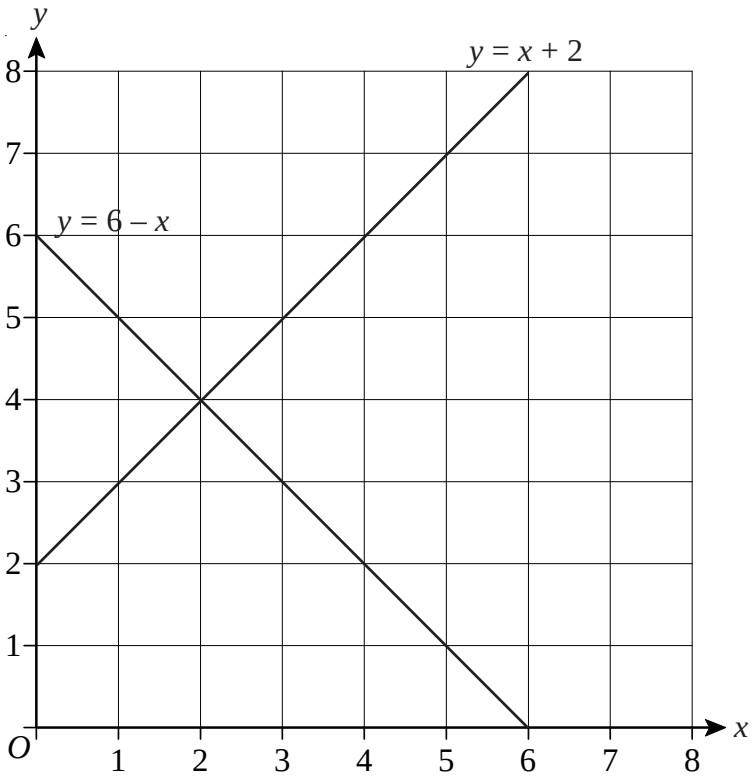
12) Solve the inequality $3x - 2 > x + 7$

13) Solve the inequality $\frac{2x}{3} < 10$

Simultaneous Equations Graphically

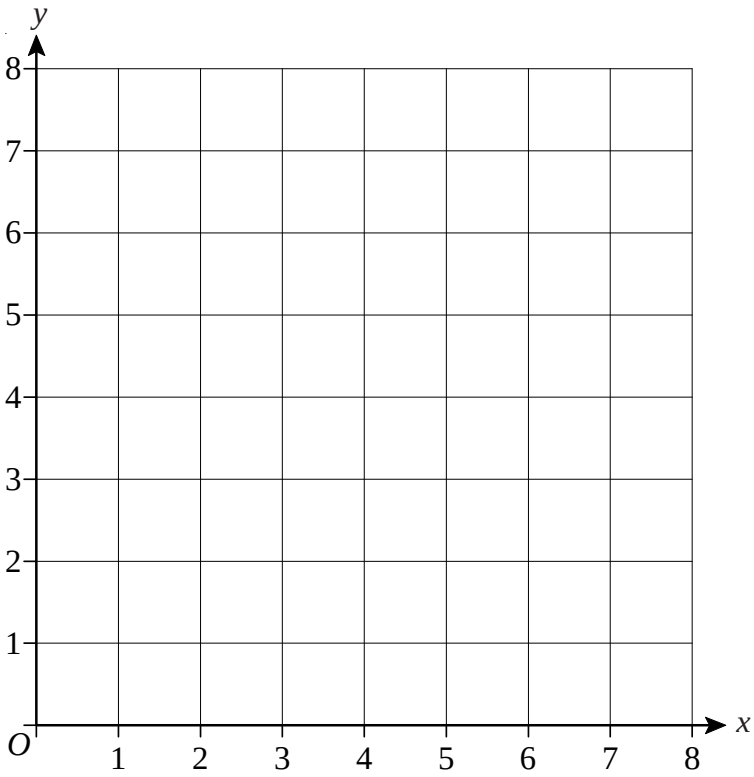
1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.

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 $y = 7 - x$



Fibonacci Sequences

1) Write down the next two terms of the Fibonacci sequence that begins

1, 1, 2, 3, 5, 8, 13, . . .

2) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the least value of n for which $x_n > 60$?

3) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_n + x_{n+1} = 89$?

4) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_n + x_{n+1} + x_{n+2} = 68$?

5) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the value of n for which $x_{n-1} + x_n = 144$?

6) If the first three Fibonacci numbers are $x_1 = 1$, $x_2 = 1$, $x_3 = 2$,

what is the least value of n for which $\frac{x_{n+1}}{x_n} = 1.619$ correct to three decimal places?

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) 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.

8) An apple has a mass of 160 g and a volume of 100 cm^3.

Find its density in g/cm^3.

9) 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**.

10) 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?

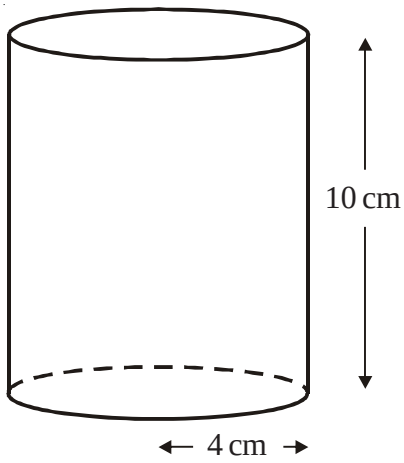
Compound Units

1) 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.

2) A solid cylinder has a radius of 4 cm and a height of 10 cm.

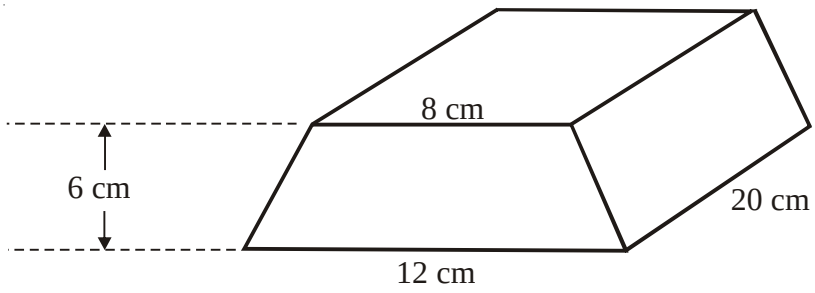


a) Work out the volume of the cylinder.
Give your answer correct to 3 significant figures.

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.

3)



The diagram shows a solid prism made from metal.
The cross-section of the prism is a trapezium.

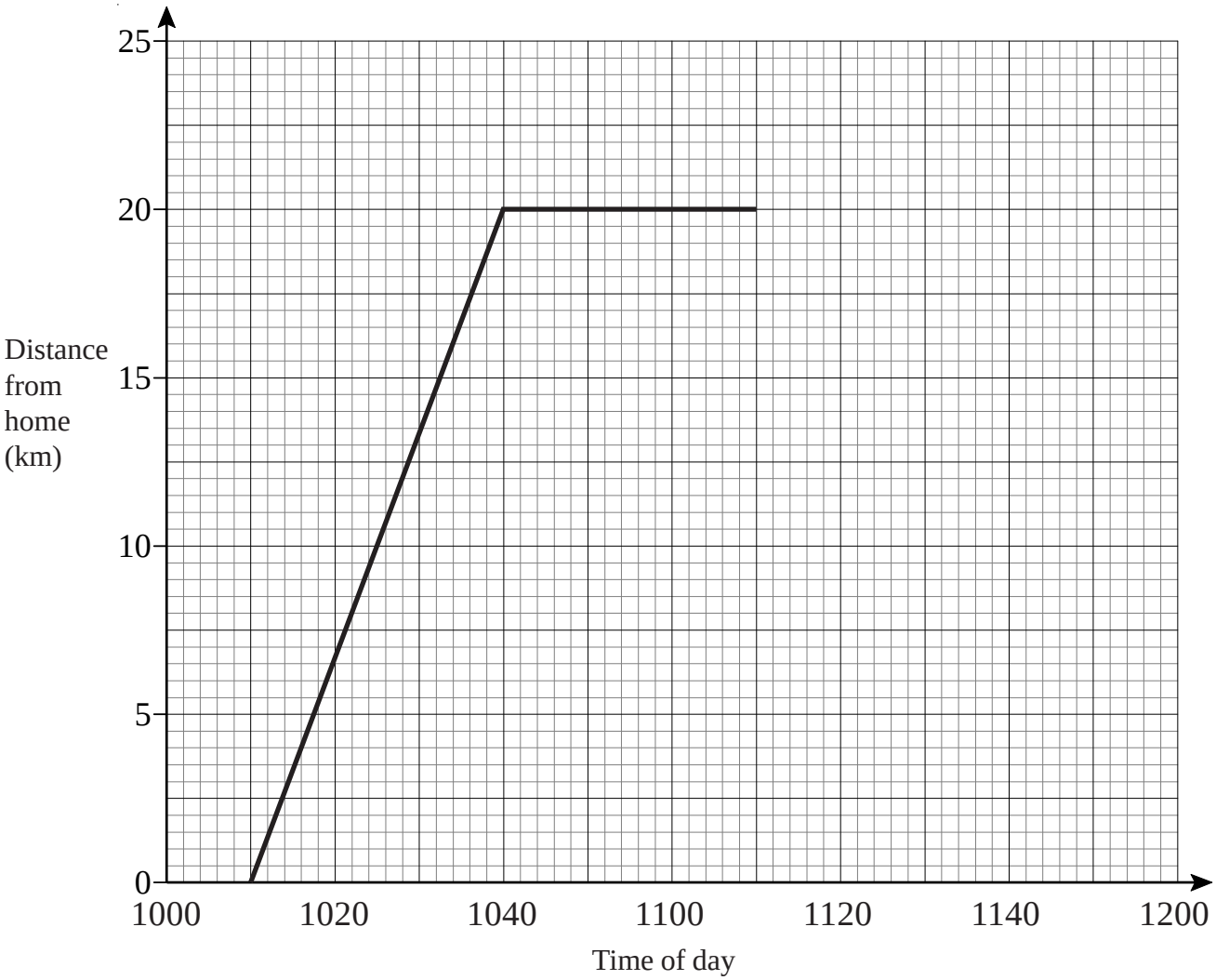
The parallel sides of the trapezium are 8 cm and 12 cm.
The height of the trapezium is 6 cm.
The length of the prism is 20 cm.

The density of the metal is 4 g/cm^3.

Calculate the mass of the prism.
Give your answer in kilograms.

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

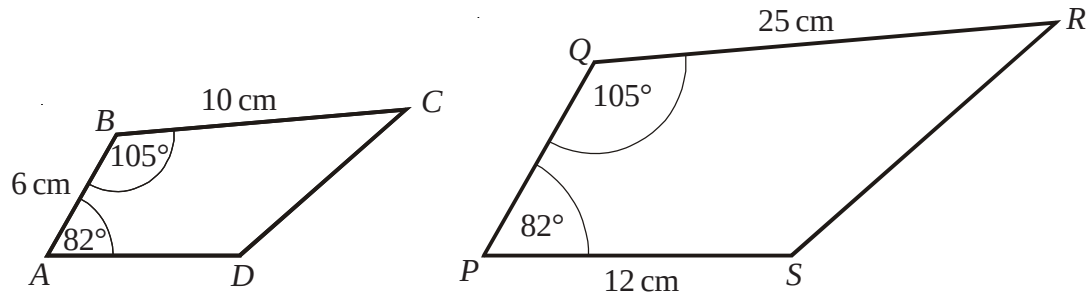
d) Complete the travel graph.

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.

Similar Shapes

1)

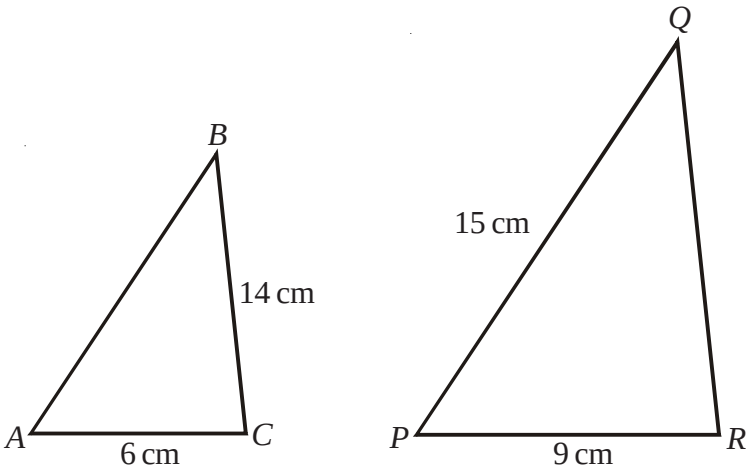


ABCD and *PQRS* are mathematically similar.

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.

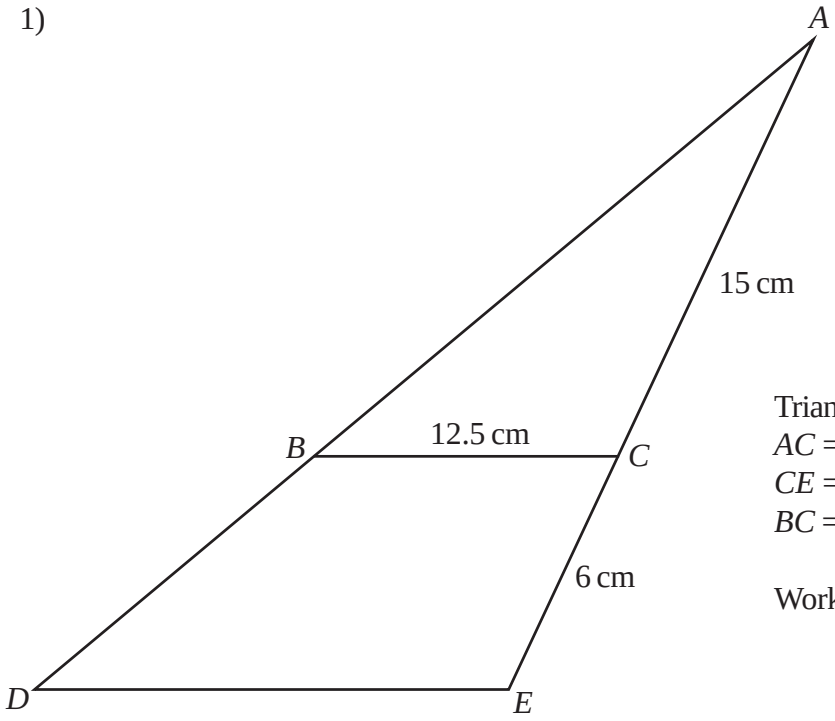
PQ = 15 cm

a) Work out the length of *QR*.

b) Work out the length of *AB*.

Similar Shapes

1)



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.

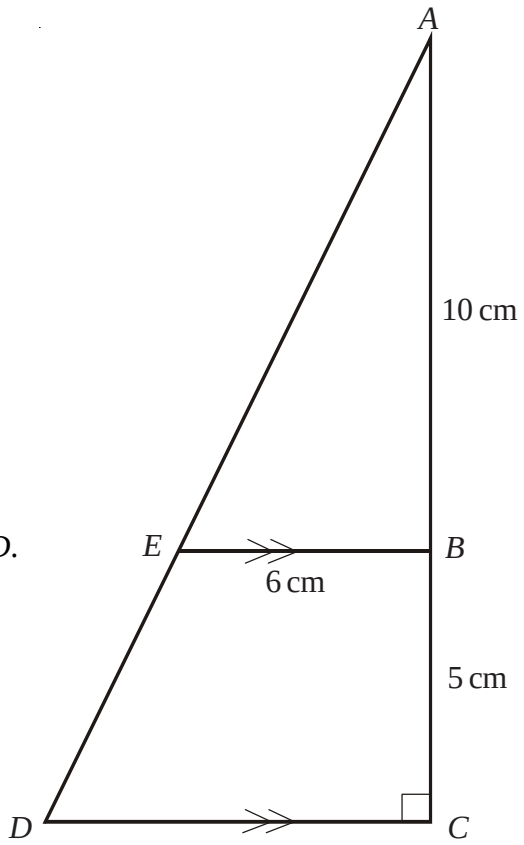
EB is parallel to *DC*.

Angle *ACD* = 90°

AB = 10 cm
BC = 5 cm
EB = 6 cm

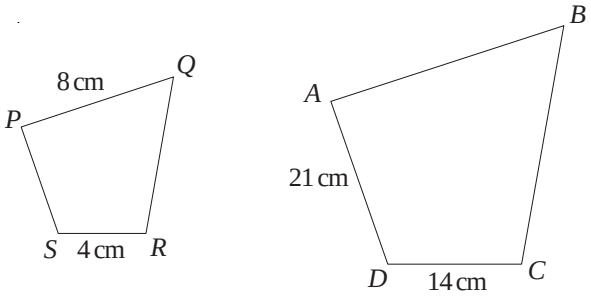
a) Work out the length of *DC*.

b) Work out the area of the trapezium *EBCD*.



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.

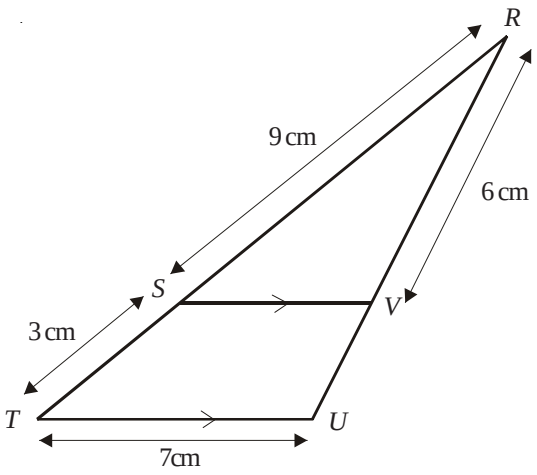


a) Calculate the length of *AB*

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

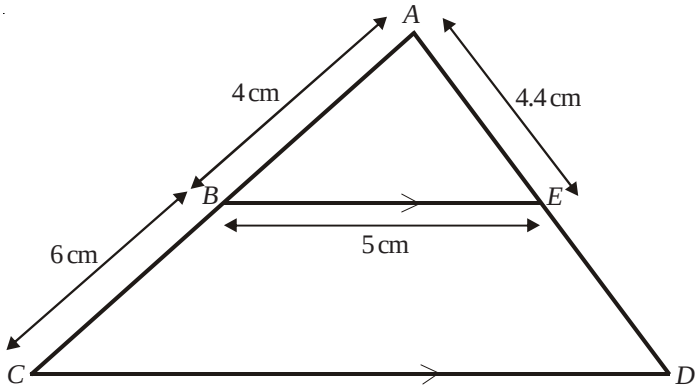
Calculate the length of *VU*.



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*.

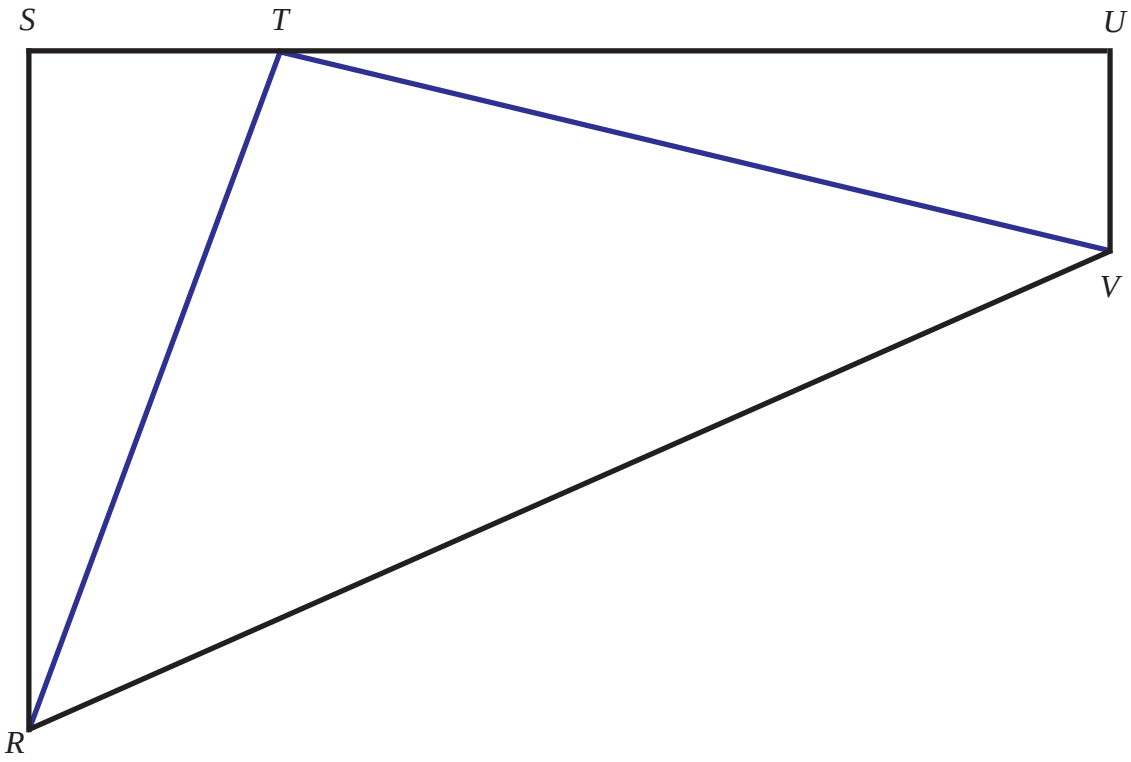
b) Calculate the length of *ED*.



Bisecting an Angle

1) Using ruler and compasses, bisect angle *ABC*.

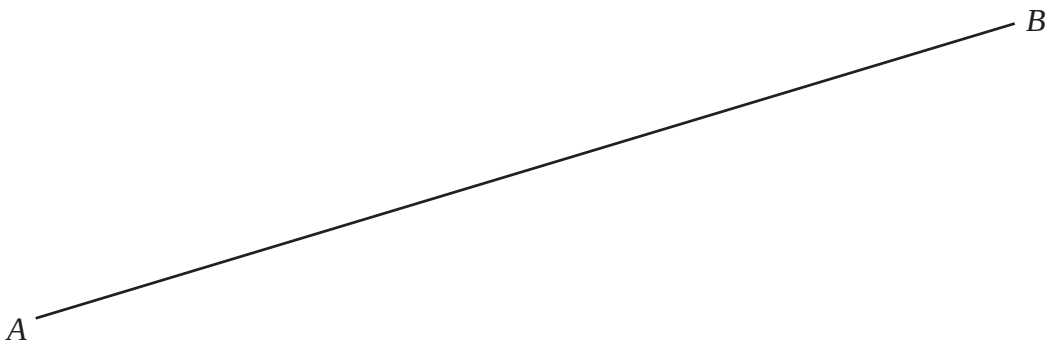
2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral *RSTUV*



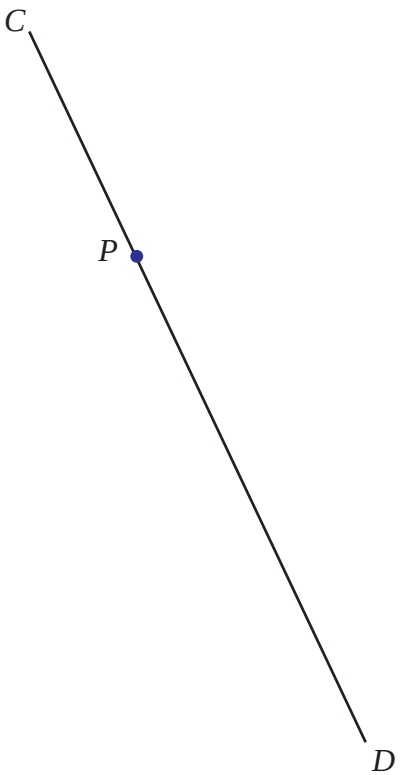
There are two paths in the park. One is labelled *TR* and the other *TV*
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Constructing Perpendiculars

1) Use ruler and compasses to bisect the line segment *AB*.
You must show all construction lines.



2) Use ruler and compasses to **construct** the perpendicular to the line segment *CD* that passes through the point *P*.
You must show all construction lines.



Drawing a Triangle Using Compasses

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

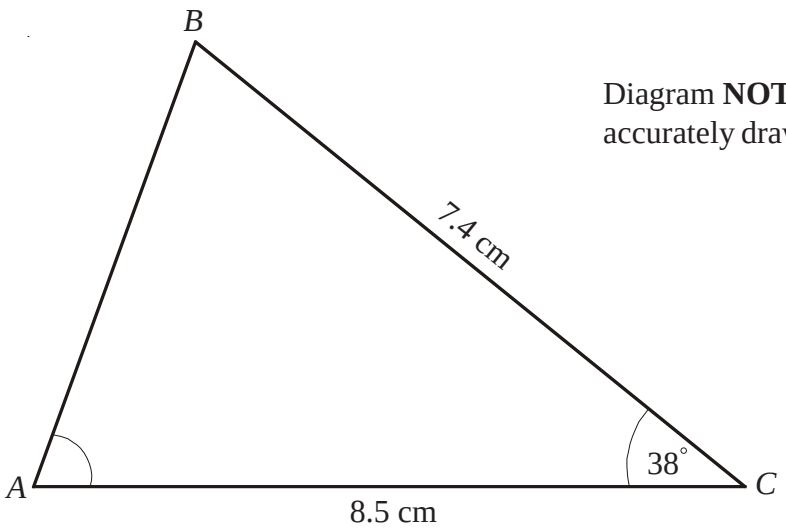


Diagram **NOT** accurately drawn

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*.

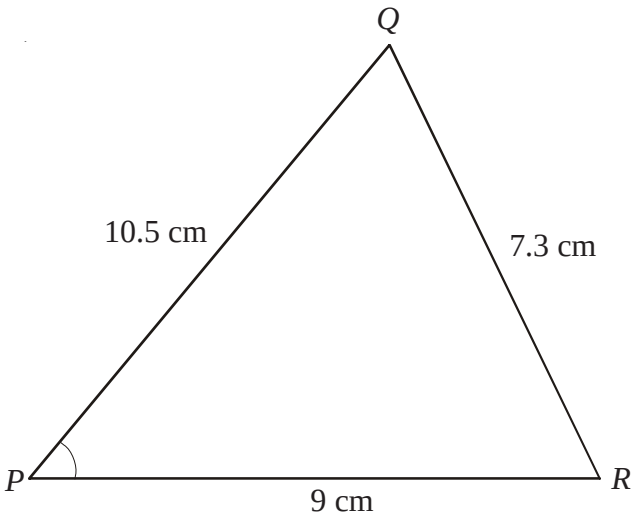


Diagram **NOT** accurately drawn

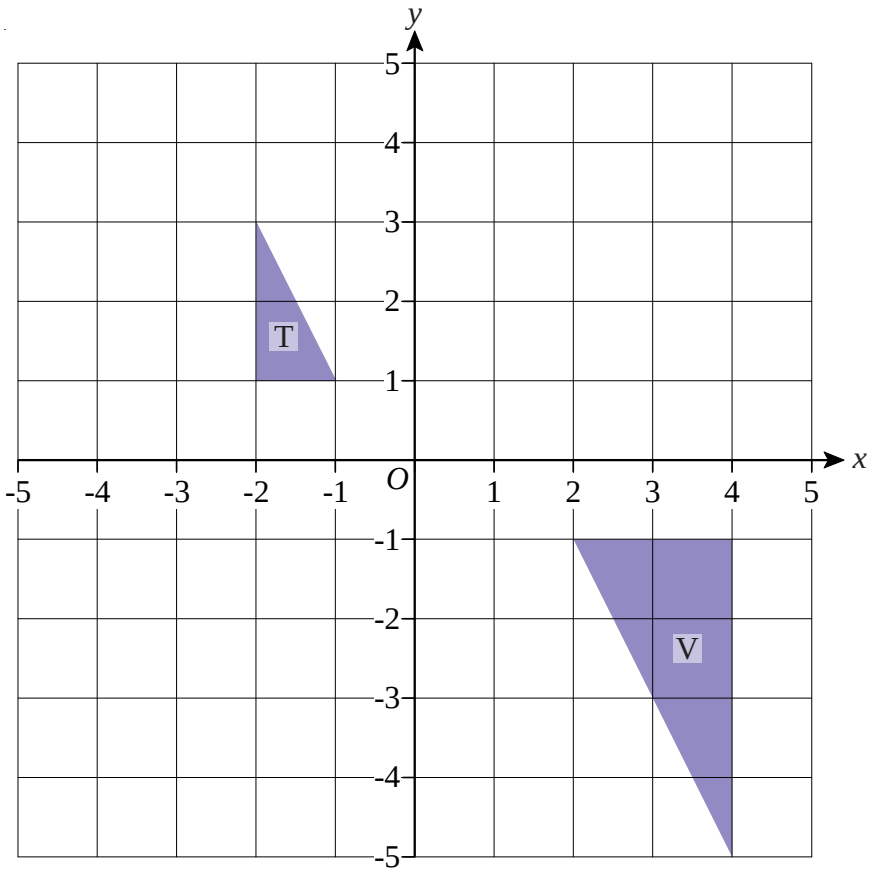
a) Use ruler and compasses to make an accurate drawing of triangle *PQR*.

b) Measure angle *P*.

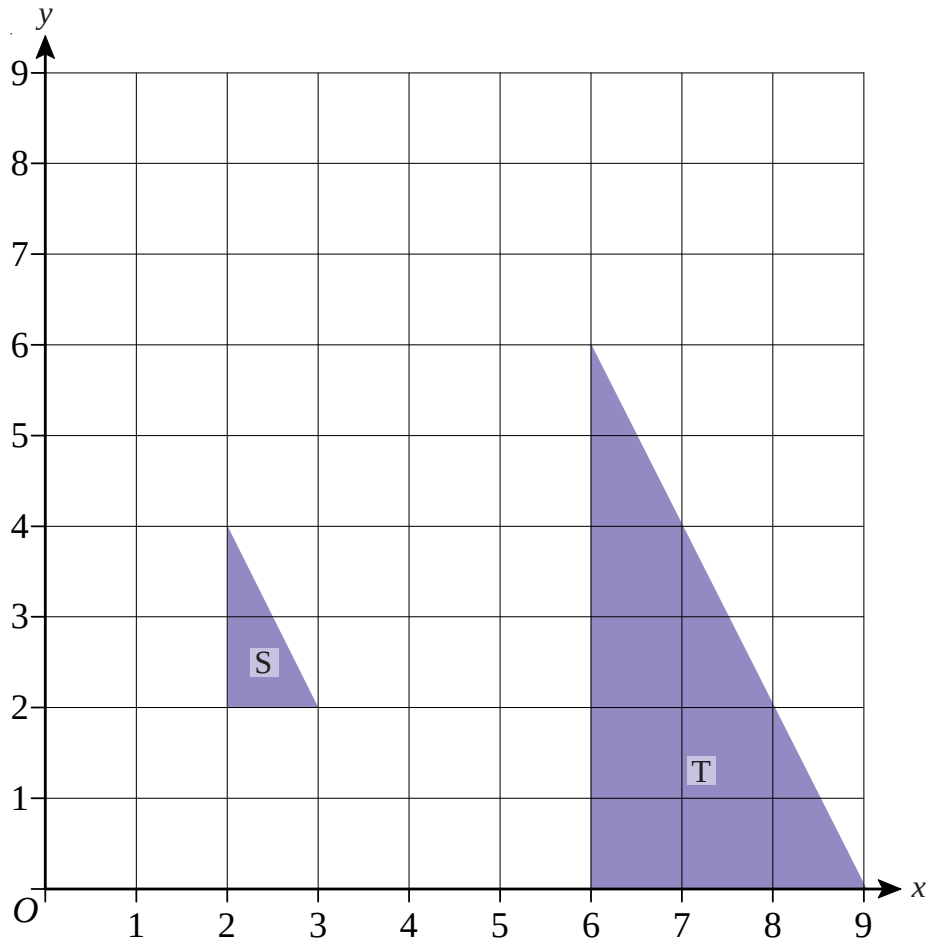
Enlargements

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.



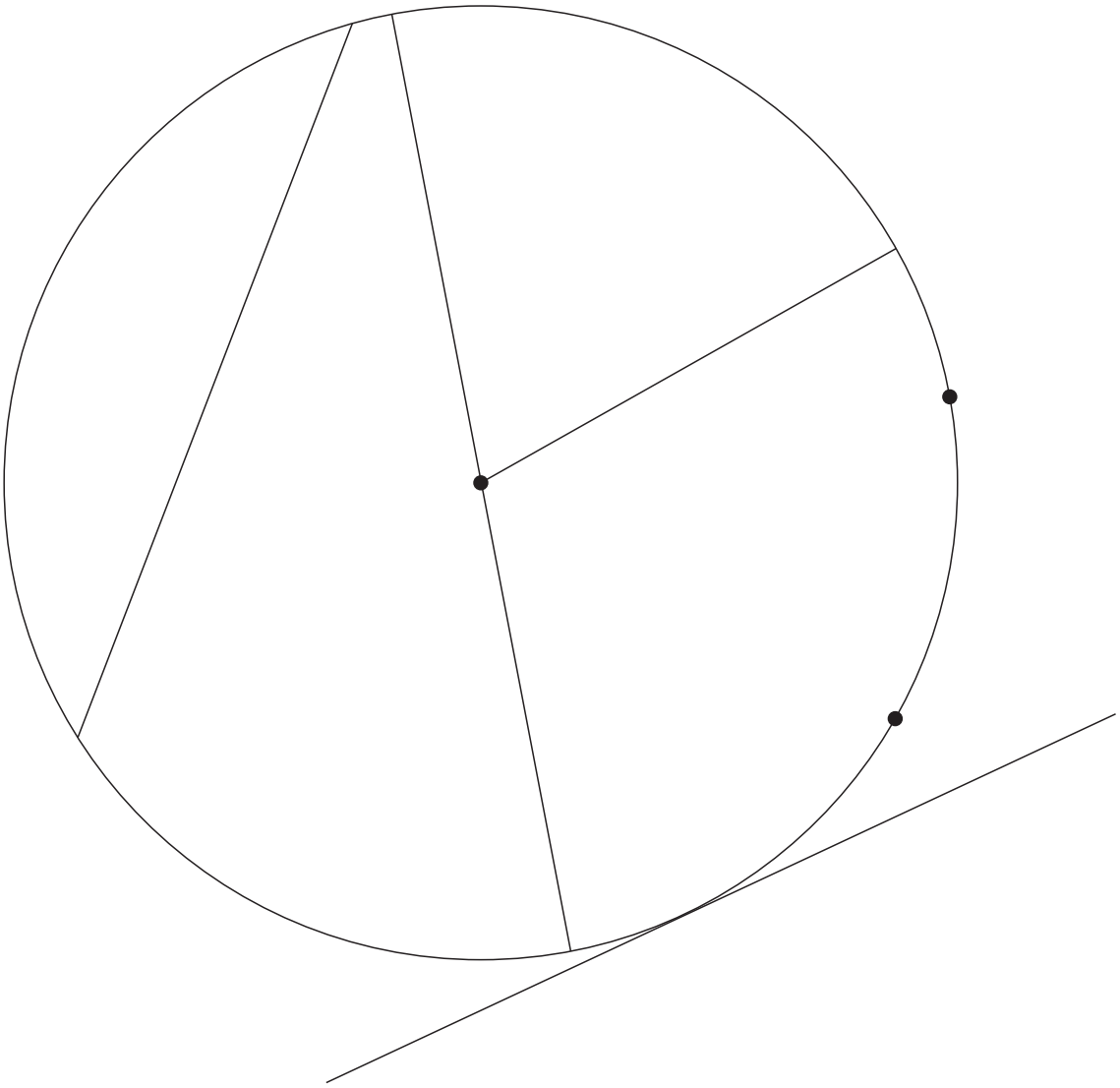
2) Describe fully the single transformation which maps triangle S to triangle T.



Tangents, Arcs, Sectors and Segments

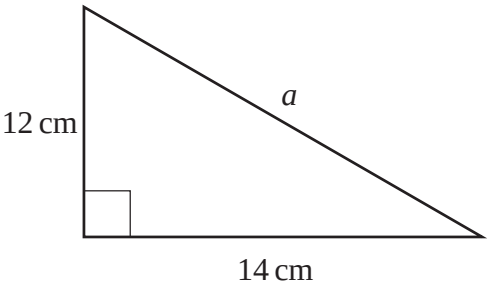
Tangent
Radius
Minor sector
Minor segment
Arc
Diameter
Chord
Circumference

On the diagram, mark on all of the words from the box in an appropriate place.

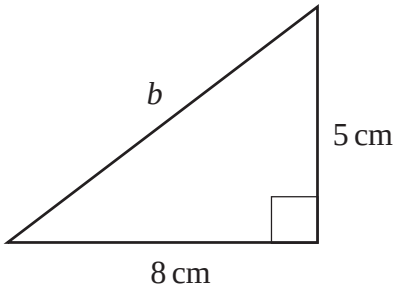


Pythagoras' Theorem

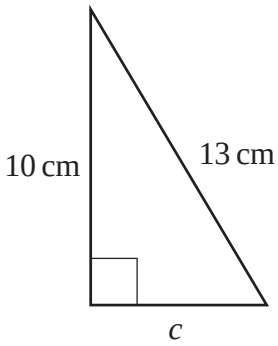
1) Find the length of side *a*.
Give your answer to 1 decimal place.



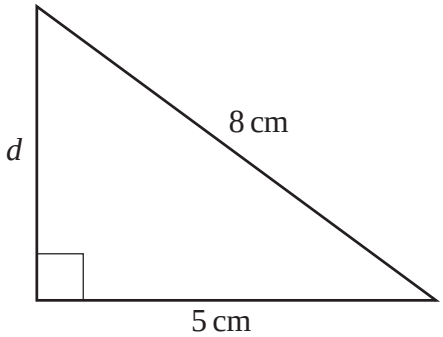
2) Find the length of side *b*.
Give your answer to 1 decimal place.



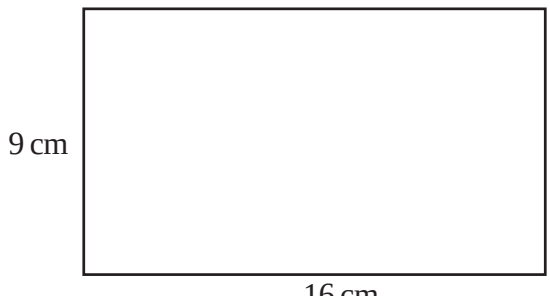
3) Find the length of side *c*.
Give your answer to 1 decimal place.



4) Find the length of side *d*.
Give your answer to 1 decimal place.

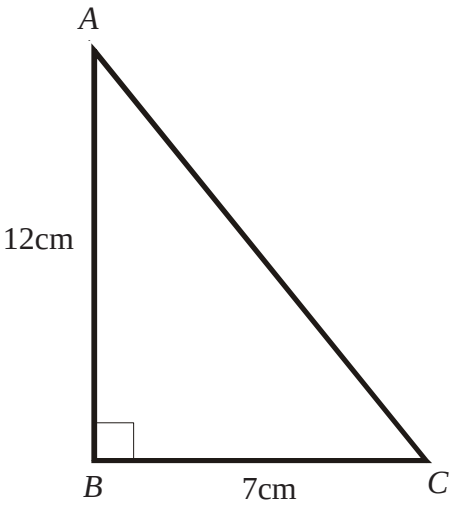


5) Find the length of the diagonal of this rectangle.
Give your answer to 1 decimal place.

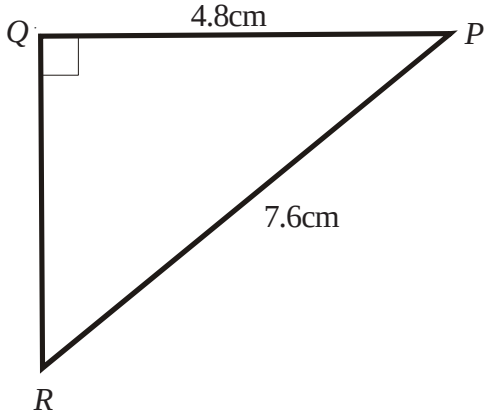


Pythagoras' Theorem

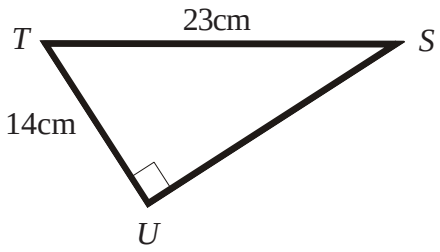
1) Find the length of side *AC*.
Give your answer to 1 decimal place.



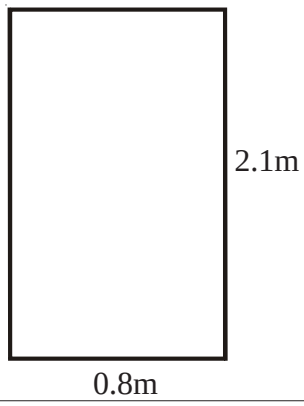
2) Find the length of side *QR*
Give your answer to 1 decimal place.



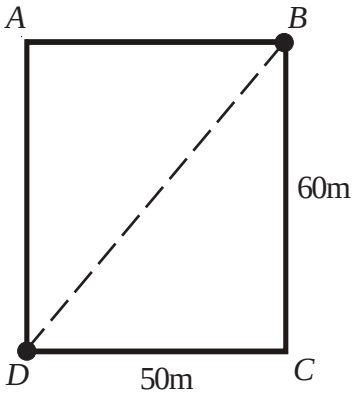
3) Find the length of side *SU*
Give your answer to 1 decimal place.



4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

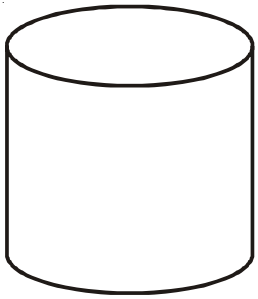


5) In the sketch of the rectangular field, below, James wants to walk from *B* to *D*.



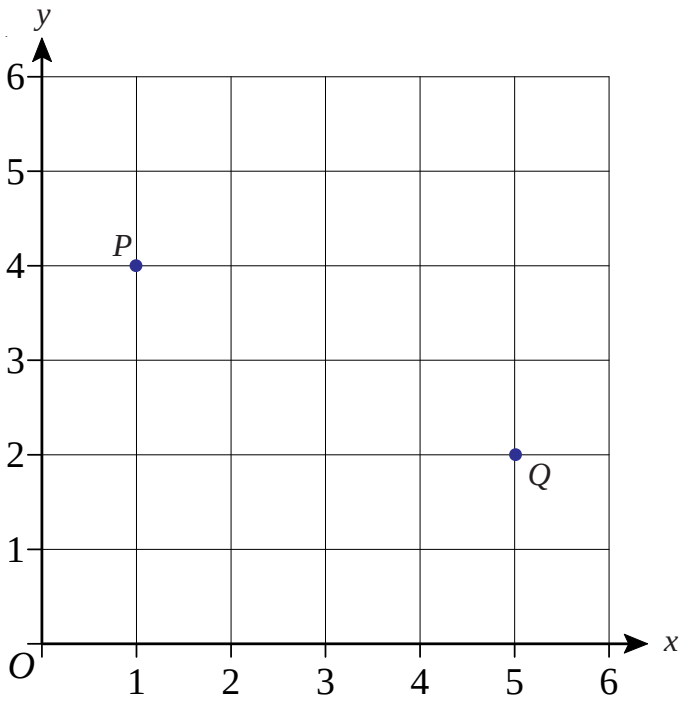
Which of the following routes is shorter and by how much?
From *B* to *C* to *D* or straight across the field from *B* to *D*.
Give your answer to the nearest metre.

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.

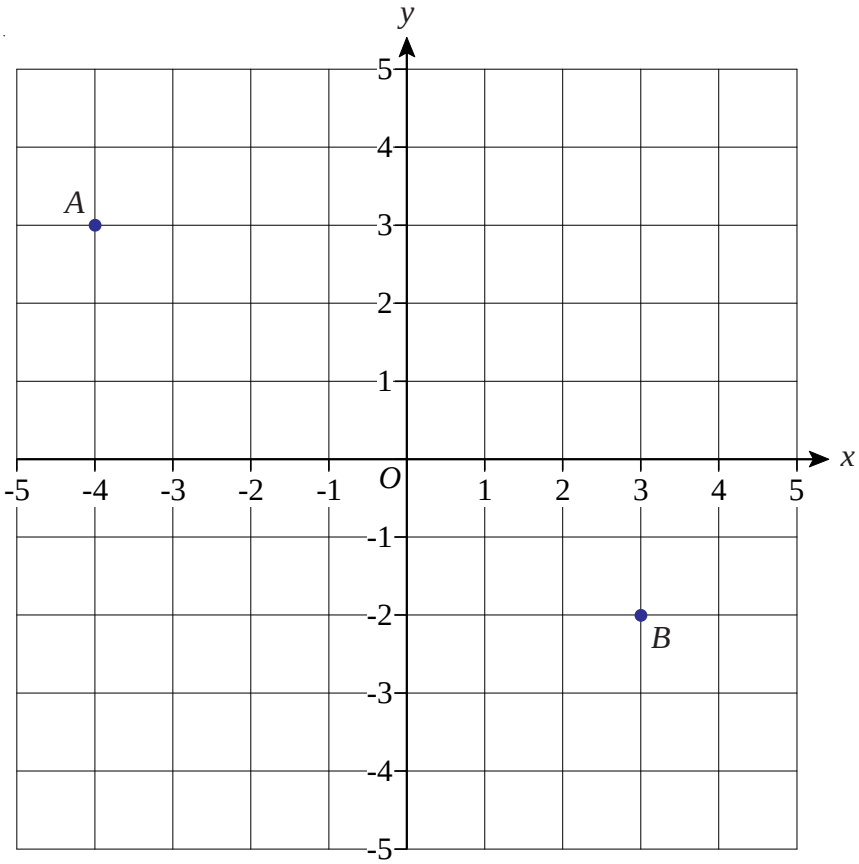


Pythagoras' Theorem

1) 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.



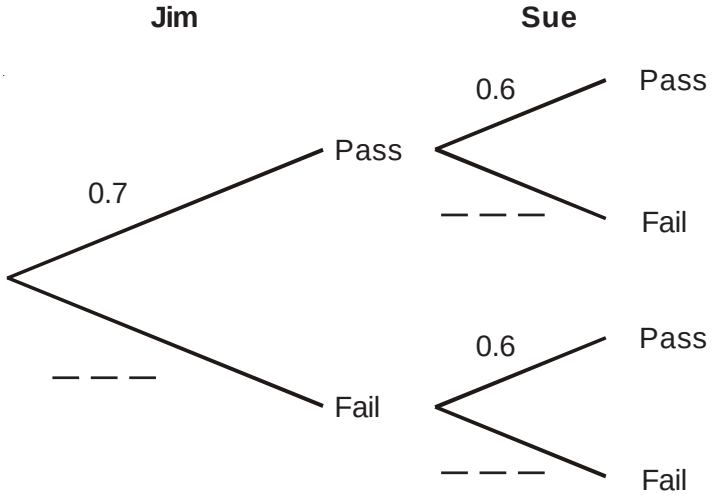
2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.



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.

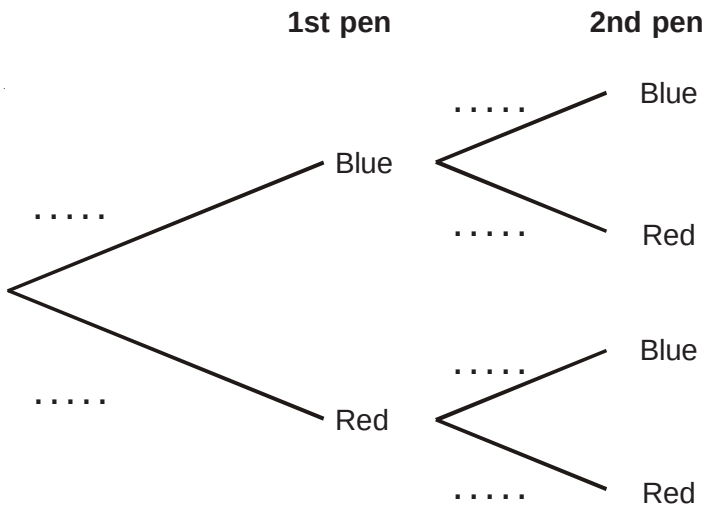
c) Work out the probability that only one of them will pass the driving test.

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.

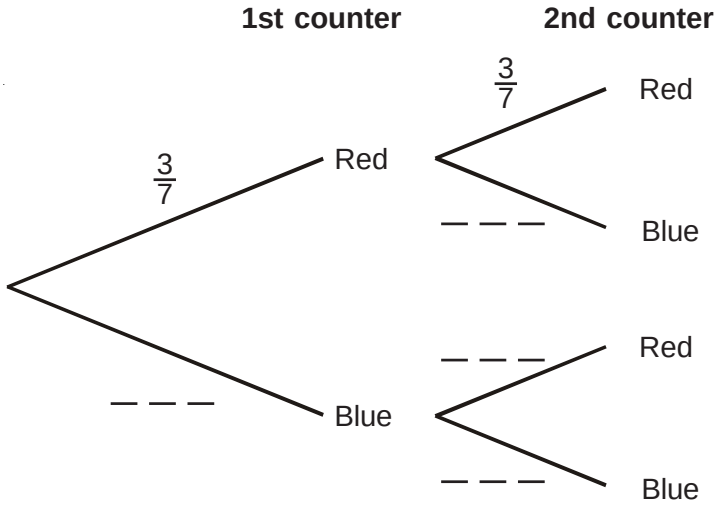


b) Work out the probability that Terri takes exactly one pen of each colour from the box.

Simple Tree Diagrams

1) 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.

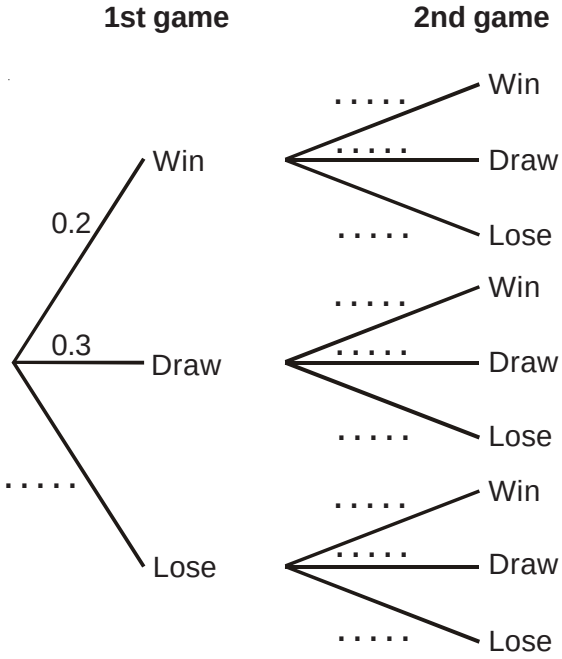
a) Complete the probability tree diagram.



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.

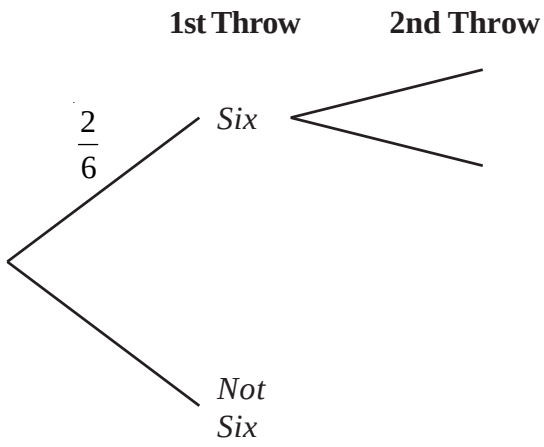
a) Complete the probability tree diagram.



b) Work out the probability that Jane will win both games.

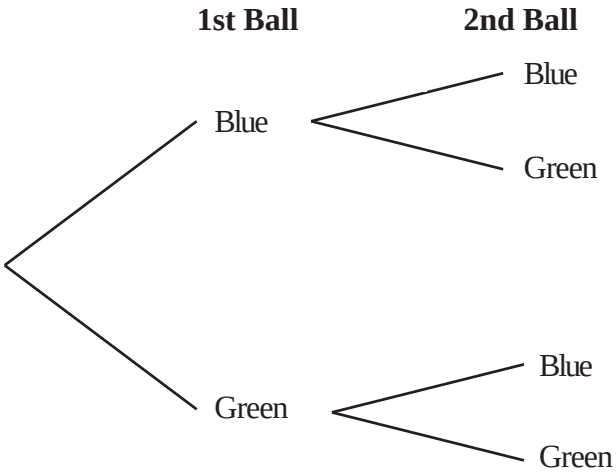
Simple Tree Diagrams

1) 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.

Sampling Populations

1) In a school there were 800 students who regularly had a school dinner.

The Headteacher of the school wanted to know whether the students liked the dinners.

a) What is the main advantage of asking a sample of the students whether they like school dinners rather than asking all of them?

b) The Headteacher asked 100 KS3 students whether they liked the dinners and 40 of them said they did.

Use this information to estimate how many of the 800 students liked school dinners.

c) In finding your answer to part b), what assumption have you made?

d) What could be done to make your estimate more accurate?

2) A park-keeper wanted to know how many fish there were in the park pond.

He went to the pond early one morning and used his fishing rod to catch 20 fish.
The bait he used was maggots.

Then, he marked each of the fish with a white dot on their tail and released them.

A week later, he used his fishing rod and maggots to catch another 20 fish.

He found that 4 of these 20 fish had the white dot on their tails.

a) Use this information to estimate how many fish there are in the pond.

b) In finding your estimate, what assumption have you made?

Time Series

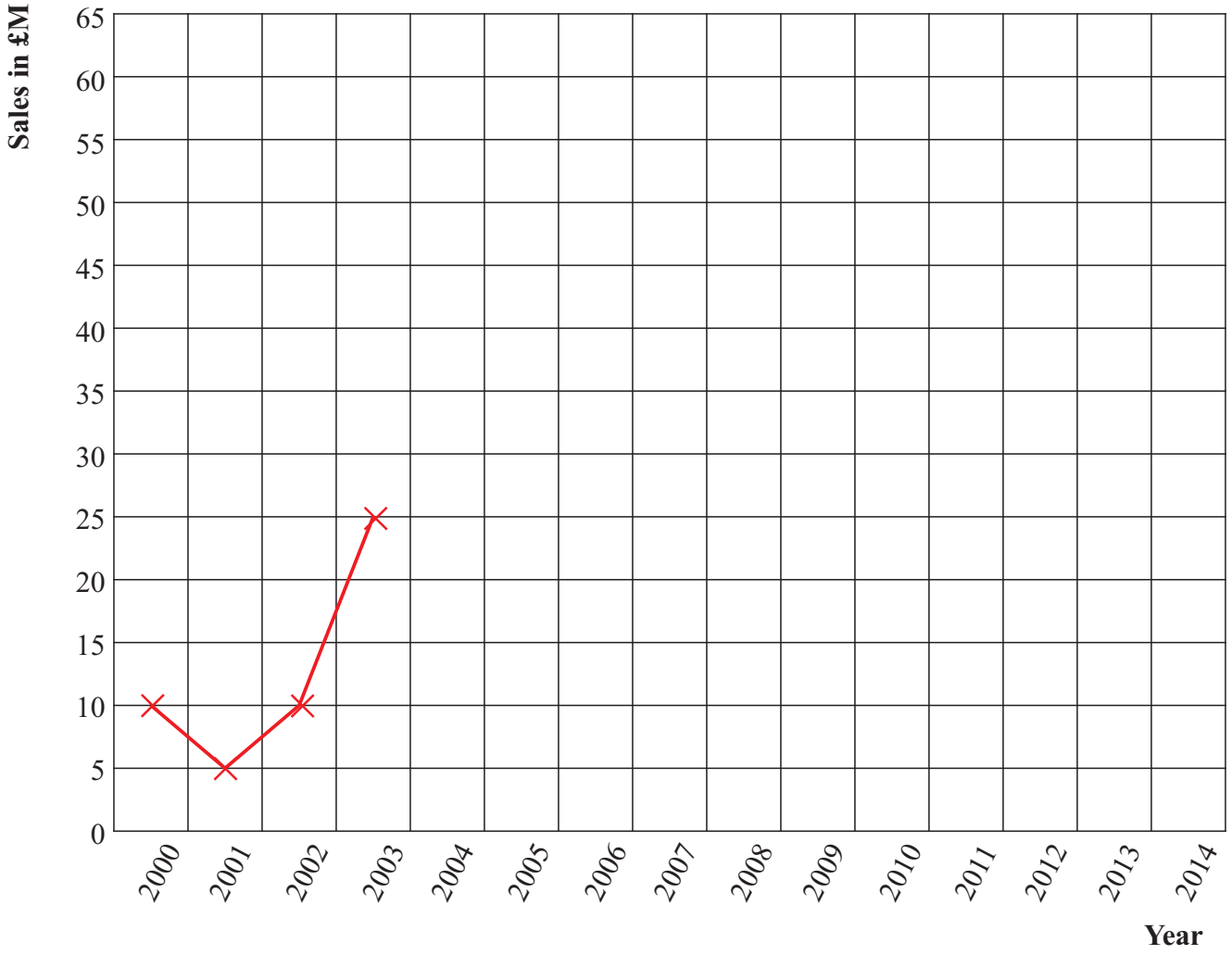
The table on the right shows the sales figures for a manufacturing company over the course of 15 years.

a) Complete the time series graph to show this information.

b) What is the range of the sales figures?

c) Comment on the trend over the course of 15 years.

Year	Sales (£M)
2000	10
2001	5
2002	10
2003	25
2004	22.5
2005	50
2006	27.5
2007	15
2008	35
2009	55
2010	50
2011	25
2012	45
2013	62.5
2014	57.5



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.

Error Intervals

1) A number, x, rounded to 1 decimal place is 4.7

Write down the error interval for x.

2) A number, y, rounded to 2 decimal places is 12.36

Write down the error interval for y.

3) A number, x, rounded to 1 significant figure is 400.

Write down the error interval for x.

4) A number, y, rounded to 2 significant figures is 67000.

Write down the error interval for y.

` 5) A number, x, rounded to 3 significant figures is 24100.

Write down the error interval for x.

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.

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

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) $4x^2 - 16 = 0$

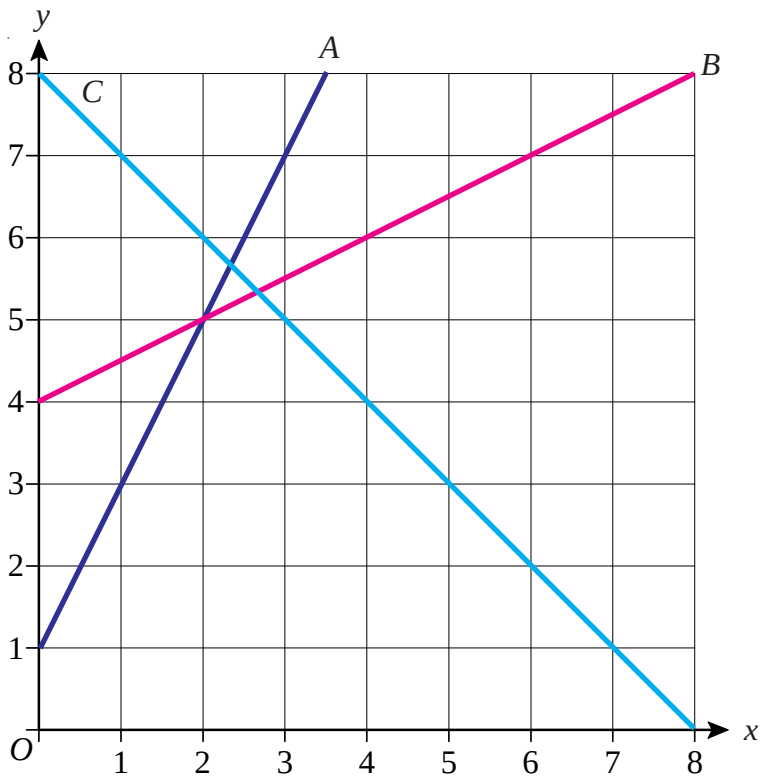
b) $25x^2 = 1$

c) $49x^2 = 121$

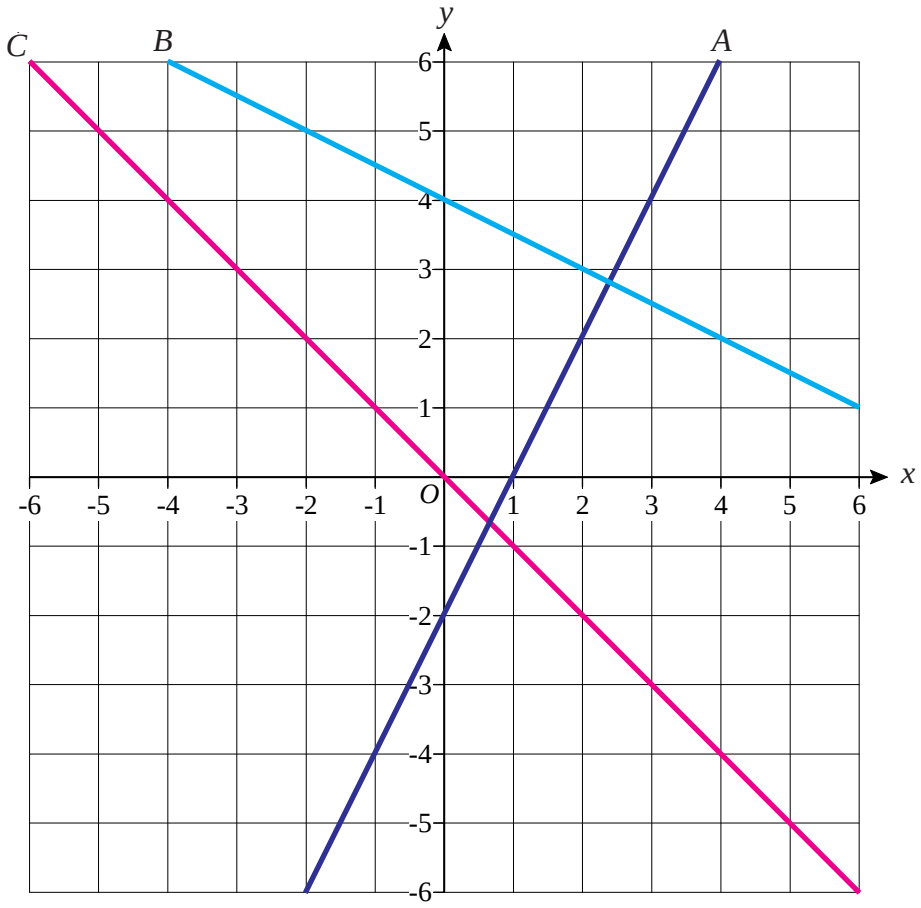
d) $9x^2 - 9 = 7$

Finding the Equation of a Straight Line

1) Find the equations of lines *A*, *B* and *C* on the axes below

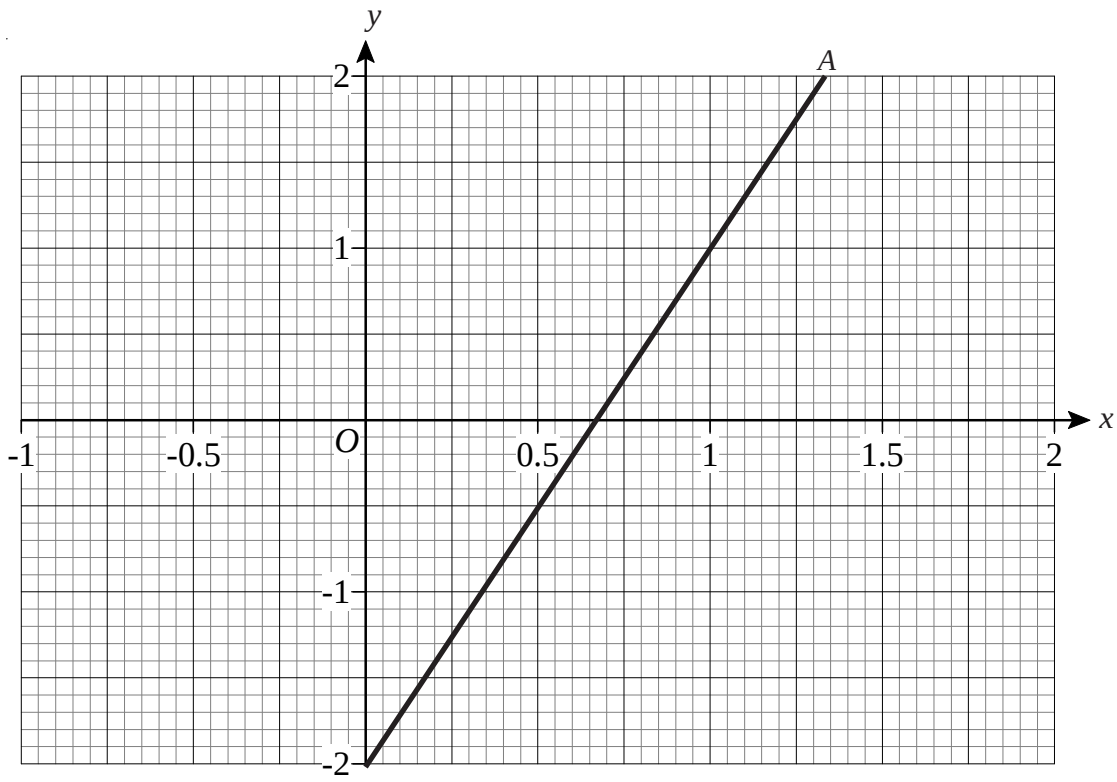


2) Find the equations of lines *A*, *B* and *C* on the axes below



Finding the Equation of a Straight Line

1) Find the equation of line *A* on the grid below.



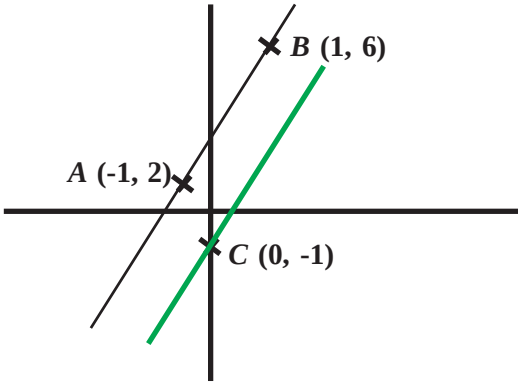
2) A straight line passes through points (0, 4) and (3, 13).
What is its equation?

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*.



Roots and Turning Points of Quadratics

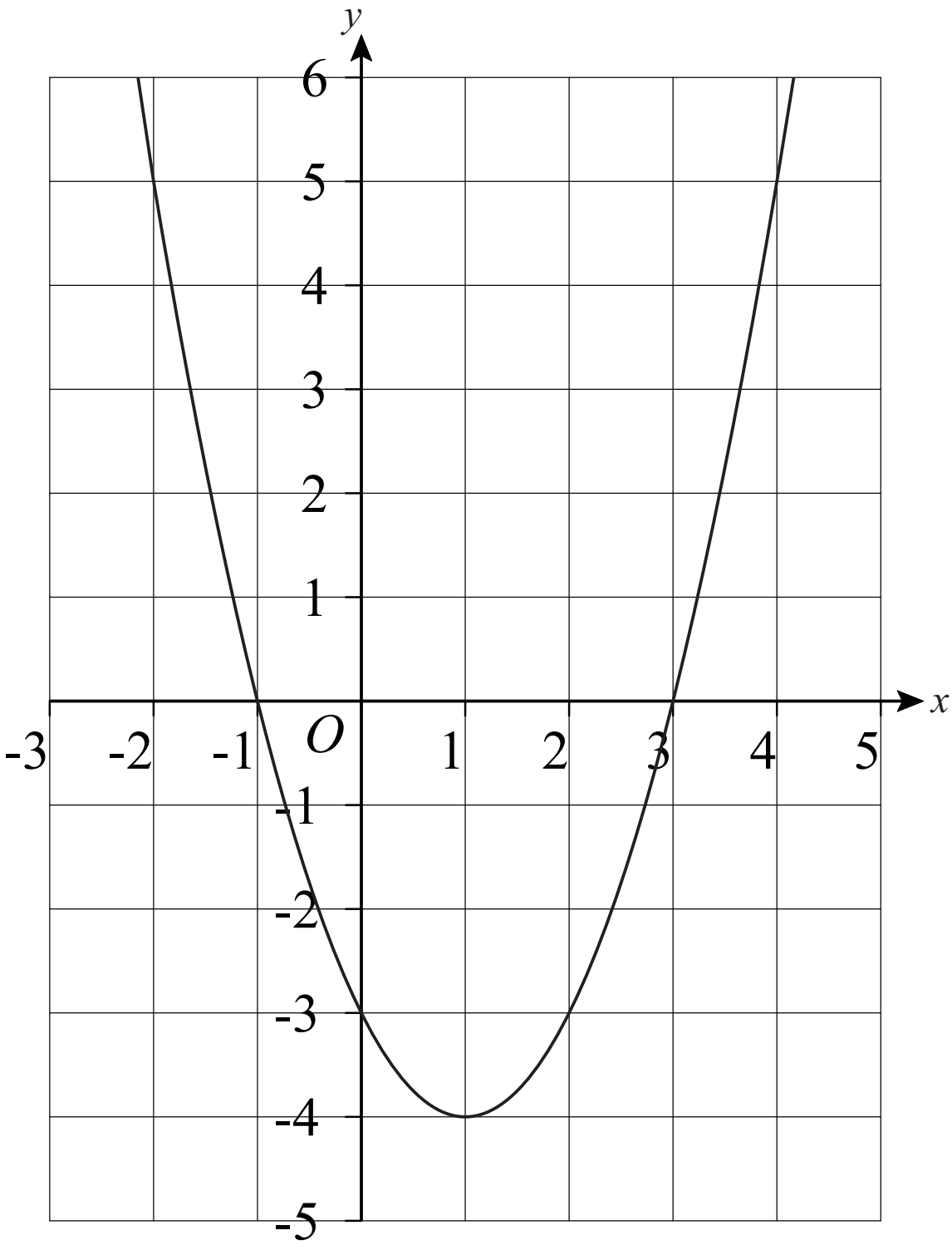
1) The graph of $y = x^2 - 2x - 3$ is shown.

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.



Cubic and Reciprocal Graphs

1) a) Complete this table of values for

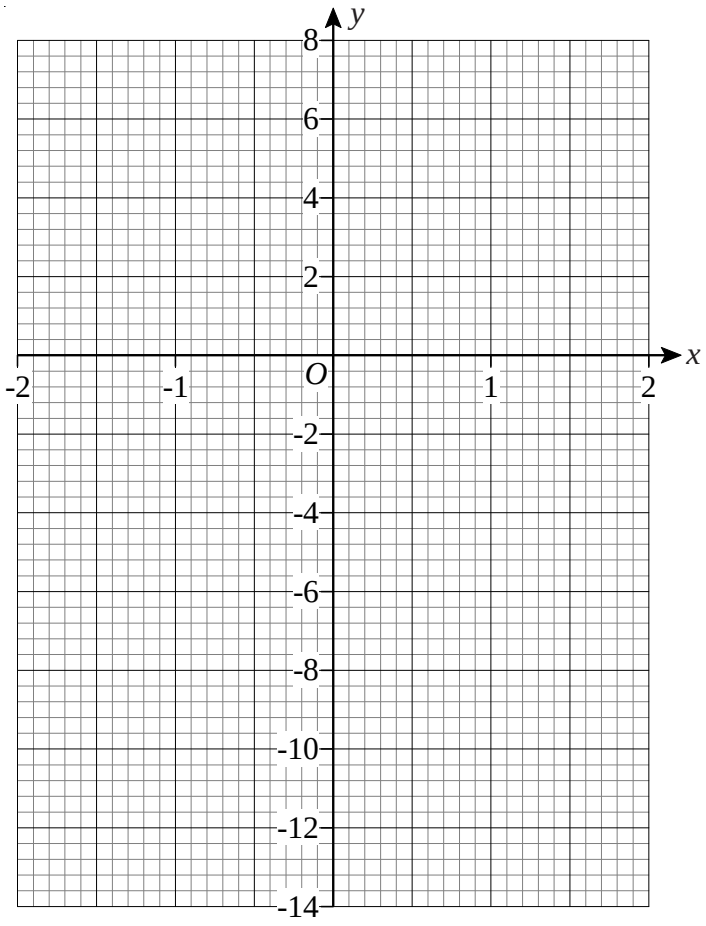
$y = x^3 + x - 4$

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

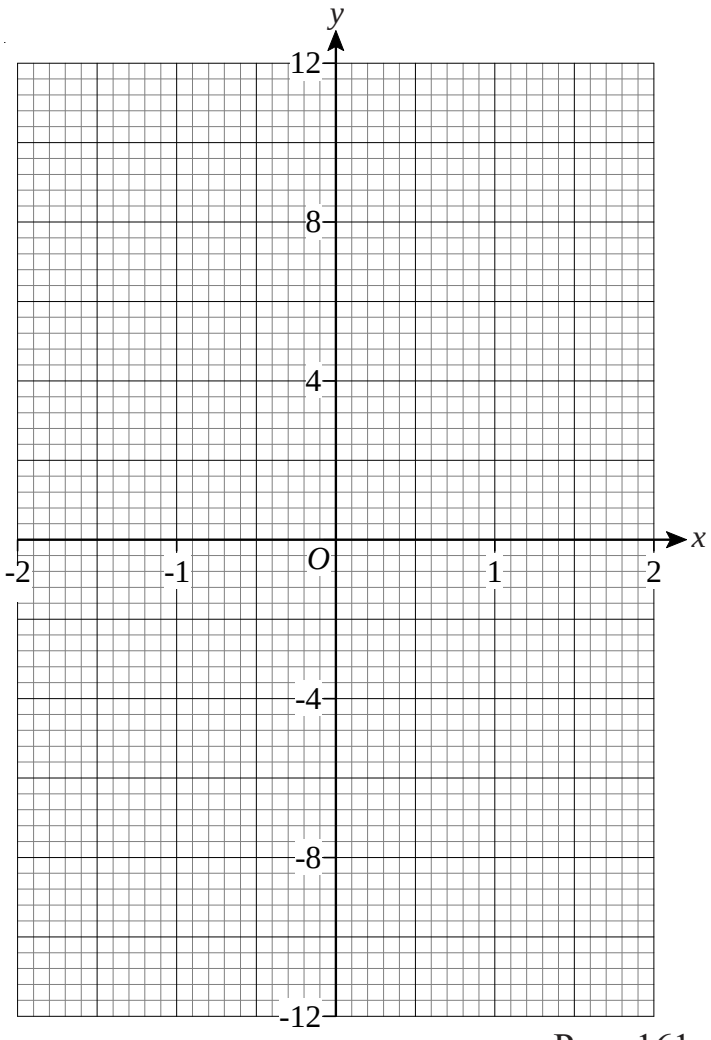
$y = x^3 + 2x$

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 $y = 1 + \frac{1}{x}$

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

$6x - 4y = 39$
$2x + y = 6$

Geometric Progressions

1) The 1st term of a geometric progression is 5 and the common ratio is 2.

   a) Write down the first four terms of the progression.

   b) What is the 10th term of the progression?

2) The 1st term of a geometric progression is 2 and the common ratio is 4.

   a) Write down the first four terms of the progression.

   b) What is the 7th term of the progression?

3) The 1st and 3rd terms of a geometric progression are 7 and 63.

   a) What is the common ratio of the progression?

   b) Write down the first four terms.

   c) Work out the 15th term of the progression.

4) The 5th term of a geometric progression is 11664.

   The 6th term of the progression is 69984.

   What is the 1st term of the progression?

5) The first four terms of a geometric progression are 1875, 375, 75, 15, . . .

   a) What is the common ratio of the progression?

   b) Work out the 8th term of the progression.

6) The third term of a geometric progression is 192.

   The 4th term of the progression is 48.

   What is the 1st term of the progression?

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?

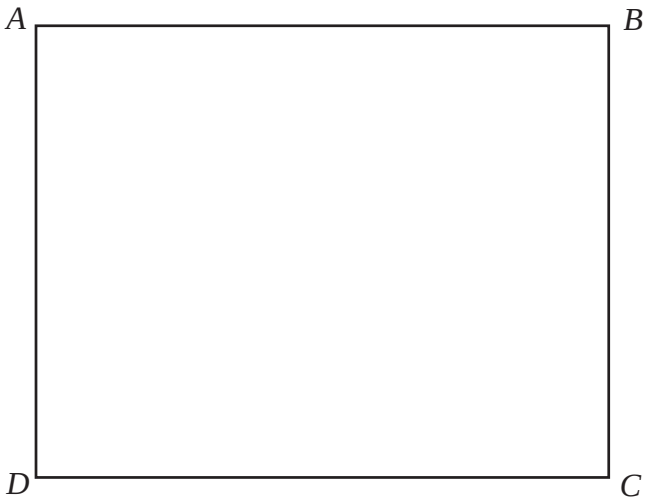
---

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?

Loci

1)



ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both**
more than 4 centimetres from the point *D*
and more than 1 centimetre from the line *AB*.

2) Two radio transmitters, *A* and *B*, are situated as below.

Transmitter *A* broadcasts signals which can be heard up to 3 km from *A*.

Transmitter *B* broadcasts signals which can be heard up to 6 km from *B*.

Shade in the area in which radio signals can be heard from both transmitters.
Use a scale of 1 cm = 1 km.

Loci

1) Draw the locus of all points which are equidistant from the lines *AB* **and** *AC*.

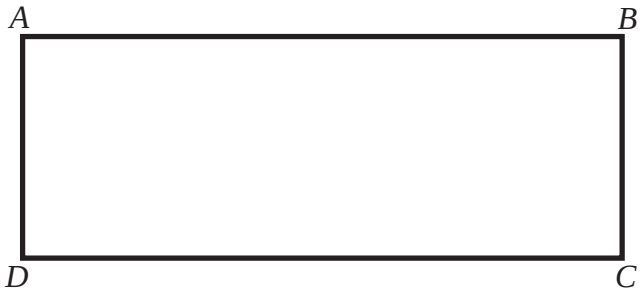
2) Draw the locus of all points which are equidistant from the points *A* and *B*.

A x x *B*

Loci

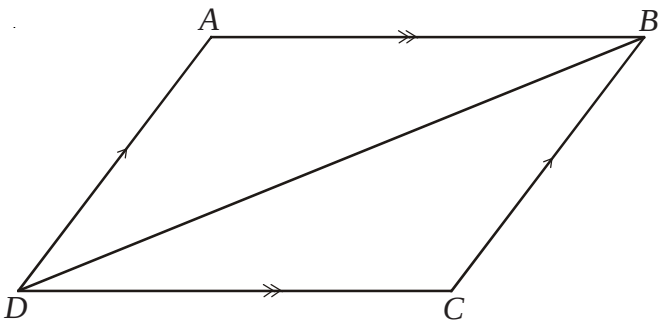
1) Draw the locus of all points that are exactly 3 cm from the line *PQ*.

2) Draw the locus of all points that are exactly 4 cm from the rectangle *ABCD*



Congruent Triangles

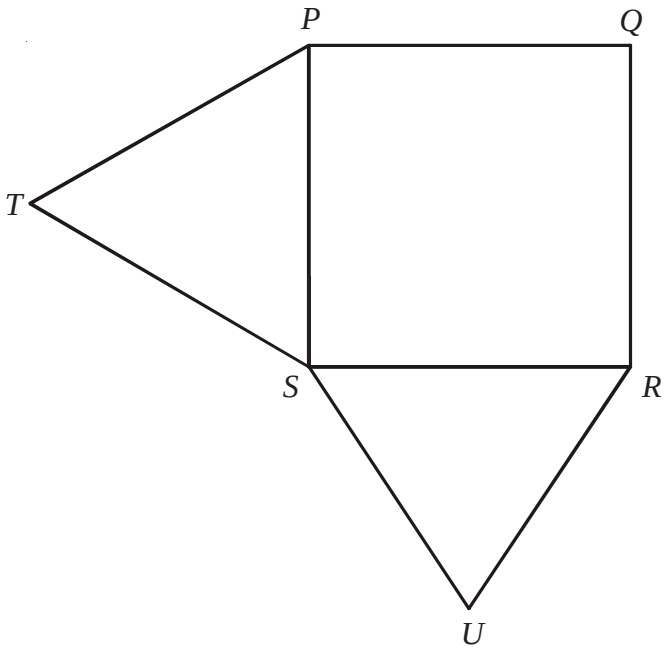
1) *ABCD* is a quadrilateral.



AB is parallel to *DC*.
DA is parallel to *CB*.

Prove that triangle *ABD* is congruent to triangle *CDB*.

2)



PQRS is a square.
PTS and *SUR* are equilateral triangles.

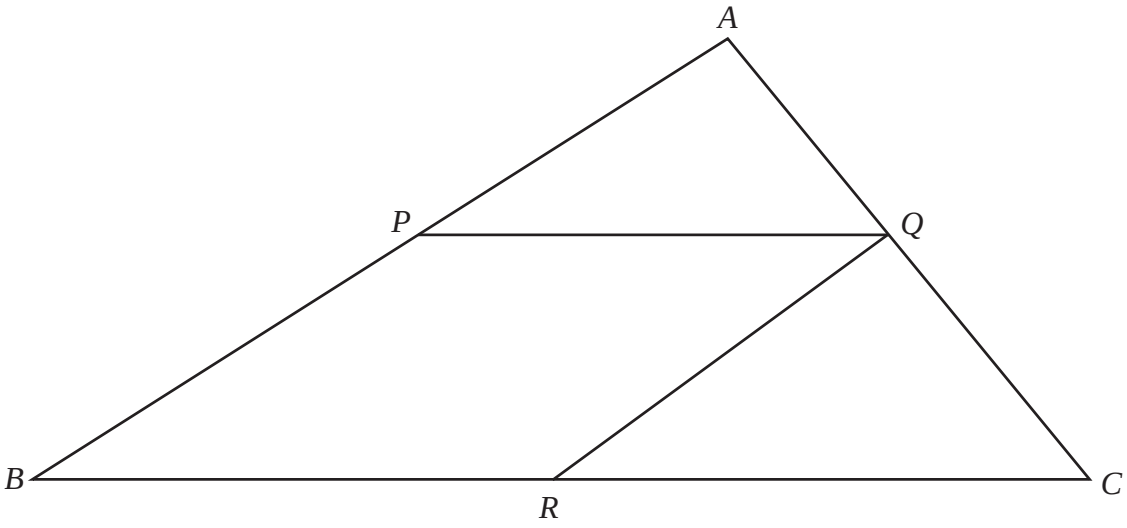
a) Prove that triangle *USP* is congruent to triangle *TSR*.

X is the point such that *RUXT* is a parallelogram.

b) Prove that *UP* = *UX*

Congruent Triangles

1)

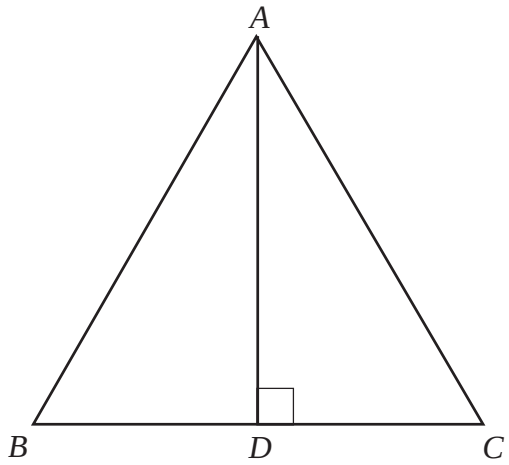


The diagram shows a triangle *ABC*.

PQRB is a parallelogram where
P is the midpoint of *AB*,
Q is the midpoint of *AC*,
and *R* is the midpoint of *BC*.

Prove that triangle *APQ* and triangle *QRC* are congruent.
You must give reasons for each stage of your proof.

2)



ABC is an equilateral triangle.

D lies on *BC*.

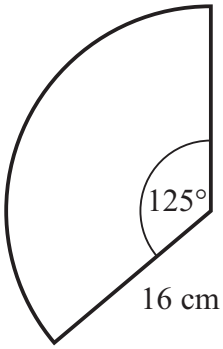
AD is perpendicular to *BC*.

a) Prove that triangle *ADC* is congruent to triangle *ADB*.

b) Hence, prove that $BD = \frac{1}{2}AB$

Sectors of a Circle

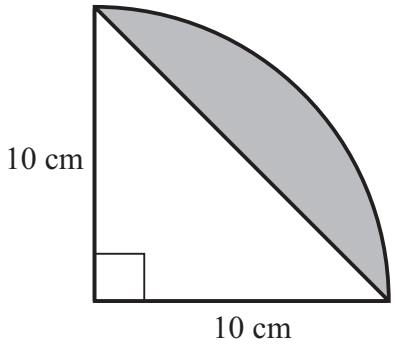
1) This sector of a circle has radius 16 cm.



a) Find the area of the sector.

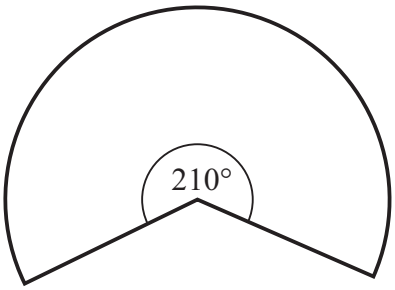
b) Find the perimeter of the sector.

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.



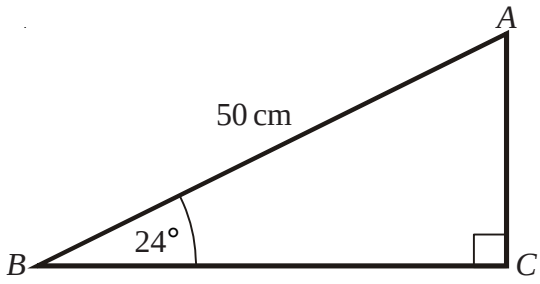
The arc length is 47.6 cm.

Work out the radius.

Trigonometry

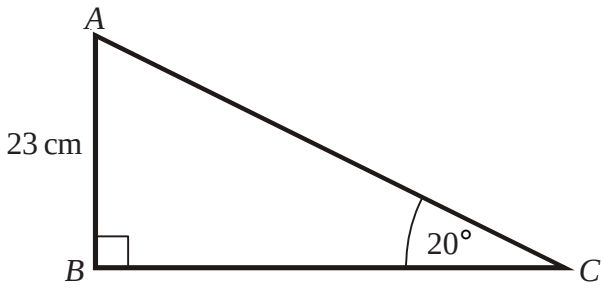
1) *ABC* is a right-angled triangle.
AB = 50 cm.
Angle *ABC* = 24°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



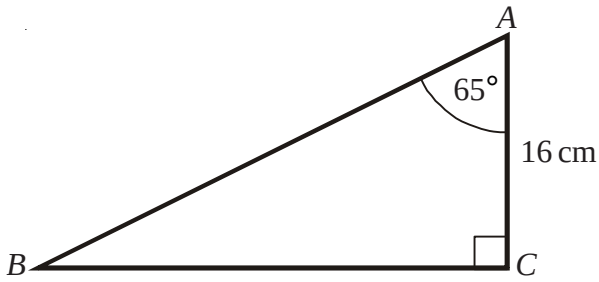
2) *ABC* is a right-angled triangle.
AB = 23 cm.
Angle *BCA* = 20°

Work out the length of *AC*.
Give your answer correct to 1 decimal place.



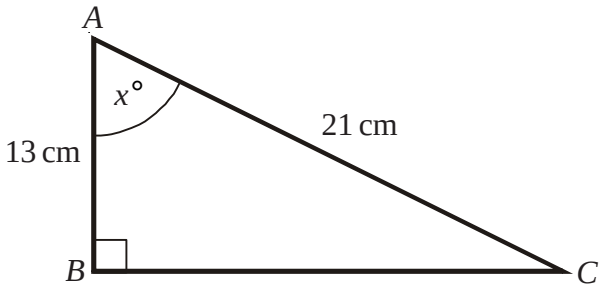
3) *ABC* is a right-angled triangle.
AC = 16 cm.
Angle *CAB* = 65°

Work out the length of *BC*.
Give your answer correct to 1 decimal place.



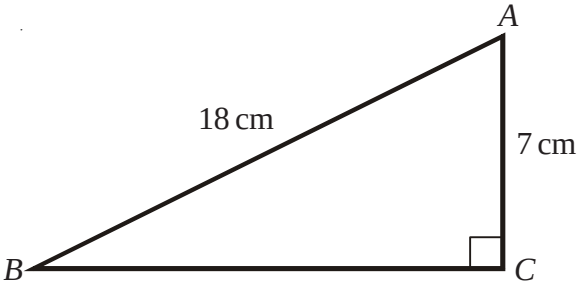
4) *ABC* is a right-angled triangle.
AB = 13 cm.
AC = 21 cm.

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.

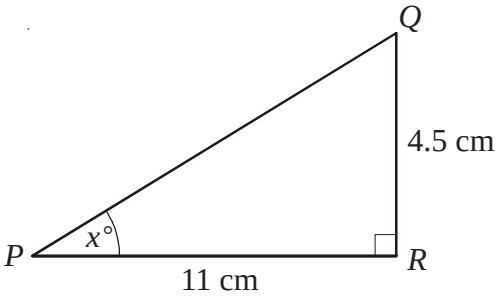
Work out the size of angle *ABC*.
Give your answer correct to 1 decimal place.



Trigonometry

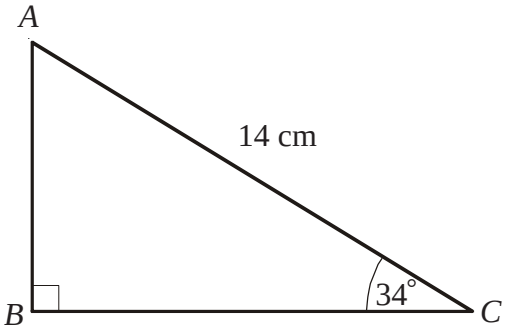
1) *PQR* is a right-angled triangle.
PR = 11 cm.
QR = 4.5 cm
Angle *PRQ* = 90°

Work out the value of *x*.
Give your answer correct to 1 decimal place.



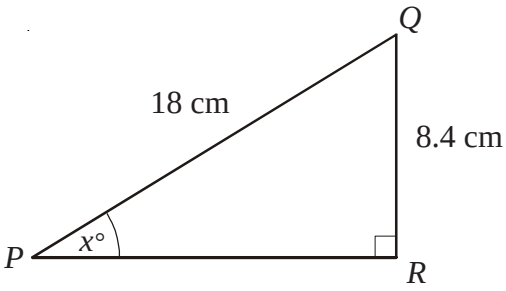
2) *AC* = 14 cm.
Angle *ABC* = 90°
Angle *ACB* = 34°

Calculate the length of *BC*.
Give your answer correct to
3 significant figures.



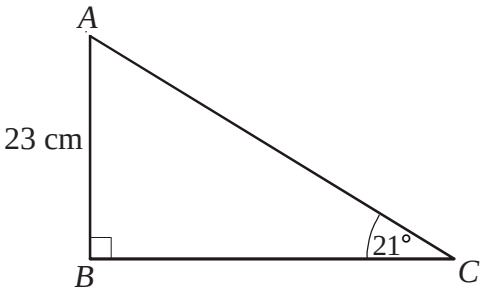
3) *PQR* is a right-angled triangle.
PQ = 18 cm.
QR = 8.4 cm
Angle *PRQ* = 90°

Work out the value of *x*.
Give your answer correct to 1 decimal place.



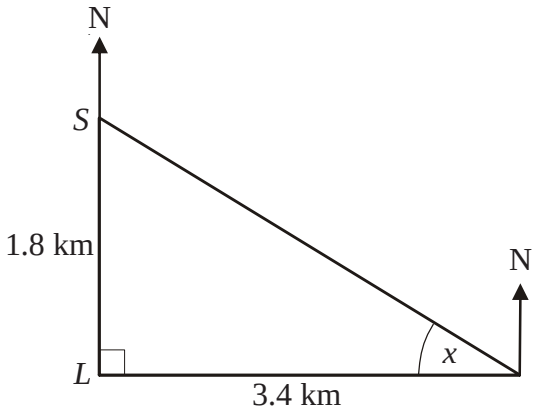
4) *AB* = 23 cm.
Angle *ABC* = 90°
Angle *ACB* = 21°

Calculate the length of *AC*.
Give your answer correct to
3 significant figures.



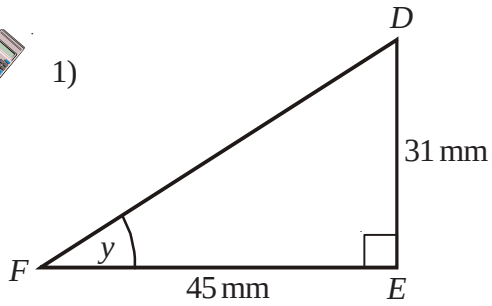
5) A lighthouse, *L*, is 3.4 km due West of a port, *P*.
A ship, *S*, is 1.8 km due North of the lighthouse, *L*.

Calculate the size of the angle marked *x*.
Give your answer correct to 3 significant figures.



Trigonometry

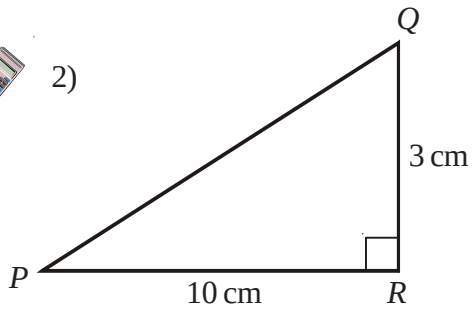
1)



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.

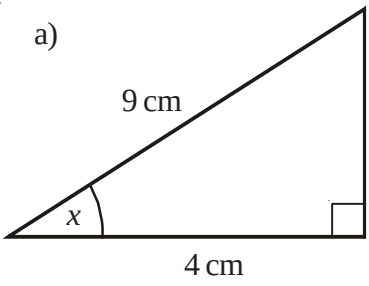
2)



PQR is a right-angled triangle.
QR = 3 cm
PR = 10 cm

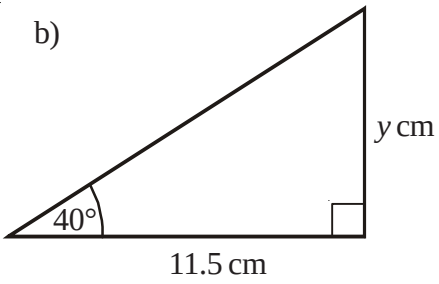
Work out the size of angle *RPQ*.
Give your answer correct to three significant figures.

3) a)



Calculate the size of the angle marked *x*.
Give your answer correct to one decimal place.

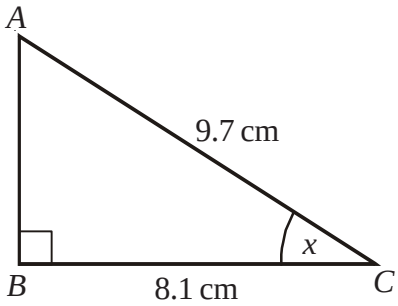
b)



Calculate the value of *y*.
Give your answer correct to one decimal place.

Trigonometry

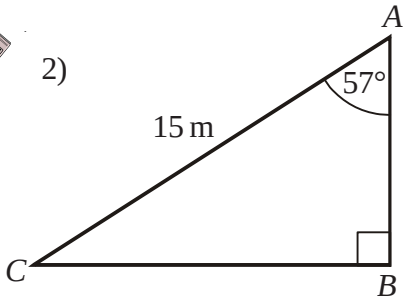
1)



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.

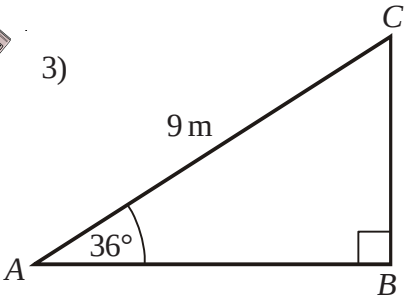
2)



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)

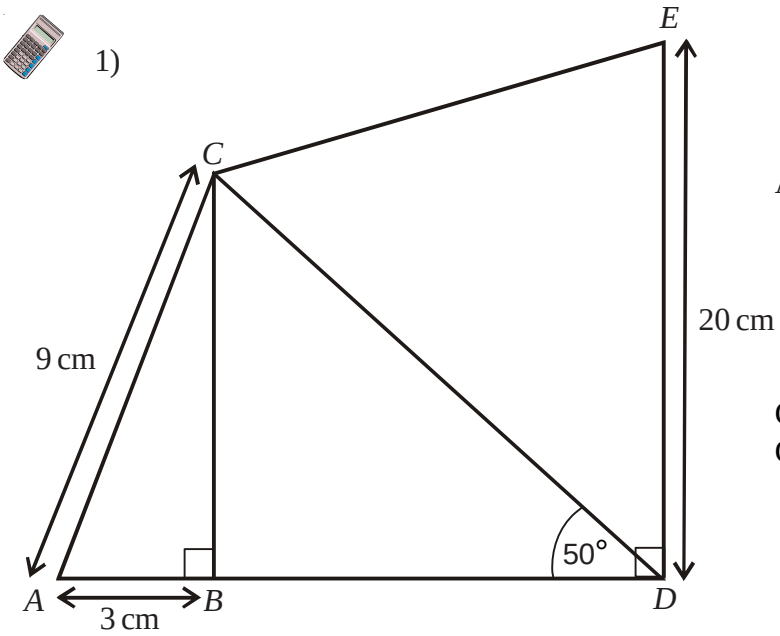


ABC is a right-angled triangle.
AC = 9 m
Angle *CAB* = 36°

Calculate the length of *AB*.
Give your answer correct to three significant figures.

Trigonometry

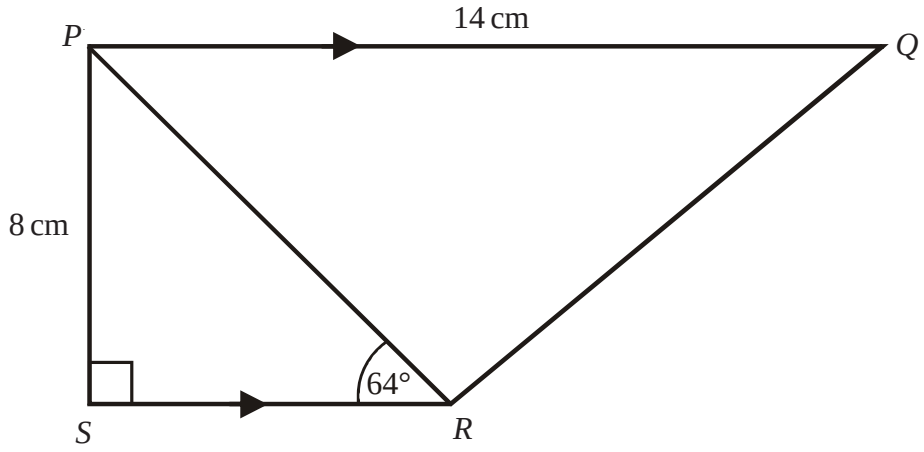
1)



$AC = 9$ 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.

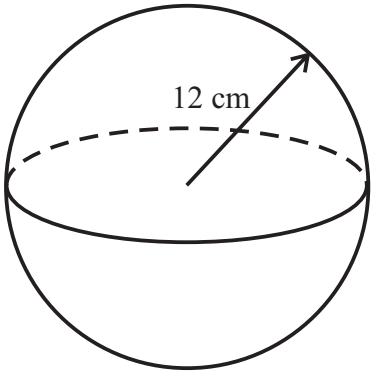
Spheres

Volume of a sphere = $\frac{4}{3}\pi r^3$

Surface area of a sphere = $4\pi r^2$

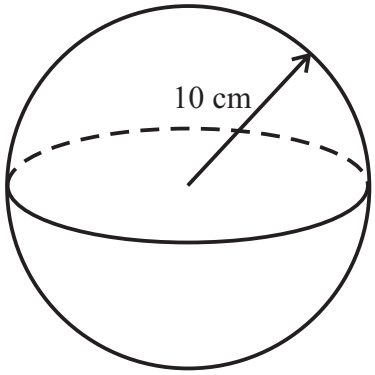
1) a) Work out the volume of the sphere.

b) Work out the surface area of the sphere.



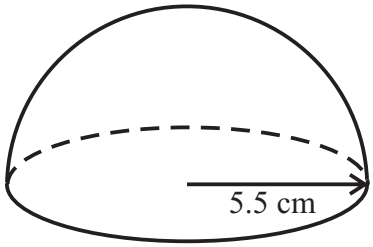
2) a) Work out the volume of the sphere, leaving your answer in terms of π.

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.

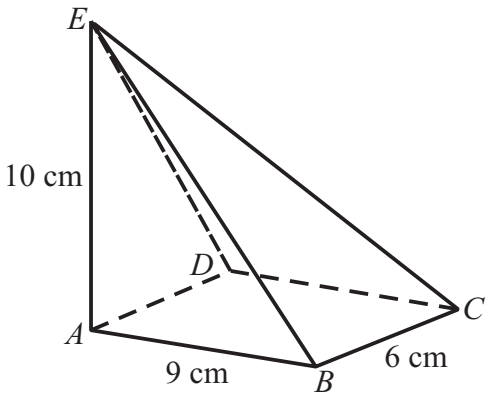
b) Work out the surface area of the solid hemisphere.



Pyramids

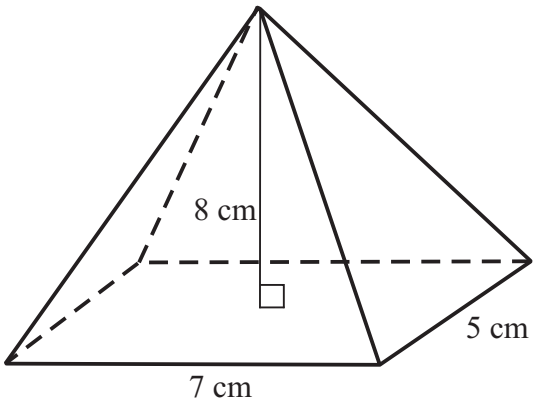
Volume of a pyramid = $\frac{1}{3}$ × base area × height

1) The pyramid has a rectangular base and E is vertically above A.

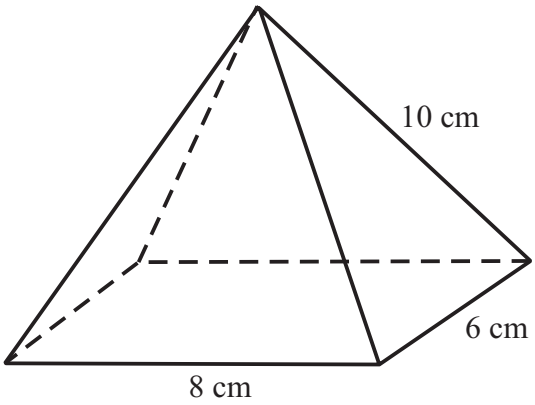


Find the volume of the pyramid.

2) Find the volume of this pyramid.



3) Find the volume of this pyramid.



Cones

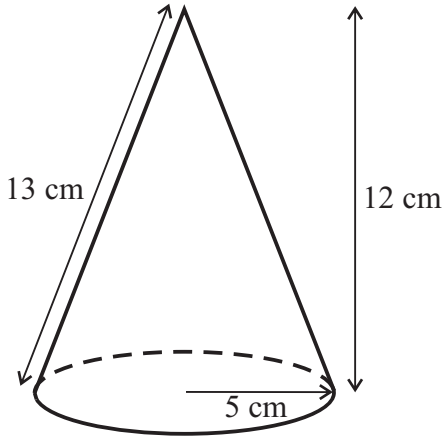
Volume of a cone = $\frac{1}{3}\pi r^2 h$

Curved surface area = πrl

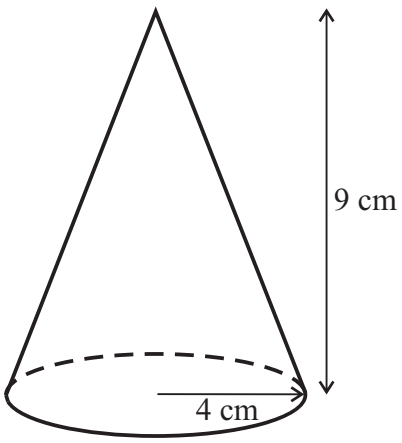
1) a) Work out the volume of the cone.

b) Work out the curved surface area of the cone.

c) The total surface area of the cone.

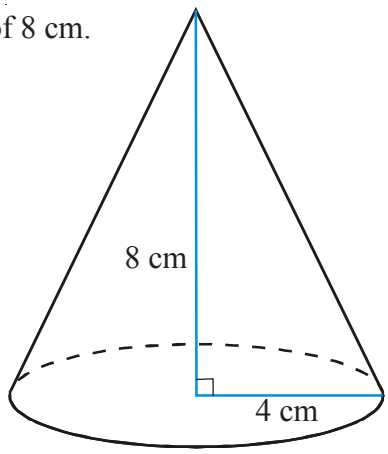


2) Work out the volume of the cone, leaving your answer in terms of π.



Spheres and Cones

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

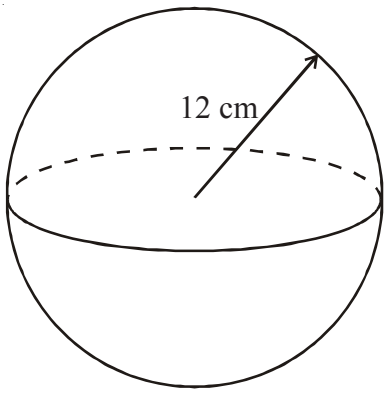


a) Calculate the volume of the cone.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

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.

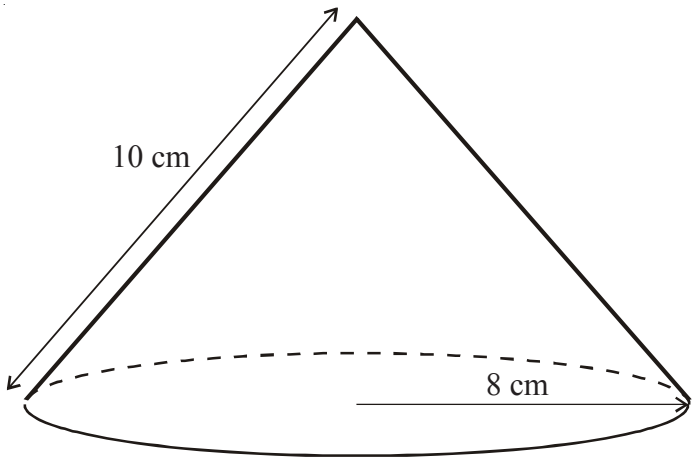


a) Calculate the volume of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

b) Find the curved surface area of the sphere.
Take π to be 3.142.
Give your answer correct to 3 significant figures.

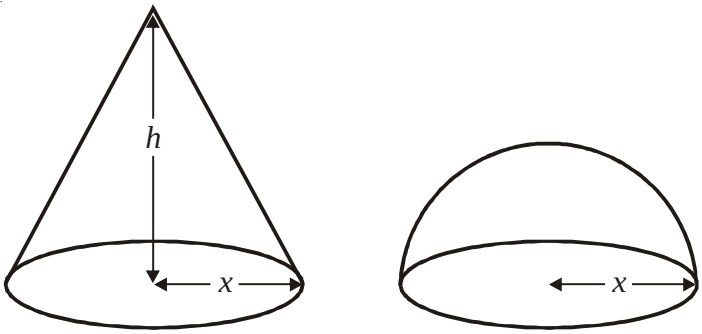
3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone.
Leave your answer in terms of π.



Spheres and Cones

1)

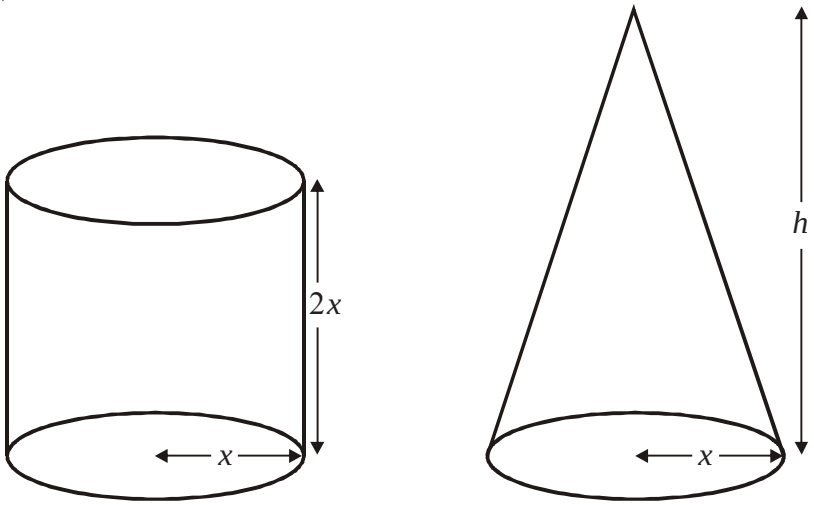


The diagram shows a solid cone and a solid hemisphere.

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.

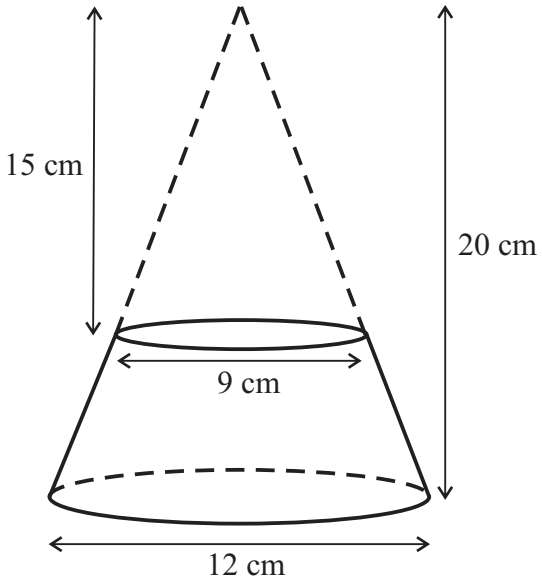
The volume of the cylinder and the volume of the cone are equal.

Find h in terms of x.
Give your answer in its simplest form.

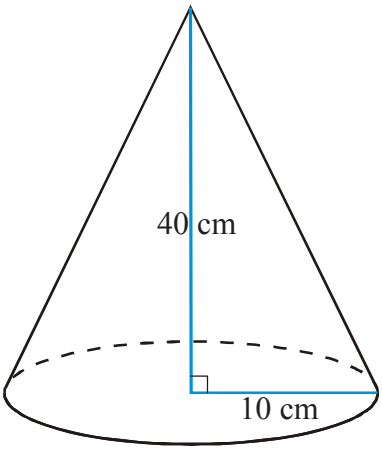
Frustums

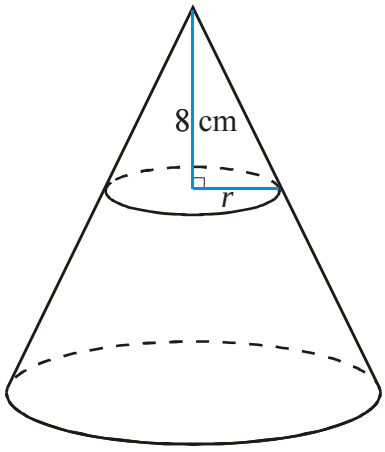
1) A frustum is made by removing a small cone from a similar larger cone.

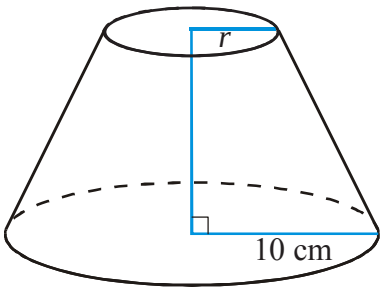
Work out the volume of the frustum.



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.

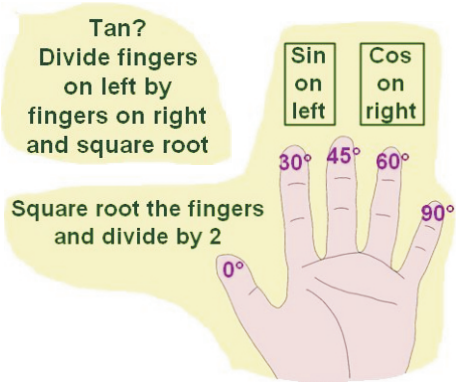
Calculate, to the nearest cm^3

b) The volume of the larger cone.

c) The volume of the smaller cone.

d) The volume of the frustum.

Exact Trigonometric Values



1) Write down the exact values of:

   a) sin 0°

   b) sin 30°

   c) sin 45°

   d) sin 60°

   e) sin 90°

2) Write down the exact values of:

   a) cos 0°

   b) cos 30°

   c) cos 45°

   d) cos 60°

   e) cos 90°

3) Write down the exact values of:

   a) tan 0°

   b) tan 30°

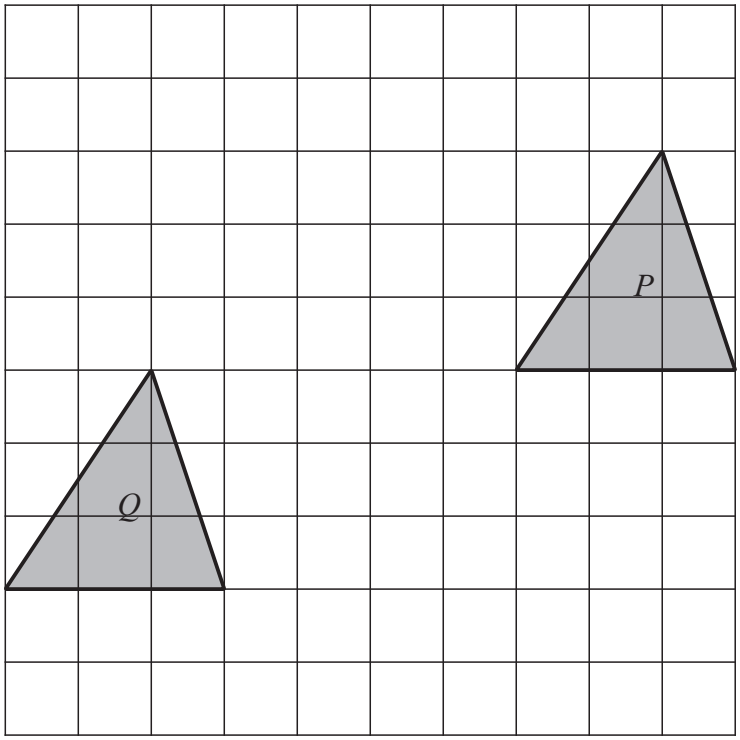
   c) tan 45°

   d) tan 60°

Introduction to Vectors

1) The translation of triangle *P* to triangle *Q* is described by column vector **v**.

Write down **v**.



2) 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) $3\mathbf{g} - \mathbf{f}$

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) 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.

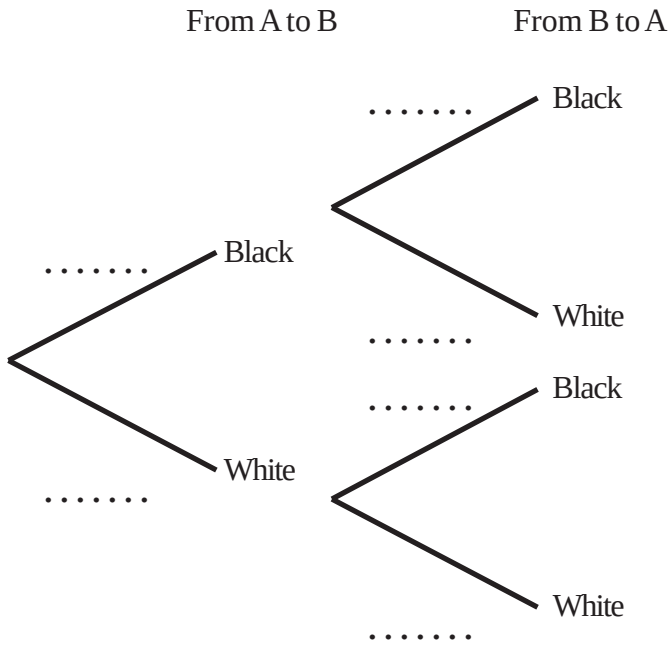
   a) Draw a tree diagram to show all the possibilities.
   b) What is the probability that all three counters are the same colour?
   c) What is the probability that exactly two of the counters are red?

Harder Tree Diagrams

1) 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.

Stratified Sampling

1) Ellen wants to do a survey with Years 9, 10 and 11 at her school.
The table shows the number of students in each of these year groups.

Year 11	Year 10	Year 9
750	700	900

Ellen takes a sample of 50 students stratified by year group.

Work out the number of students from Year 10 in the sample.

2) The table shows information about the year groups of 1000 students in a school.

Year group	7	8	9	10	11	12	13
Number in year	157	180	166	140	132	114	111

Tony takes a sample of 50 of these students, stratified by year group.

Calculate the number of Year 8 students he should have in his sample.

3) The table shows information about Ben's collection of 652 coins.

Country	France	Spain	Germany	Italy	Total
Number of coins	240	182	133	97	652

Ben takes a sample of 50 coins stratified by country.

Work out the number of coins from Italy in this sample.

4)

	Male	**Female**
Lower sixth	399	602
Upper sixth	252	198

The table gives information about the number of students in the two years of a sixth form.

Amy wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the lower sixth.

Stratified Sampling

1) The table below shows the number of employees in each section of a company.

Department	**Managerial**	**Sales**	**Technical**	**Production**
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

a) Explain why a simple random sample of employees is unsuitable.

b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	**Managerial**	**Sales**	**Technical**	**Production**
Number of employees in sample				

2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	**Boys**	**Girls**
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	**Boys in Sample**	**Girls in Sample**
7		
8		
9		
10		
11		

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	**Boys in Sample who answered YES**	**Girls in Sample who answered YES**
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.