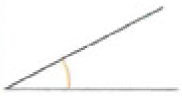
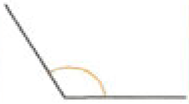
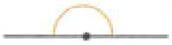
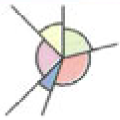
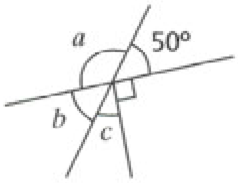
ORGANISE

8 Angle properties

Angle facts

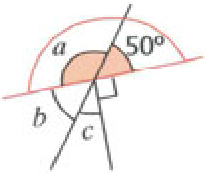
Acute angle	Right angle	Obtuse angle	Straight line	Reflex angle	Angles at a point	Vertically opposite
						
Less than 90°	90°	Between 90° and 180°	180°	Between 180° and 360°	Angles at a point add up to 360°	Vertically opposite angles are equal

Find the sizes of the angles labelled with letters. Give reasons for your answers.

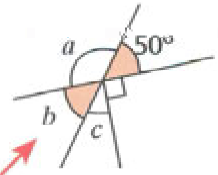


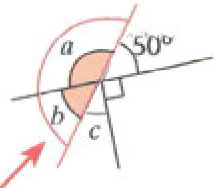
$a = 180° - 50° = 130°$

Angles on a straight line add up to 180°.



$b = 50°$



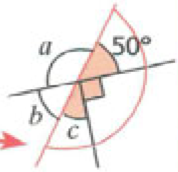


Vertically opposite angles are equal. OR Angles on a straight line add up to 180°.

$c + 90° + 50° = 180°$

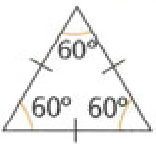
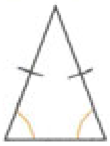
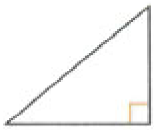
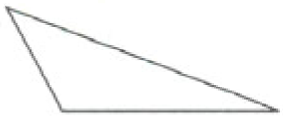
$c = 180° - 140° = 40°$

Angles on a straight line add up to 180°.

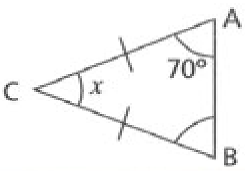


Angles in triangles and quadrilaterals

Angles in a triangle add up to 180°.

Equilateral	Isosceles	Right-angled	Scalene
			
All angles are 60°	Two equal angles at the base of the equal sides	One angle of 90°	No equal angles

ABC is an isosceles triangle.
Work out the size of angle x.



Angle B = 70°

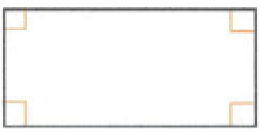
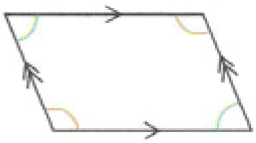
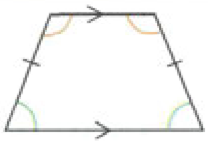
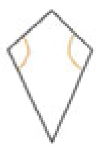
Base angles of an isosceles triangle are equal.

Angle $x = 180° - 70° - 70° = 40°$

Angles in a triangle add up to 180°.

The equal angles at the base of the equal sides in an isosceles triangle may not be at the bottom of the diagram.

Angles in a quadrilateral add up to 360°.

Rectangle or Square	Parallelogram or Rhombus	Isosceles trapezium	Kite
			
All angles are 90°	Opposite angles are equal	Two pairs of equal angles	One pair of equal angles

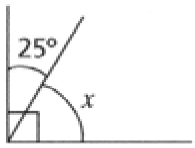
RETRIEVE

8 Angle properties

Angle facts

1 Work out the size of each angle labelled with a letter. Give reasons for your answers.

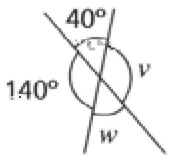
a)



$x =$ ....

....

b)



$v =$ ....

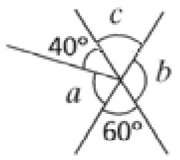
$w =$ ....

c)

$z =$ ....

....

d)

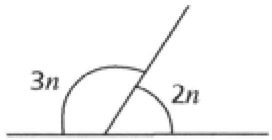


$a =$ ....

$b =$ ....

$c =$ ....

e)



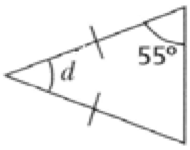
$2n =$ ....

$3n =$ ....

Angles in triangles and quadrilaterals

2 Work out the size of each angle labelled with a letter. Give reasons for your answers.

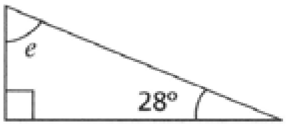
a)



$d =$ ....

....

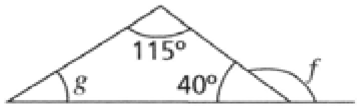
b)



$e =$ ....

....

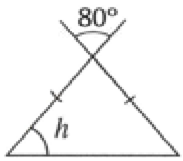
c)



$f =$ ....

$g =$ ....

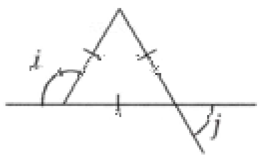
d)



$h =$ ....

....

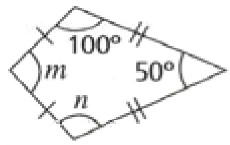
e)



$i =$ ....

$j =$ ....

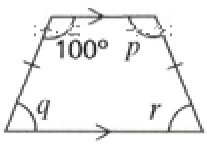
f)



$m =$ ....

$n =$ ....

g)

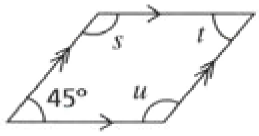


$p =$ ....

$q =$ ....

$r =$ ....

h)



$s =$ ....

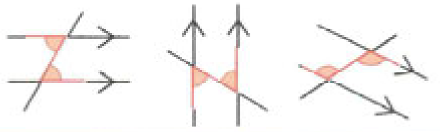
$t =$ ....

$u =$ ....

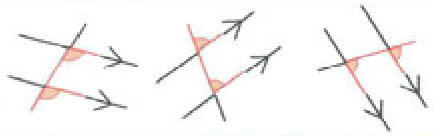
ORGANISE

8 Angles in parallel lines

Angles in parallel lines



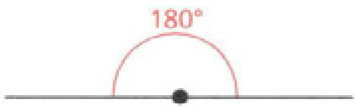
Alternate angles make a 'Z' shape. They are equal.



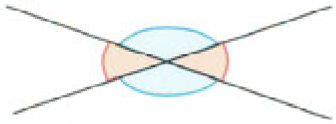
Corresponding angles make an 'F' shape. They are equal.

The 'F' and the 'Z' may be upside down or back to front.

You may also need to use these angle facts.



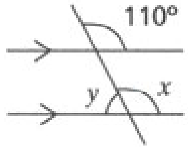
Angles on a straight line add up to 180°.



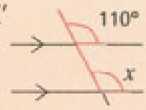
Vertically opposite angles are equal.

Find the sizes of the angles labelled with letters. Give reasons for your answers.

a)

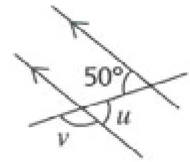


Use 'F' and 'Z' to identify the angles, but write their proper names to give reasons.



$x = 110°$ Corresponding angles
$y = 180° - 110° = 70°$ Angles on a straight line add up to 180°

b)



Look for 'F' or 'Z' angles.

$u = 50°$ Alternate angles

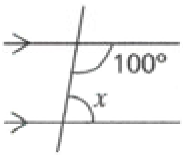
$v = 180° - 50° = 130°$ Angles on a straight line add up to 180°

Solving parallel line problems

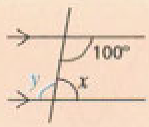
You may need to work out other angles before you can work out the value of the labelled angle. Parallel lines in an angle problem mean there will be alternate and corresponding angles.

Find the sizes of the angles labelled with letters. Give reasons for your answers.

a)

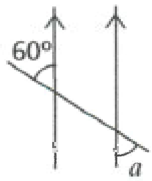


x and 100° are not alternate or corresponding angles. Draw in an angle that is either alternate or corresponding to 100°.

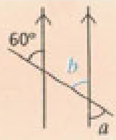


$y = 100°$ Alternate angles
$x = 180° - 100° = 80°$ Angles on a straight line add up to 180°

b)



a and 60° are not alternate or corresponding angles. Draw in an angle that is either alternate or corresponding to 60°.

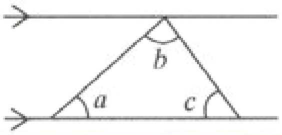


$b = 60°$ Corresponding angles
$a = 60°$ Vertically opposite angles

Proving angle facts

A proof is a logical chain of reasoning to show a fact is true.

Use this diagram to prove that the angles in a triangle add up to 180°.



Draw and label angles that are alternate to a and c.

a, b and c make a straight line, so $a + b + c = 180°$
The angles in a triangle add up to 180°.

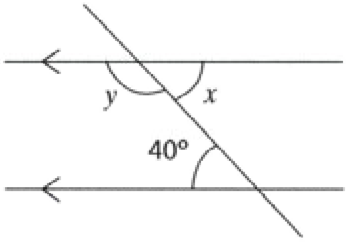
RETRIEVE

8 Angles in parallel lines

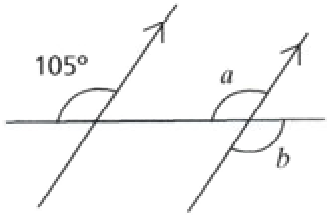
Angles in parallel lines

1 Work out the size of each angle labelled with a letter. Give reasons for your answers.

a)



b)



$x =$ ....

....

$y =$ ....

....

$a =$ ....

....

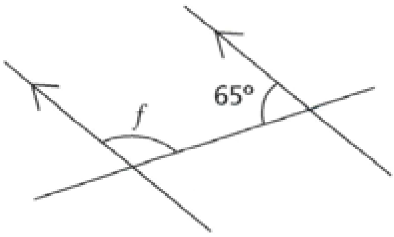
$b =$ ....

....

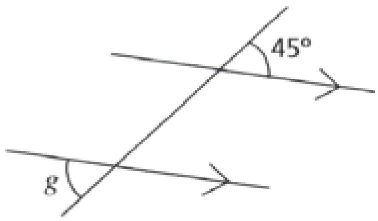
Solving parallel line problems

2 Work out the size of each angle labelled with a letter. Give reasons for your answers.

a)



b)



$f =$ ....

....

$g =$ ....

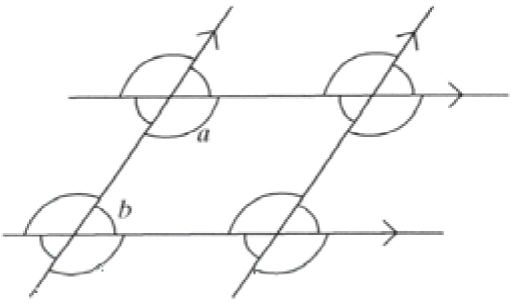
....

Proving angle facts

3 This diagram shows two pairs of parallel lines that cross to make a parallelogram.

Use the diagram to prove that opposite angles in a parallelogram are equal.

Label equal angles with the same letter.



....

....

ORGANISE

3 Coordinates

Reading and plotting coordinates

Coordinates tell you the position of a point on a grid.

Coordinates are written like this:

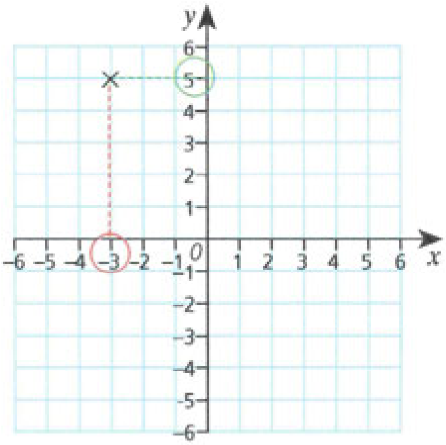
x-coordinate

↓

(−3, 5)

↑

y-coordinate



> *x* comes before *y* in the alphabet, and also in coordinates.

Relationships between coordinates

The relationships between coordinates of points on a straight line can help you find the equation of the line.

a) **Find the relationship between the x- and y-values in these coordinates.**

(−5, −4) (−3, −2) (−1, 0) (2, 3) (4, 5) (5, 6)

> Look at each pair of coordinates. What do you need to do to the x-coordinate to get the y-coordinate in each pair?

(−5, −4) (−3, −2) (−1, 0) (2, 3) (4, 5) (5, 6)

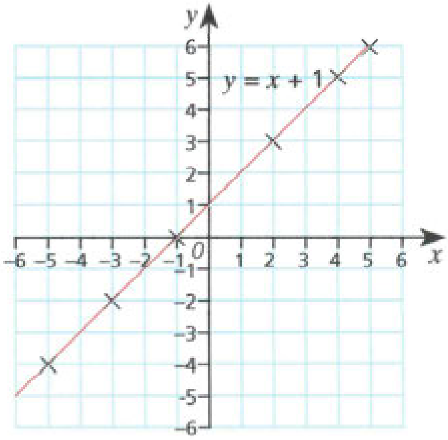
−5 + 1 = −4   −1 + 1 = 0   5 + 1 = 6

$x + 1 = y$

> To find the y-coordinate, you add 1 to the x-coordinate.

The relationship is $y = x + 1$

b) **Plot the points and label the line with its equation.**



a) **Find the relationship between the x- and y-values in these coordinates.**

(−5, −20) (−3, −12) (−1, −4) (0, 0)

(2, 8) (4, 16) (6, 24)

(−5, −20) (−3, −12) (−1, −4) (0, 0) (2, 8) (4, 16) (6, 24)

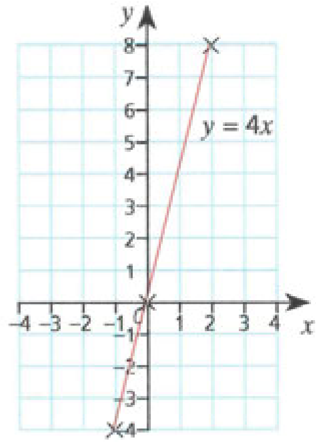
−5 × 4 = −20   −1 × 4 = −4   4 × 4 = 16

$x \times 4 = y$

> To find the y-coordinate, you multiply the x-coordinate by 4.

The relationship is $y = 4x$

b) **Plot the points (−1, −4) (0, 0) (2, 8) and label the line with its equation.**

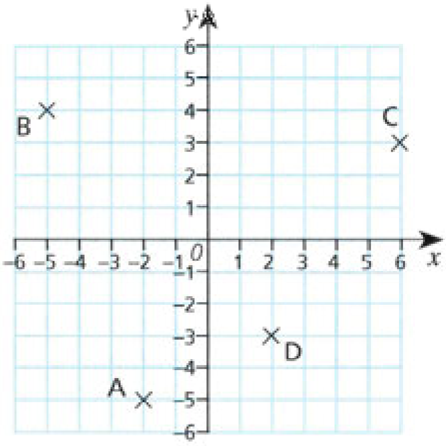


RETRIEVE

3 Coordinates

Reading and plotting coordinates

1 **a)** Write the coordinates of the points labelled A to D.



A ....

B ....

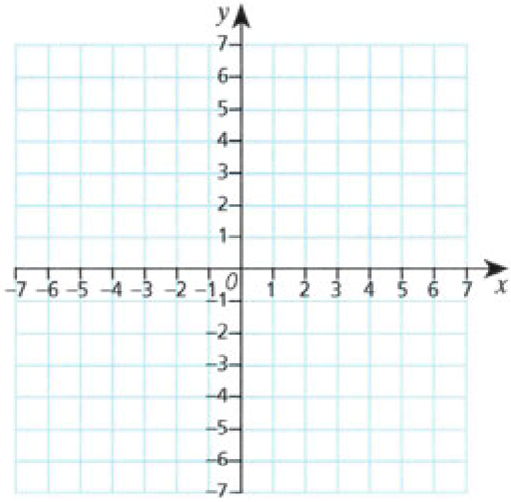
C ....

D ....

b) Plot and label these points on the coordinate grid.

E (7, –3) F (–5, 0) G (–1, 3) H (3, 2)

i) Join points E to F to G to H to E with straight lines.



ii) Name the shape you have drawn.

....

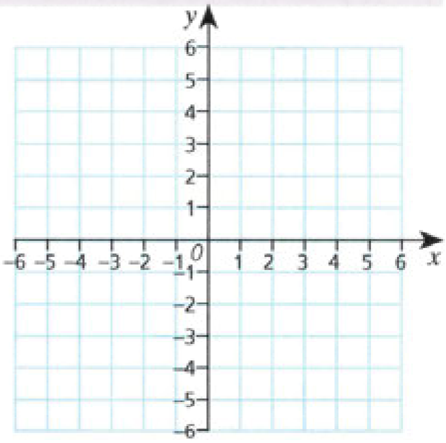
Relationships between coordinates

2 **a)** Find the relationship between the x- and y-values in these coordinates.

(–6, –4) (–4, –2) (–2, 0) (1, 3) (3, 5)

....

b) Plot these points and label the line with its equation.



3 Find the relationship between the x- and y-values in these coordinates.

(–6, –12) (–4, –8) (–2, –4) (1, 2) (3, 6) ....

4 Find the relationship between the x- and y-values in these coordinates.

(–6, –8) (–4, –6) (–2, –4) (1, –1) (3, 1) (5, 3) ....

5 Here are the equations of some straight lines:

$y = 3x$ $\quad$ $y = x + 3$ $\quad$ $y = -3x$ $\quad$ $y = x - 3$

Circle the equation of the line that passes through all these points: (–5, 15) (0, 0) (2, –6)

ORGANISE

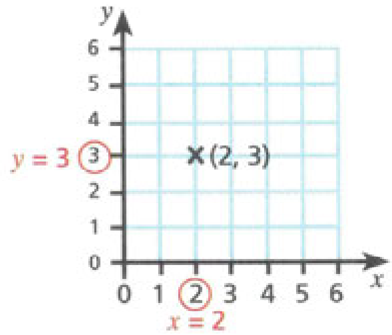
4 Working with coordinates

Reading and writing coordinates

Coordinates tell you the position of a point on a grid.

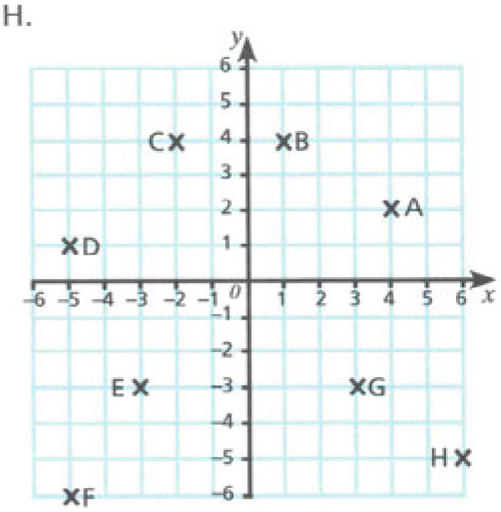
Coordinates are written like this: (2, 3)

x-coordinate y-coordinate

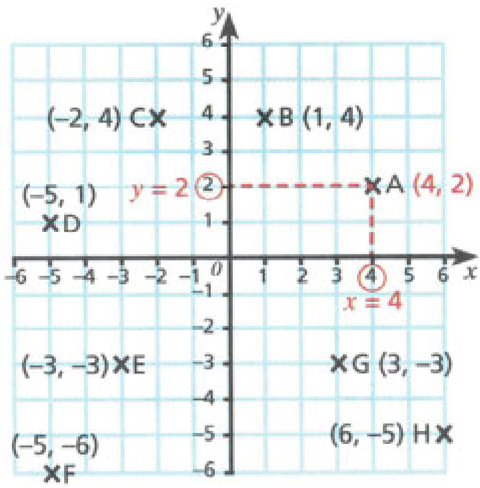


> **Remember that x comes before y in the alphabet and in coordinates.**
> **Write coordinates in brackets, like this: (x-coordinate, y-coordinate)**

Write the coordinates of the points labelled A to H.



Read the x-coordinate and the y-coordinate from the axes.



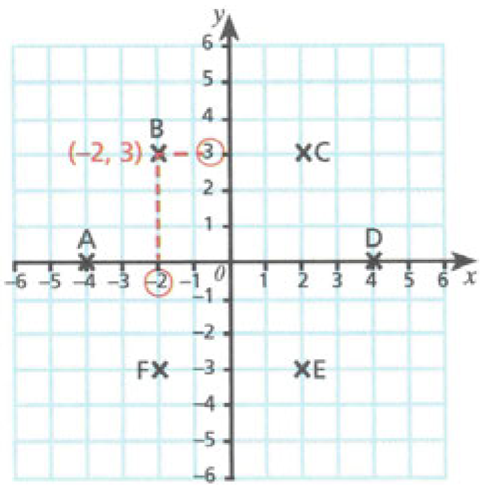
You can write the coordinates in a list like this:

A (4, 2) B (1, 4) C (−2, 4) D (−5, 1)
E (−3, −3) F (−5, −6) G (3, −3) H (6, −5)

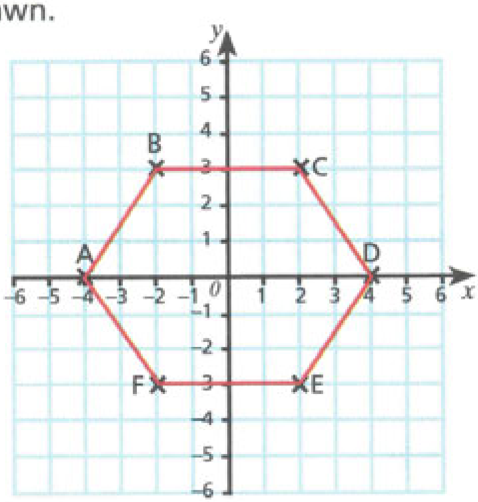
Plotting coordinates

Plot these points on a coordinate grid: A (−4, 0) B (−2, 3) C (2, 3) D (4, 0) E (2, −3) F (−2, −3)

Join the points in order, with straight lines, to make a 2D shape.
Write down the name of the shape you have drawn.



Plot each point with a cross. Label it with its letter.



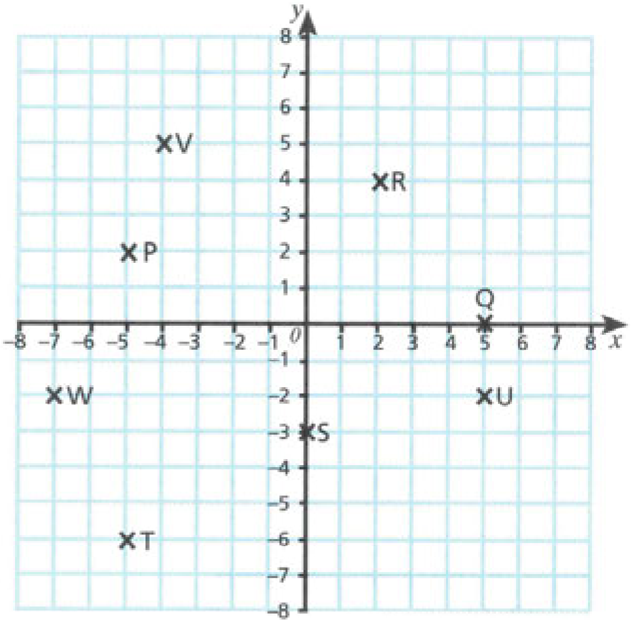
The shape is a hexagon.

Join A to B, B to C, and so on. Use a ruler to draw the straight lines. Join F to A to finish the shape. Count the sides and name the shape.

4 Working with coordinates

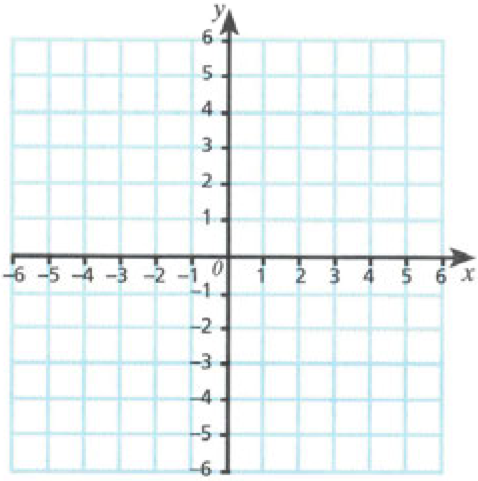
Reading and writing coordinates

1. Write the coordinates of the points labelled P to W.

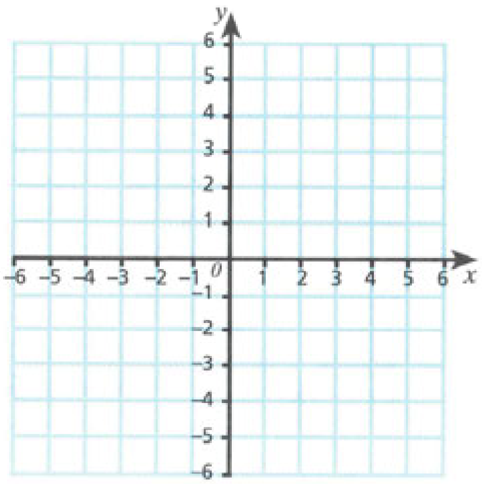


Plotting coordinates

2. Plot and label these points on the coordinate grid: J (3, –1) K (–1, 3) L (0, 2) M (–3, 0)



3. Plot these points on the coordinate grid: A (–2, –2) B (3, –2) C (3, 5) D (–2, 5) E (–4, 2)
Join the points in order, with straight lines, to make a 2D shape.



Write down the name of the shape you have drawn.

ORGANISE

4 Solving problems involving coordinates

Coordinates of points on straight lines

The relationships between coordinates of points on a straight line can help you find the equation of the line.

a) Find the relationship between the x- and y-values in these coordinates:

(–5, –5) (–3, –3) (–1, –1) (2, 2) (4, 4) (6, 6)

Look at each pair of coordinates. What do you notice about the x- and y-values in each pair?

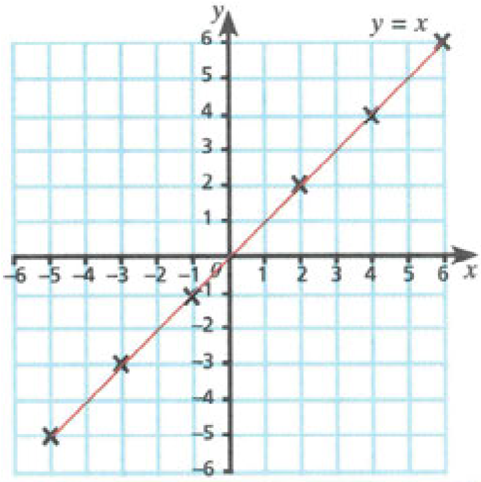
(–5, –5)	(–3, –3)	(–1, –1)	(2, 2)	(4, 4)	(6, 6)
–5 = –5	–3 = –3	–1 = –1	2 = 2	4 = 4	6 = 6

The relationship is $y = x$

b) Do all these points lie on a straight line?
If so, what is the equation of the line?

Plot the points on a graph to see if they lie on a straight line.

The points do lie on a straight line.
The equation of the straight line is $y = x$



a) Find the relationship between the x- and y-values in these coordinates:

(3, –5) (3, –3) (3, –1) (3, 2) (3, 4) (3, 6)

Look at each pair of coordinates. What do you notice about the x- and y-values?

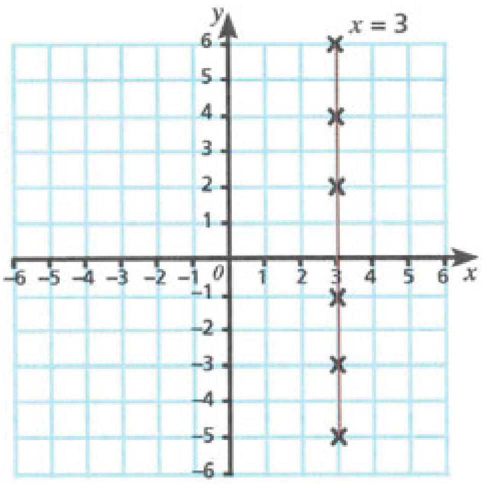
(3, –5)	(3, –3)	(3, –1)	(3, 2)	(3, 4)	(3, 6)
↑ $x = 3$	↑ $x = 3$	↑ $x = 3$	↑ $x = 3$	↑ $x = 3$	↑ $x = 3$

The relationship is $x = 3$ (for every y-value).

b) Do all these points lie on a straight line?
If so, what is the equation of the line?

Plot the points on a graph to see if they lie on a straight line.

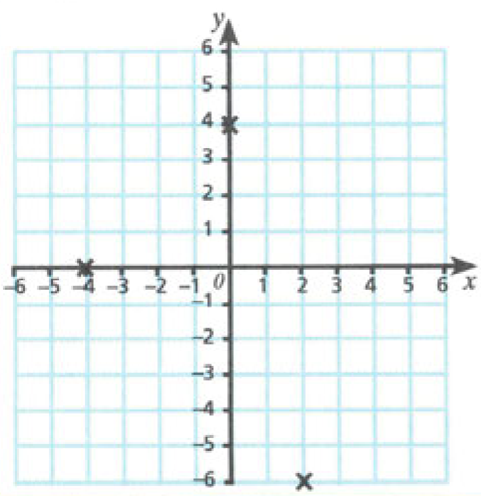
The points do lie on a straight line.
The equation of the straight line is $x = 3$

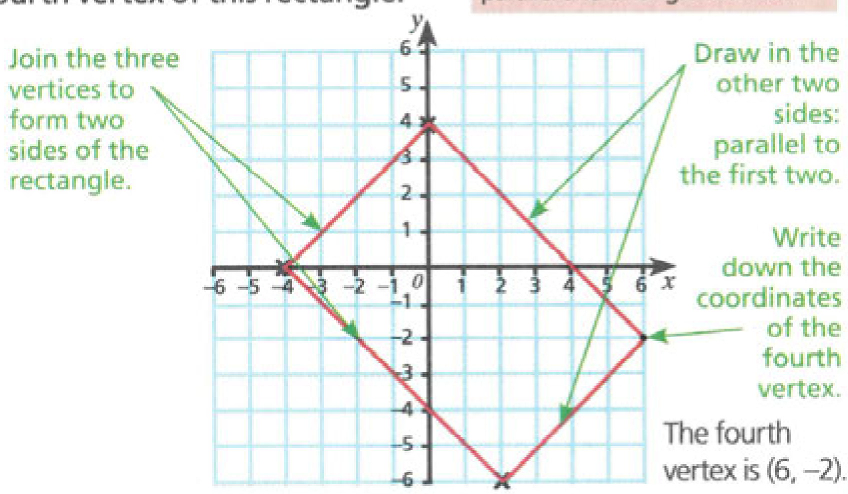


Coordinates of missing vertices

The three points plotted on this grid are three vertices of a rectangle. Write down the coordinates of the fourth vertex of this rectangle.

In a rectangle, opposite sides are parallel and all angles are 90°.





The fourth vertex is (6, –2).

RETRIEVE

4 Solving problems involving coordinates

Coordinates of points on straight lines

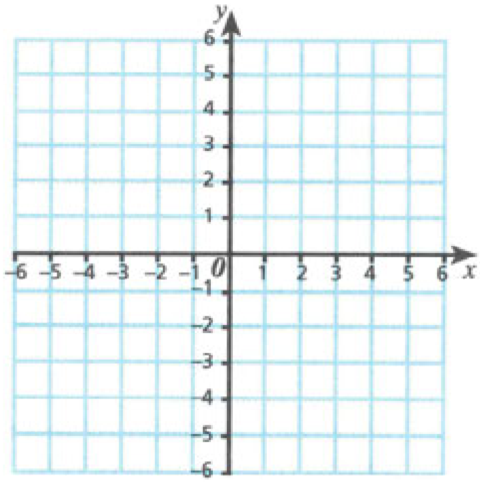
1 **a)** Find the relationship between the x- and y-values in these coordinates:

(–5, 5) (–3, 3) (–1, 1) (2, –2) (4, –4) (6, –6)

....

b) Do all these points lie on a straight line?
If so, what is the equation of the line?

....



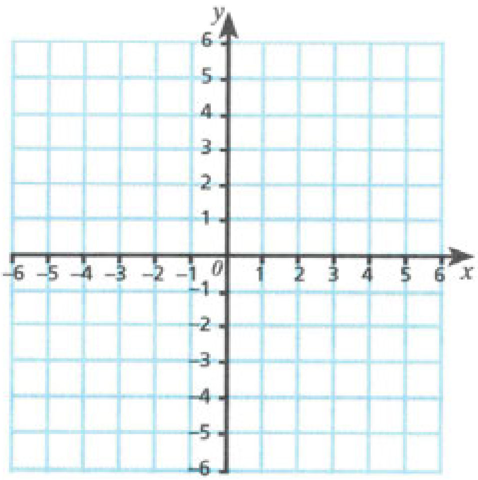
2 **a)** Find the relationship between the x- and y-values in these coordinates:

(–2, –6) (–2, –4) (–2, –2) (–2, 0) (–2, 1) (–2, 3) (–2, 5)

....

b) Do all these points lie on a straight line?
If so, what is the equation of the line?

....

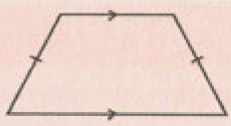


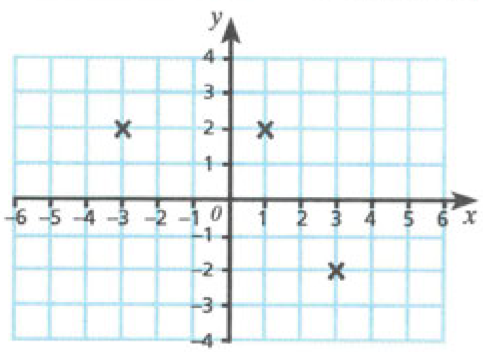
Coordinates of missing vertices

3 The three points plotted on this grid are three vertices of an isosceles trapezium.

Write down the coordinates of the fourth vertex of this trapezium. ....

Isosceles trapezium:

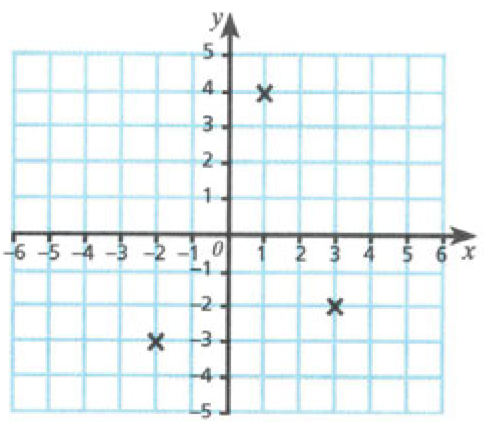




4 The three points plotted on this grid are three vertices of a parallelogram.

Write down the possible coordinates of the fourth vertex of the parallelogram. ....

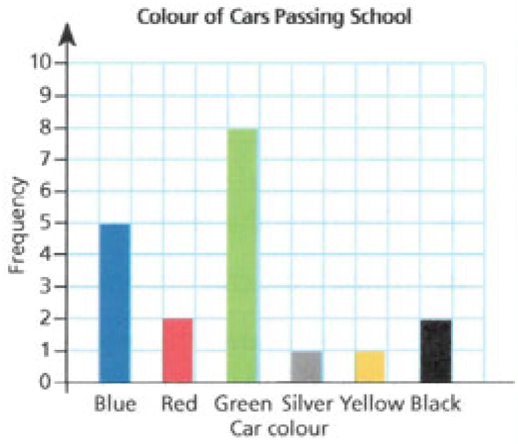
Draw a parallelogram with these three vertices. There are two possible parallelograms with different fourth vertices. You only need to find one.



6 Interpreting statistical representations

Interpreting statistical measures and representations

The bar chart shows information about the colour of cars passing a school over a 10-minute period.



a) How many blue cars drove past?

Read off the frequency from the y-axis of the blue car category.

5 blue cars drove past.

b) How many more green cars than silver cars drove past?

Find how many cars of each colour drove past and find the difference between them by **subtracting**.

7 more green cars than silver cars drove past.

c) What colour of car drove past the most?

Green cars had the highest frequency, so green cars drove past most often. This is the **mode**.

d) How many cars drove past in total?

19 cars drove past in total. To find the total, add together the frequencies of each colour of car.

Choosing an appropriate statistical measure

When choosing an appropriate statistical measure, consider the advantages and disadvantages of each.

Measure of central tendency	Advantage	Disadvantage
Mean	Takes account of every value	Affected by very large or very small values
Median	Unaffected by very large or very small values	May not be an actual number in the data set
Mode	Only average that can be used for qualitative data	There may be more than one mode or no mode

The salaries of five employees in a company are:

£23000 £25000 £30000 £33000 £120000

Which statistical measure should be used to represent the average?

The **median** should be used because it is unaffected by very large or very small values. £120000 is a very large value compared to the others.

A shop wants to find the average size of shoe sold to help it to decide which size it needs most stock of. The sizes sold on a particular day are:

3, 4, 4, 5, 6, 7, 8, 8, 9, 9, 9, 9, 9, 10, 10, 11, 12, 14

Which statistical measure should be used for the average?

The **mode** (9) should be used because it shows which shoe size is in greatest demand.

The heights of some Year 8 students, in metres, are:

1.72, 1.54, 1.57, 1.50, 1.55, 1.46, 1.63, 1.61

Which statistical measure should be used for the average height?

The **mean** should be used because it takes account of every value and there are few very large or very small values in the data set.

The range is not a measure of central tendency. It measures the spread of the data set.

The daily temperatures across March last year for two cities are summarised in this table.

City	Mean maximum daily temperature	Range of maximum daily temperature
A	22°C	6°C
B	22°C	13°C

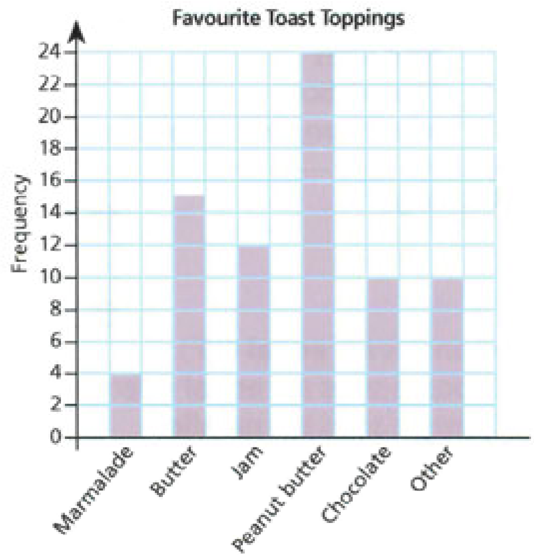
Which city should you choose if you want to enjoy high temperatures? Justify your answer.

City A should be the city you choose to visit. Both cities have the same mean, but city A has the smaller range. This means that the temperature is more consistently high in city A compared to city B.

Interpreting statistical representations

Interpreting statistical measures and representations

1 The bar chart shows the preferred toast toppings of a group of students.



a) How many students prefer chocolate on their toast? ....

b) How many students prefer marmalade on their toast? ....

c) How many more students prefer butter on their toast than jam? ....

d) What is the mode of this data? ....

e) How many students took part in the survey? ....

Choosing an appropriate statistical measure

2 A boutique had daily sales of **£326, £540, £385, £450, £2435, £459** and **£493** over the last week.

Is the mean or median a more reliable measure of central tendency? Justify your answer.

....

....

3 The favourite subjects of some students were collected and recorded:

French, PE, Maths, Science, Maths, ICT, Maths, DT, Maths

Which measure of central tendency can best be used to describe this data? Justify your answer.

....

....

4 The daily temperatures across March last year for two cities are summarised in this table.

City	Mean maximum daily temperature	Range of maximum daily temperature
C	12°C	8°C
D	21°C	8°C

Which city should you choose to visit if you want to enjoy high temperatures? Justify your answer.

....

....

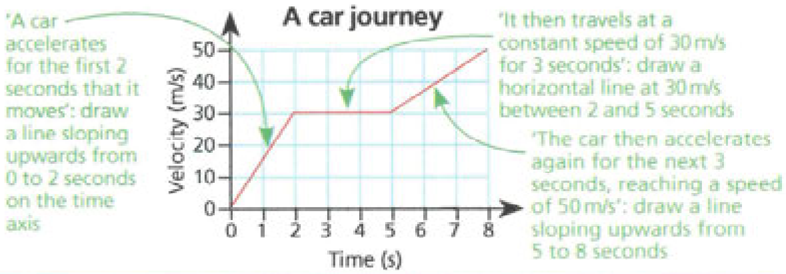
ORGANISE

7 Plotting real-life graphs

Velocity–time graphs

A car accelerates for the first 2 seconds that it moves. It then travels at a constant speed of 30 m/s for 3 seconds. The car then accelerates again for the next 3 seconds, reaching a speed of 50 m/s.

Draw a velocity–time graph to represent this information.

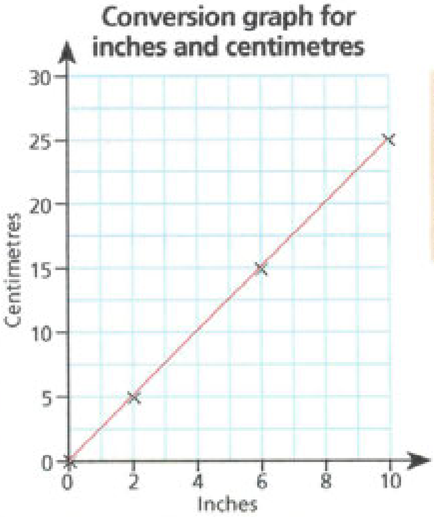


Conversion graphs

When there is a table of values, a conversion graph is plotted in the same way as a linear graph in the form $y = mx + c$. The first row of the table of values is usually plotted against the x-axis and the second row against the y-axis.

Use the information in the table to draw a conversion graph for inches and centimetres.

Inches	0	2	6	10
Centimetres	0	5	15	25



Plot the points (0, 0), (2, 5), (6, 15) and (10, 25) from the table of values.

An electrician charges a £20 call-out fee plus £30 per hour of work she does.

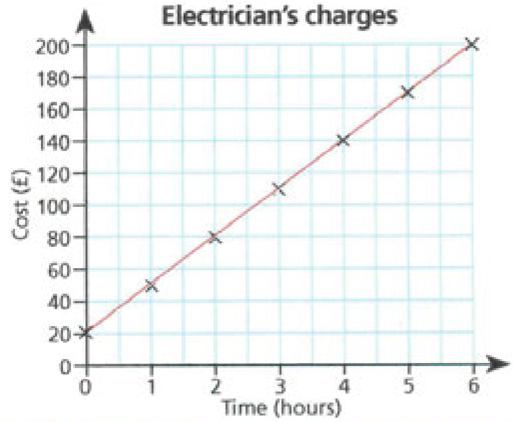
a) Complete the table of costs for different lengths of jobs.

Time (hours)	0	1	2	3	4	5	6
Cost (£)							

The charge at 0 hours is £20 because this is the call-out fee. For every hour, the cost increases by £30.

Time (hours)	0	1	2	3	4	5	6
Cost (£)	20	50	80	110	140	170	200

b) Plot a graph of cost against time.



A conversion is given that 5 miles = 8 km.

a) Complete the table using this fact.

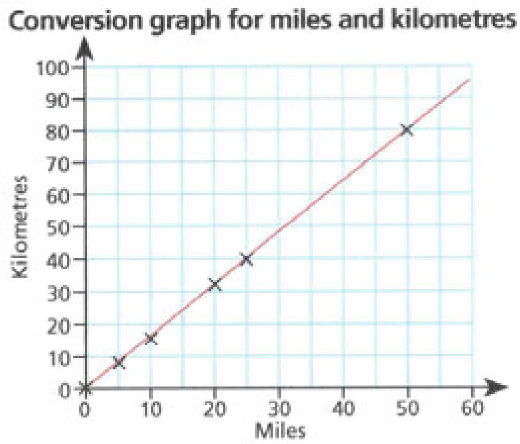
Miles	5	10	20	25	50
Kilometres					

The two units are in direct proportion. This means that if one part of the ratio is multiplied or divided by an amount, the same is done to the other part, e.g.:

×2 (5 miles : 8 km → 10 miles : 16 km) ×2 ×4 (5 miles : 8 km → 20 miles : 32 km) ×4

Miles	5	10	20	25	50
Kilometres	8	16	32	40	80

b) Draw a conversion graph from the point (0, 0) to represent this information.



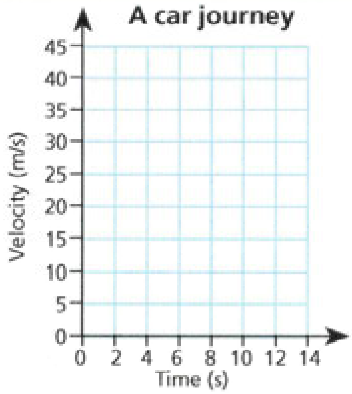
RETRIEVE

7 Plotting real-life graphs

Velocity–time graphs

1 A car accelerates for the first 2 seconds that it moves. It then travels at a constant speed of 40 m/s for 8 seconds. The car then slows down for 1 second, and then travels at a constant speed of 20 m/s for 2 seconds.

Draw a velocity–time graph to represent this information.



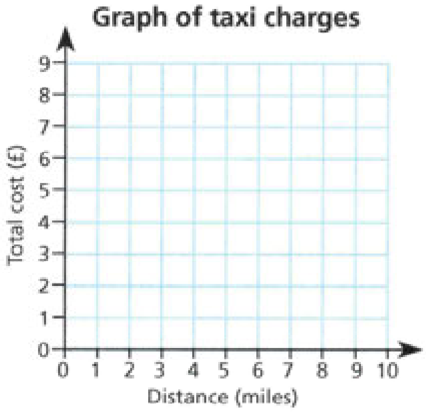
Conversion graphs

2 A taxi driver charges customers a fixed amount of £3 plus an extra 50p for every mile travelled.

a) Use this information to complete the table.

Distance (miles)	0	1	2	4	6	8	10
Total cost (£)							

b) Use this information to complete the graph showing the total cost to customers for journeys of up to 10 miles.

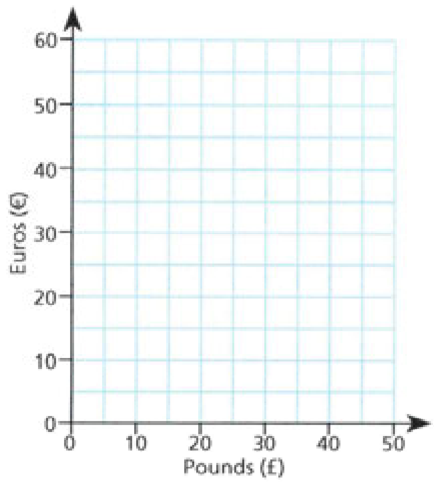


3 **a)** A conversion is given that £1 = €1.20

Complete the table using this fact.

Pounds (£)	1.00	10.00		25.00	
Euros (€)	1.20		24.00		60.00

b) Draw a conversion graph to represent this information. Start by plotting the point (0, 0).

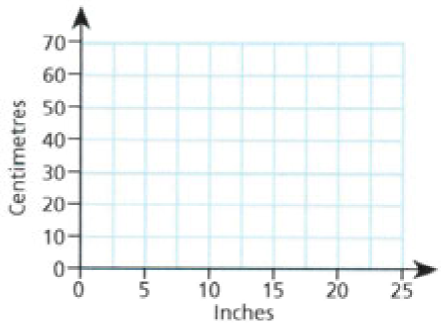


4 **a)** A conversion is given that 2 inches = 5 cm.

Complete the table using this fact.

Inches	2	4	12	20	25
Centimetres					

b) Draw a conversion graph to represent this information. Start by plotting the point (0, 0).

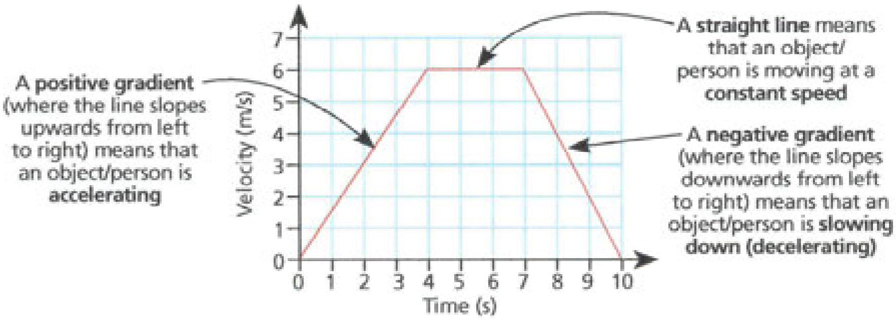


ORGANISE

7 Interpreting other real-life graphs

Velocity–time graphs

Velocity–time graphs show how acceleration changes over time. Time is on the horizontal (x) axis and velocity (or speed) is on the vertical (y) axis. Make sure you understand what the gradient of the line on a velocity–time graph represents.



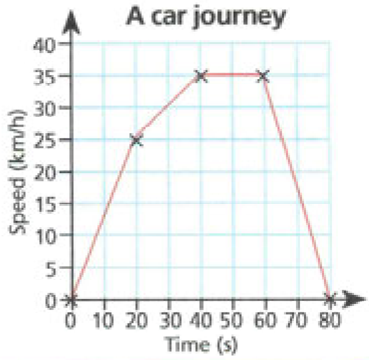
The speed of a car is recorded at 20-second intervals and shown on this speed–time graph. Describe the car's speed.

Between 0 and 20 seconds, the car is accelerating.

Between 20 and 40 seconds, the car is accelerating but at a slower rate because the gradient has decreased.

Between 40 and 60 seconds, the car is moving at a constant speed.

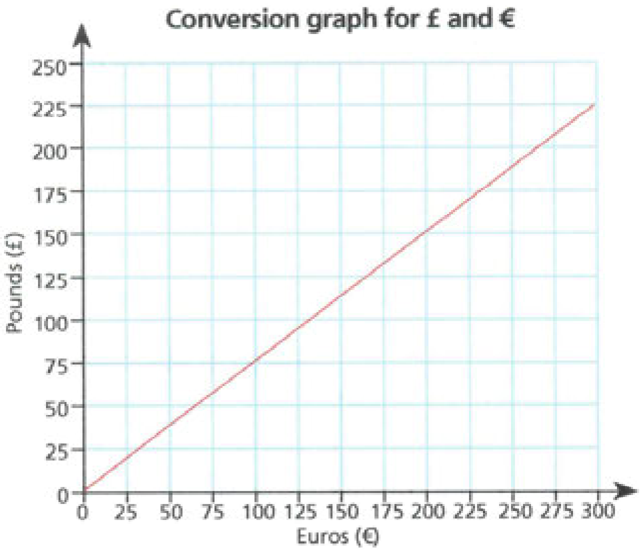
Between 60 and 80 seconds, the car is slowing down (decelerating) until it stops moving at 80 seconds.

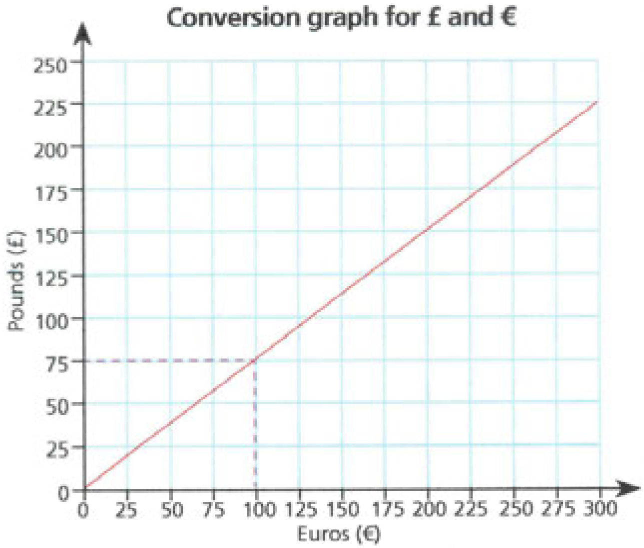


Conversion graphs

Conversion graphs are straight line graphs that can be used to convert from one unit to another. They are often used for currency conversions and measurement conversions.

This graph converts between pounds (£) and euros (€) using an exchange rate on a particular day. How many pounds would you get for €100?





Use a ruler to draw a vertical line from the amount in the currency you have been given, until you reach the graph. Then draw a horizontal line to the other axis to find how much it converts to.

According to the graph, €100 = £75

When interpreting real-life graphs, make sure you consider:

- the gradient of the line
- the y-intercept.

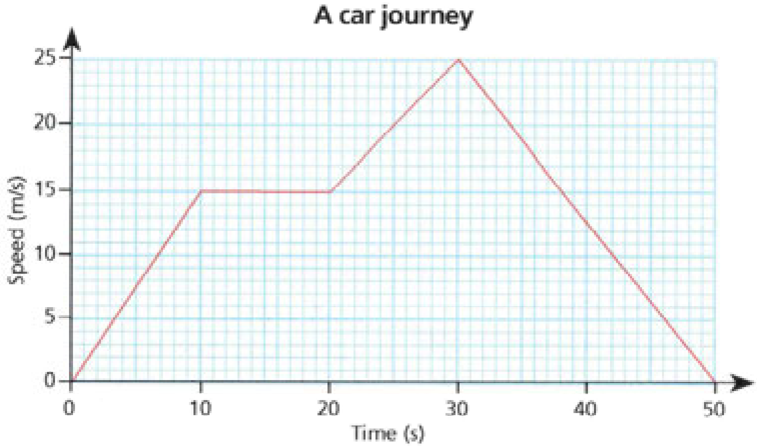
RETRIEVE

7 Interpreting other real-life graphs

Velocity–time graphs

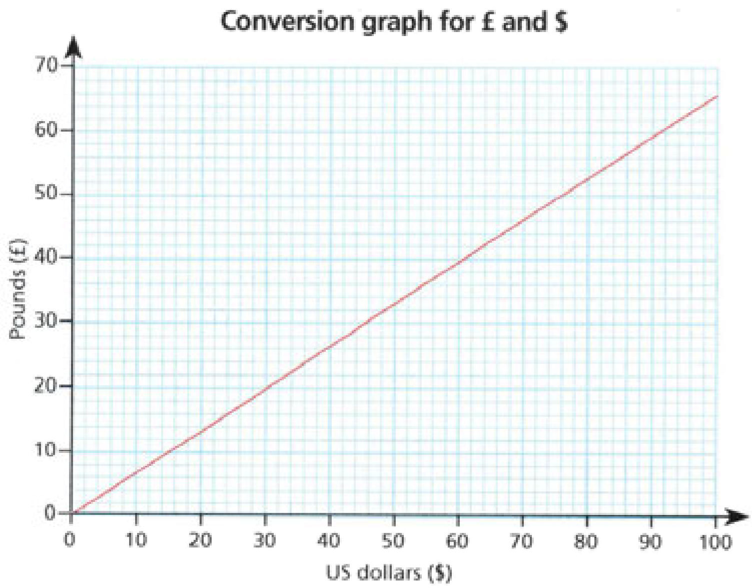
1 The velocity–time graph shows a 50-second car journey.

Describe the car's journey.



Conversion graphs

2 The graph converts between pounds (£) and US dollars ($) using an exchange rate on a particular day.



a) How much is $60 worth in pounds? £ ....

b) How much is £20 worth in US dollars? $ ....