

Equivalent fractions and decimals

Fractions as division

A fraction represents part of a whole so is a way of showing division, e.g. $\frac{5}{8}$ is $5 \div 8$.

To work with fractions on a calculator, use the fraction button .

4 friends share 3 pizzas. How much of one pizza does each person get?



3 pizzas divided into 4 parts is $3 \div 4$, or $\frac{3}{4}$. Each person gets $\frac{3}{4}$ of a pizza.



Writing decimals as fractions

Decimals also represent part of a whole. In a **terminating decimal**, the place value of the last digit shows how many parts the whole is divided into. Terminating decimals can be written as fractions by using the place value as the denominator.

a) Convert 0.32 to a fraction.

Ones	tenths	hundredths	thousandths
0	3	2	

The last place value in 0.32 is **hundredths**, so 0.32 is 32 parts out of **100**.

$$0.32 = \frac{32}{100}$$

Then simplify: $\frac{32}{100} = \frac{8}{25}$

b) Convert 0.527 to a fraction.

Ones	tenths	hundredths	thousandths
0	5	2	7

The last place value in 0.527 is **thousandths**, so 0.527 is 527 parts out of **1000**.

$$0.527 = \frac{527}{1000}$$

This fraction can't be simplified.

Take care if the digit after the decimal point is a zero.

Convert 0.08 to a fraction.

Ones	tenths	hundredths	thousandths
0	0	8	

The last place value in 0.08 is **hundredths**, so 0.08 is 8 parts out of **100**.

$$0.08 = \frac{8}{100}$$

Simplified, $\frac{8}{100} = \frac{2}{25}$

The place value furthest right in the decimal becomes the denominator of the fraction.

Decimal numbers greater than 1 can also be converted to improper fractions or to mixed numbers.

Convert 3.62 to a mixed number.

$$3.62 = \frac{362}{100} = 3\frac{62}{100}$$

Simplified, $3\frac{62}{100} = 3\frac{31}{50}$

Writing fractions as decimals

To convert from a fraction to a decimal, divide the numerator by the denominator.

If the denominator is a factor or multiple of a power of 10, you can also use equivalent fractions to write the fraction as a decimal.

To convert between fractions and decimals on a calculator, find the fraction button and the fraction-to-decimal conversion button. They may look like this:  .

a) Convert $\frac{3}{8}$ to a decimal.

$$\begin{array}{r} 0.375 \\ 8 \overline{) 3.750} \\ \underline{24} \\ 130 \\ \underline{120} \\ 100 \\ \underline{80} \\ 200 \\ \underline{160} \\ 400 \\ \underline{400} \\ 0 \end{array} \quad \frac{3}{8} = 0.375$$

b) Convert $\frac{17}{20}$ to a decimal.

$$\frac{17}{20} = \frac{85}{100}$$

20 is a multiple of 10. Multiply the numerator and denominator by 5 to get a fraction with a denominator of 100.

$$\frac{17}{20} = \frac{85}{100} = 0.85$$

Equivalent fractions and decimals

Fractions as division

- 1 Draw lines to join each fraction to the matching image and the correct division calculation.

Fraction

$$\frac{3}{8}$$

$$\frac{9}{10}$$

$$\frac{5}{6}$$

$$\frac{13}{15}$$

Image



Division

$$5 \div 6$$

$$13 \div 15$$

$$3 \div 8$$

$$9 \div 10$$

Writing decimals as fractions

- 2 Write each decimal as a fraction.

a) 0.335

b) 0.27

c) 1.18

d) 8.04

- 3 Use a calculator to write each decimal as a fraction.

a) 0.018

b) 0.524

c) 3.28

Writing fractions as decimals

- 4 Write each fraction as a decimal.

a) $\frac{15}{25}$

b) $\frac{39}{50}$

c) $\frac{9}{20}$

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

- 5 Use a calculator to write each fraction as a decimal. Give your answers to 2 decimal places.

a) $\frac{12}{26}$

b) $\frac{14}{6}$

c) $\frac{2}{23}$

Powers

A **power** is a shorter way of writing repeated multiplication of the same number.

A power is also sometimes called an **index** or **exponent**. The number being multiplied is called the **base**.

Power (or index)

$$8^5 = 8 \times 8 \times 8 \times 8 \times 8$$

Base

In words, this is said '8 to the power of 5'.

$$3 \times 3 = 3^2$$

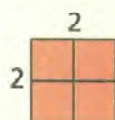
'3 squared'

$$3 \times 3 \times 3 = 3^3$$

'3 cubed'

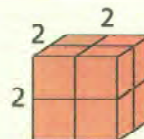
$$3 \times 3 \times 3 \times 3 = 3^4$$

'3 to the power of 4'



$$2 \times 2 = 4$$

$$2^2 = 4$$



$$2 \times 2 \times 2 = 8$$

$$2^3 = 8$$

A number raised to the power of 2 is called **squared**. A number raised to the power of 3 is called **cubed**.

Roots

A **root** is the **inverse** of a power. In other words, it is the base: the number that is being multiplied by itself. For example, $\sqrt{4}$ means 'What number multiplied by itself gives 4?'

$$3^3 = 27, \text{ so } \sqrt[3]{27} = 3$$

In words: 'the cube root of 27 is 3'

$$3^5 = 243, \text{ so } \sqrt[5]{243} = 3$$

In words: 'the fifth root of 243 is 3'

The square root is the number that is squared to make a given number.

Estimating square roots

You can estimate a square root by knowing the square roots of nearby numbers.

The square root of 96 is between 9 and 10.

$$9^2 = 81, \text{ so } \sqrt{81} = 9$$

$$10^2 = 100, \text{ so } \sqrt{100} = 10$$

Since 96 is closer to 100 than to 81, the square root will be between 9.5 and 9.9 to 1 decimal place.

Using a calculator, we see that $\sqrt{96} = 9.8$ to 1 d.p.

You should know all the square numbers up to 144 from your times tables.

Using a calculator

You can use a calculator to find other powers and roots. You will often need to use the **SHIFT** or **2ndF** buttons to access other functions.

The buttons to find any power and any root may look like x^y and $\sqrt[y]{x}$.

SHIFT to use other functions

Squared
SHIFT: Cubed

Square root
SHIFT: Cube root

Any power
SHIFT: Any root



$$3^8 = 6561$$

$$3 \text{ } x^y \text{ } 8 \text{ } =$$

Check the order you must push the buttons on your calculator. You may need to push x^y first.

$$\sqrt[3]{1728} = 12$$

$$\text{SHIFT } \sqrt[3]{\square} \text{ } 1 \text{ } 7 \text{ } 2 \text{ } 8 \text{ } =$$

Again, check the order you must push the buttons on your own calculator.

Find the buttons on your own calculator for powers and roots and learn how to use them.

Powers

1 Write the following as powers.

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

b) $9 \times 9 \times 9$

c) $2 \times 2 \times 2 \times 2$

2 Write the following powers as multiplications.

a) 3^8

b) 4^5

c) 10^4

3 Find the value of:

a) 7^2

b) 2^4

Roots

4 Find the square roots.

a) $\sqrt{36}$

b) $\sqrt{121}$

5 Find the cube roots.

a) $\sqrt[3]{8}$

b) $\sqrt[3]{64}$

Estimating square roots

6 Estimate the square roots (to 1 decimal place).

a) $\sqrt{135}$

b) $\sqrt{200}$

c) $\sqrt{78}$

Using a calculator

7 Use a calculator to find the value of:

a) 2^6

b) 3^5

c) $\sqrt{256}$

d) $\sqrt[3]{3375}$

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?

$(-5, -5)$ $(-3, -3)$ $(-1, -1)$ $(2, 2)$ $(4, 4)$ $(6, 6)$
 $-5 = -5$ $-3 = -3$ $-1 = -1$ $2 = 2$ $4 = 4$ $6 = 6$

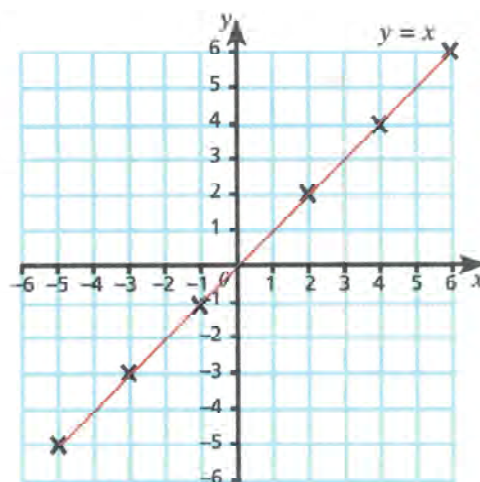
The relationship is $y = x$

- 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?

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

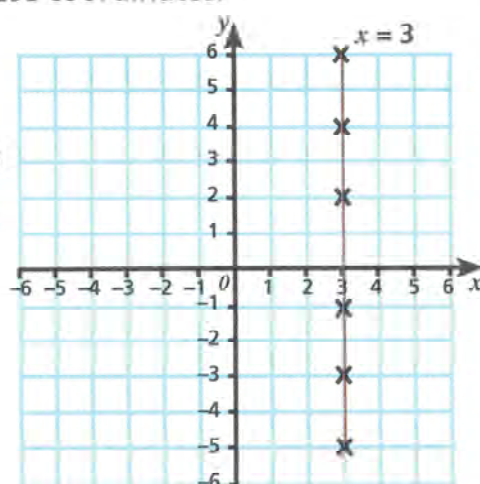
The relationship is $x = 3$ (for every y -value).

- 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.

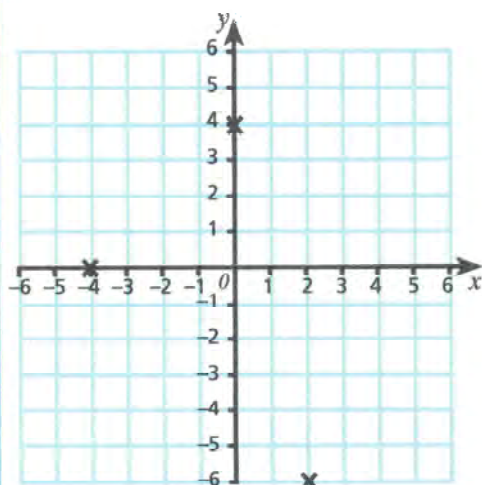
The equation of the straight line is $x = 3$



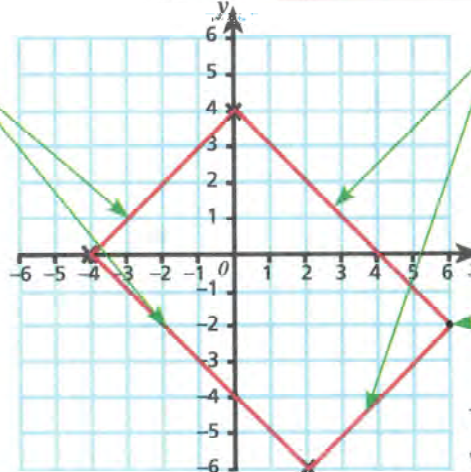
Coordinates of missing vertices

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° .



Join the three vertices to form two sides of the rectangle.



Draw in the other two sides: parallel to the first two.

Write down the coordinates of the fourth vertex.

The fourth vertex is $(6, -2)$.

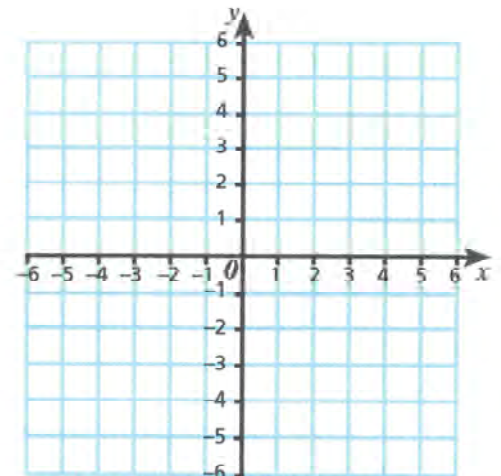
Solving problems involving coordinates

Coordinates of points on straight lines

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

$(-5, 5)$ $(-3, 3)$ $(-1, 1)$ $(2, -2)$ $(4, -4)$ $(6, -6)$

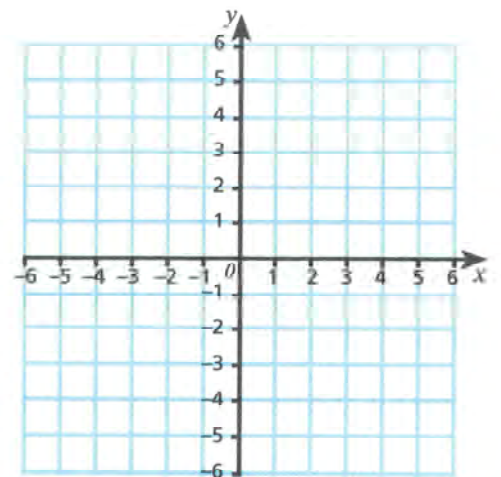
- b) Do all these points lie on a straight line?
If so, what is the equation of the line?



- 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?

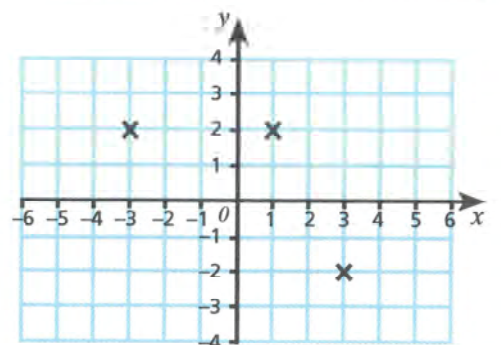
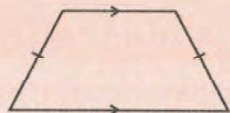


Coordinates of missing vertices

- 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.

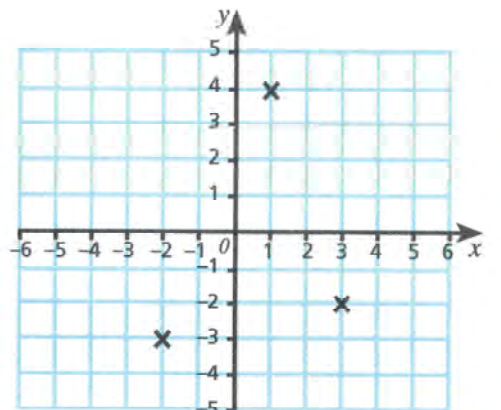
Isosceles trapezium:



- 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.



Reading and writing coordinates

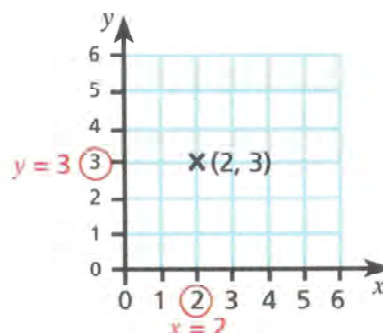
Coordinates tell you the position of a point on a grid.

Coordinates are written like this: $(2, 3)$

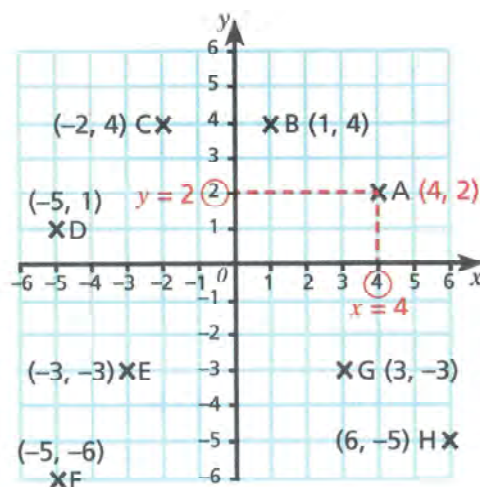
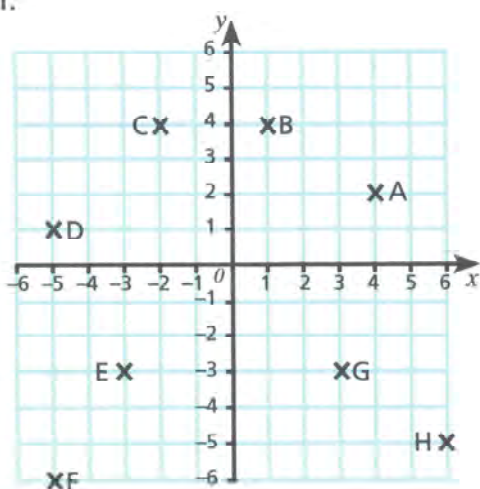
x-coordinate y-coordinate

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.



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 $(6, -5)$

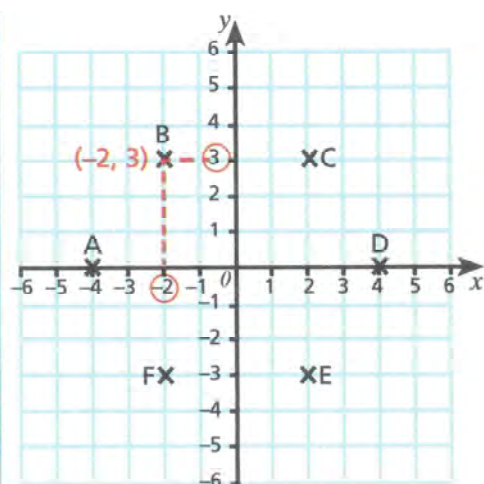
Read the x -coordinate and the y -coordinate from the axes.

Plotting coordinates

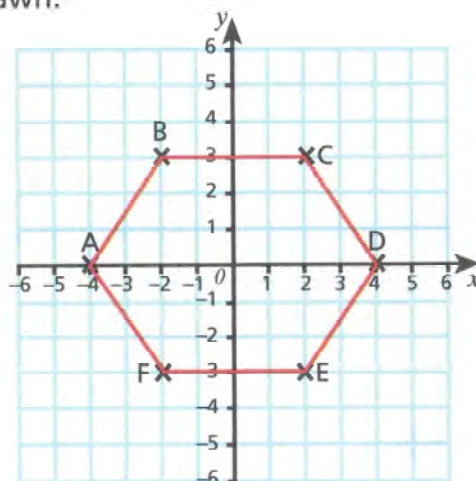
Plot these points on a coordinate grid: A $(-4, 0)$ B $(-2, 3)$ C $(2, 3)$ D $(4, 0)$ E $(2, -3)$ F $(-2, -3)$

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.



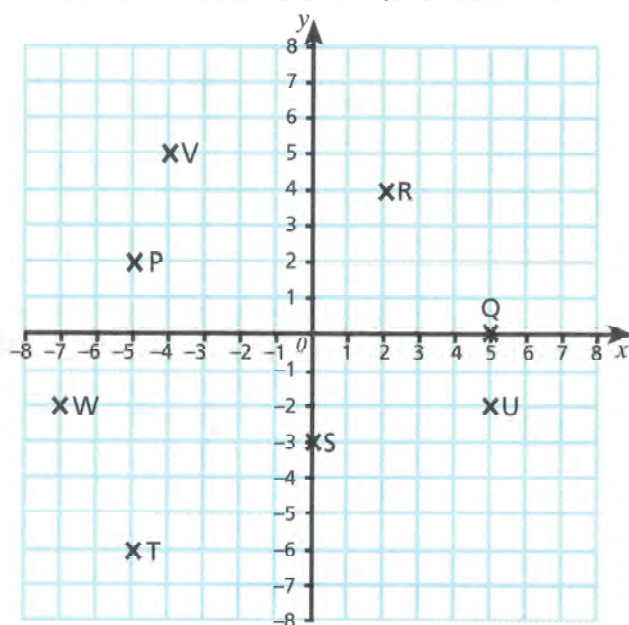
Join A to B, B to C, and so on. Use a ruler to draw the straight lines. Join F to A to finish the shape. Count the sides and name the shape.

The shape is a hexagon.

Working with coordinates

Reading and writing coordinates

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



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.....

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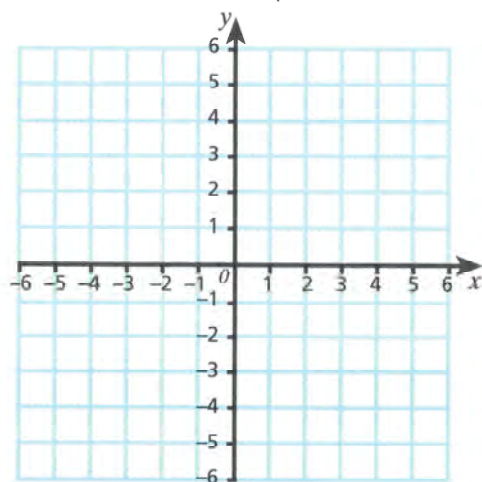
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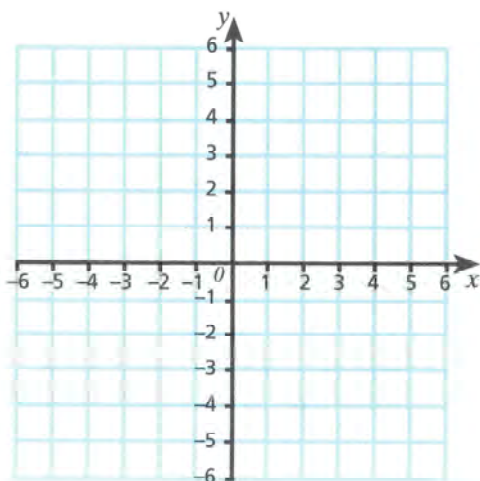
.....

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.

.....

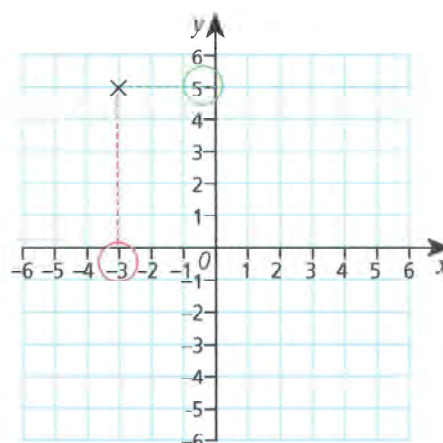
Reading and plotting coordinates

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.

$(-5, -4) (-3, -2) (-1, 0) (2, 3) (4, 5) (5, 6)$

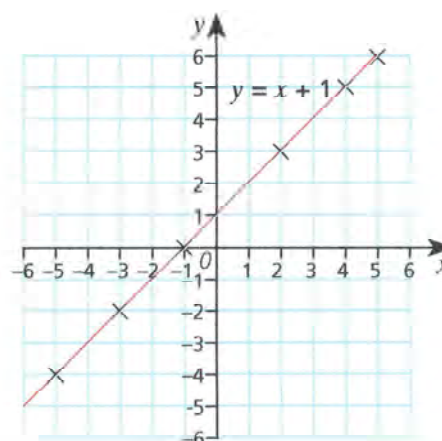
Look at each pair of coordinates. What do you need to do to the *x*-coordinate to get the *y*-coordinate in each pair?

$(-5, -4) (-3, -2) (-1, 0) (2, 3) (4, 5) (5, 6)$
 $-5 + 1 = -4$ $-3 + 1 = -2$ $-1 + 1 = 0$ $2 + 1 = 3$ $4 + 1 = 5$ $5 + 1 = 6$
 $x + 1 = y$

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.

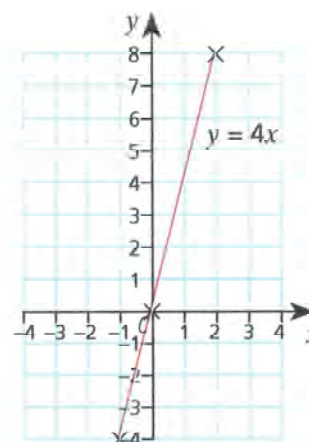
$(-5, -20) (-3, -12) (-1, -4) (0, 0) (2, 8) (4, 16) (6, 24)$

$(-5, -20) (-3, -12) (-1, -4) (0, 0) (2, 8) (4, 16) (6, 24)$
 $-5 \times 4 = -20$ $-3 \times 4 = -12$ $-1 \times 4 = -4$ $0 \times 4 = 0$ $2 \times 4 = 8$ $4 \times 4 = 16$ $6 \times 4 = 24$
 $x \times 4 = y$

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

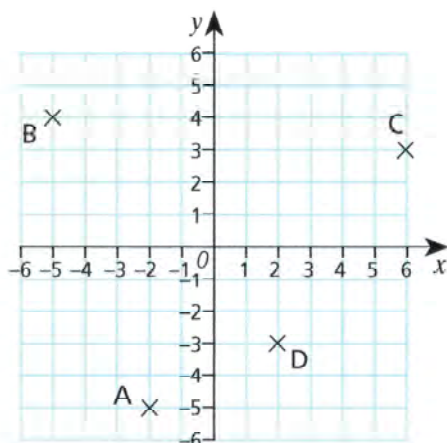
The relationship is $y = 4x$

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



Reading and plotting coordinates

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

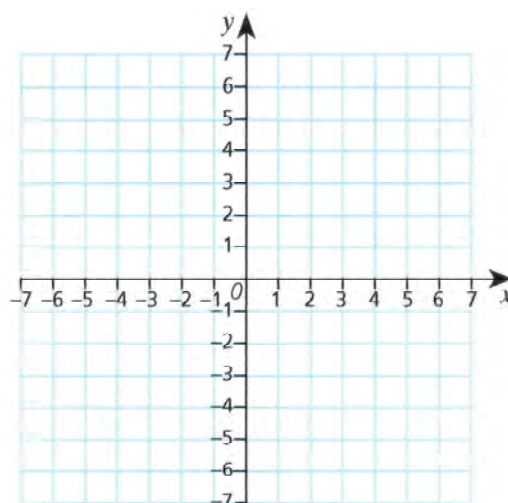


- A
 B
 C
 D

- 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.



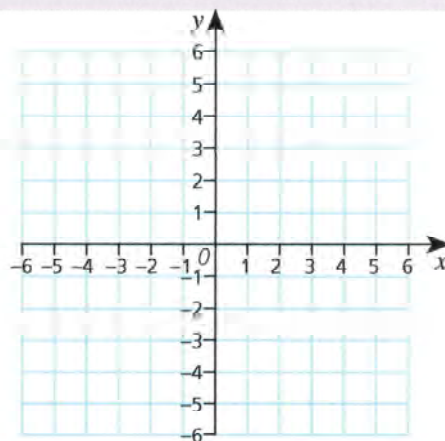
- ii) Name the shape you have drawn.

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:

$y = 3x$ $y = x + 3$ $y = -3x$ $y = x - 3$

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

Estimating calculations by rounding and limits of accuracy

Estimating calculations, including in real-life situations

Estimating is rounding **before** doing the calculation rather than after.

Imagine you are at an ice cream van and want to make sure you have enough cash for your order. Instead of adding up each item's exact price, you can round and estimate instead.



For two ice lollies, you could round each to £3, then $2 \times £3 = £6$. This is an **overestimate** – it is more than the actual price.

You will often need to estimate to the nearest power of 10 (e.g. 10, 100, or 1000), to 1 s.f., or to the nearest measurement.

$$\frac{(21.7 \times 11.5) + 9.8}{10.1} = ?$$

- a) Estimate the answer to the calculation by rounding each number to 1 s.f.

21.7 is 20 to 1 s.f. 11.5 is 10 to 1 s.f.
9.8 is 10 to 1 s.f. 10.1 is 10 to 1 s.f.

$$\frac{(21.7 \times 11.5) + 9.8}{10.1} \approx \frac{(20 \times 10) + 10}{10} \approx \frac{210}{10} = 21$$

- b) Calculate the actual answer.

$$\frac{(21.7 \times 11.5) + 9.8}{10.1} = 25.68 \text{ to 2 d.p.}$$

- c) Is the estimate an overestimate or an underestimate?

It is an underestimate as 21 is less than 25.68



- a) Kian wants to buy 3 apples, 2 bananas and 4 carrots. By rounding to the nearest 5p, estimate the total.

42p apple rounded to the nearest 5p is 40p.
14p banana rounded to the nearest 5p is 15p.
6p carrot rounded to the nearest 5p is 5p.

$$(40p \times 3) + (15p \times 2) + (5p \times 4) \\ = 120p + 30p + 20p = 170p = £1.70$$

- b) Find the actual total.

$$(42p \times 3) + (14p \times 2) + (6p \times 4) \\ = 126p + 28p + 24p = 178p = £1.78$$

- c) Is the estimate an overestimate or an underestimate?

It is an underestimate.

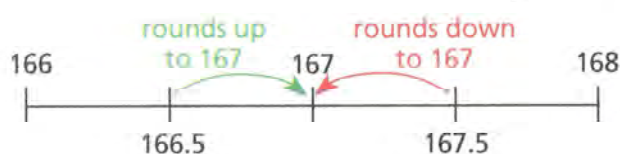
It is less than the actual value as the prices of the apples and carrots have been rounded down by more than the bananas have been rounded up.

Accuracy

Nothing can be measured exactly. It is measured to a certain degree of accuracy. Even if the degree of accuracy is very small, it is not an exact measurement.

The degree of accuracy can be inferred by the way the measurement is written. For example, a measurement of 167 cm was recorded to the nearest cm while a measurement of 1.2 cm was recorded to the nearest tenth of a cm, or mm.

A measurement can also be expressed using **error intervals** to show the possible values it could be. A table measured as 167 cm won't be **exactly** 167 cm.



Numbers greater than 166.5 round to 167.

166.5 also rounds to 167, so use an 'or equal to' symbol, $\leq$. This is the **lower bound**, i.e. 166.5 is the absolute smallest the actual measurement could be in order to be rounded to 167.

Numbers less than 167.5 also round to 167.

However, 167.5 itself rounds to 168, so use a strictly 'less than' symbol, $<$. This is the **upper bound**, as it means all numbers **up to** 167.5.

To write the bounds in error interval notation:

$$166.5 \text{ cm} \leq \text{length of table} < 167.5 \text{ cm}$$

A quick way to find the bounds is to divide the degree of accuracy by 2. Then subtract that from the measurement to find the lower bound and add it to the measurement to find the upper bound.

Estimating calculations by rounding and limits of accuracy

Estimating calculations, including in real-life situations

- 1 Estimate the answer to the calculation by rounding to the given amount. Before calculating, decide whether rounding will give an overestimate or an underestimate. Give your estimate as a fraction if appropriate.

$$108.3 \div 6.24 =$$

- a) i) Estimate the calculation by rounding to 1 significant figure.

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- ii) Will this be an overestimate or an underestimate?

.....

- b) i) Estimate the calculation by rounding to the nearest integer.

.....

- ii) Will this be an overestimate or an underestimate?

.....

- c) Use a calculator to find the actual value of the calculation.

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- 2 Sophia orders two lattes, one hot chocolate and three teas for her friends. The prices are shown.

☉	Latte	£3.97
♥	Hot chocolate	£2.95
☪	Tea	£3.17
COFFEE CORNER	Flavoured syrup...	£0.23

- a) i) Estimate the total cost of Sophia's order by rounding to the nearest integer.

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- ii) Will this be an overestimate or an underestimate?

.....

- b) Use a calculator to find the actual cost of her order.

.....

Accuracy

- 3 Write these measurements using error interval notation. Each is measured to the nearest unit.

- a) The height of a jug measured to be 32 cm

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- b) The volume of milk in a glass measured to be 107 ml

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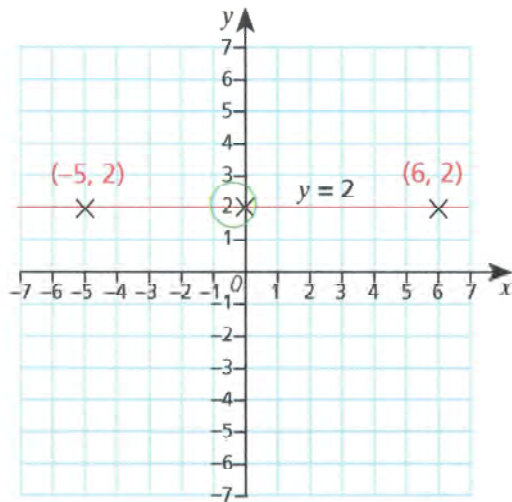
- c) The distance from London to Boston measured as 5264 km

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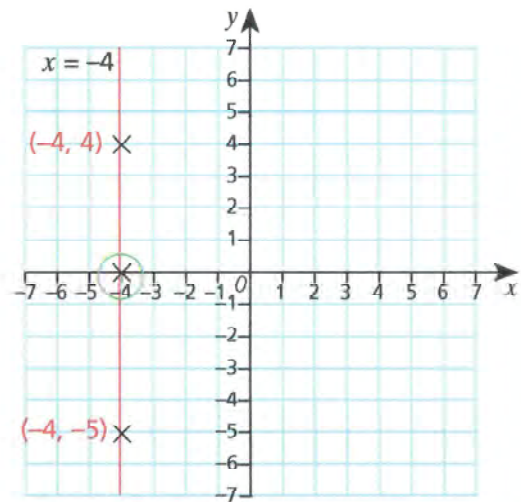
Graphing linear equations

Drawing graphs of equations like $y = 2$ and $x = -4$

On the line with equation $y = 2$, all the points have y -coordinate 2.



On the line with equation $x = -4$, all the points have x -coordinate -4 .



Drawing a graph from a table of values

To draw the graph of an equation:

- Make a table of values.

x	-4	-2	0	1	3
y					

- Substitute each x -value into the equation and work out the corresponding y -value.
- Plot the (x, y) pairs on a coordinate grid, and join them.

Draw the graph of $y = 2x - 3$ for values of x between -2 and 5 .

Make a table of values:

$y = 2x - 3$ x -values between -2 and 5

x	-2	-1	0	3	5
y	-7	-5	-3	3	7

When $x = -2$,
 $y = 2x - 3$
 $y = 2 \times -2 - 3$
 $y = -4 - 3$
 $y = -7$
 $(-2, -7)$

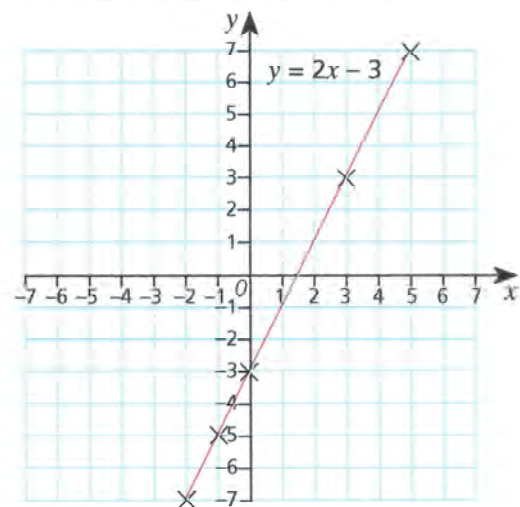
When $x = 0$,
 $y = 2x - 3$
 $y = 2 \times 0 - 3$
 $y = 0 - 3$
 $y = -3$
 $(0, -3)$

When $x = 5$,
 $y = 2x - 3$
 $y = 2 \times 5 - 3$
 $y = 10 - 3$
 $y = 7$
 $(5, 7)$

Plot the points on the coordinate grid.

Join them with a straight line.

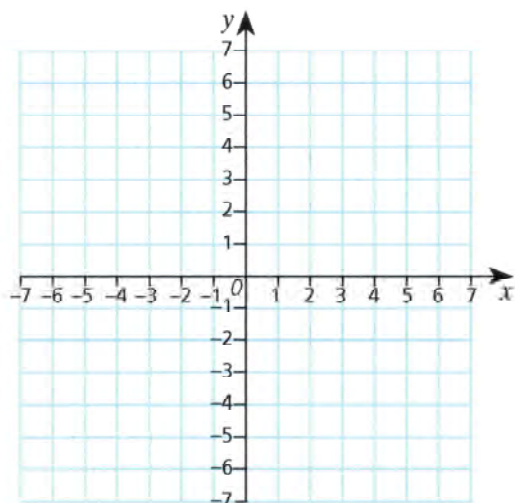
Label the graph with its equation.



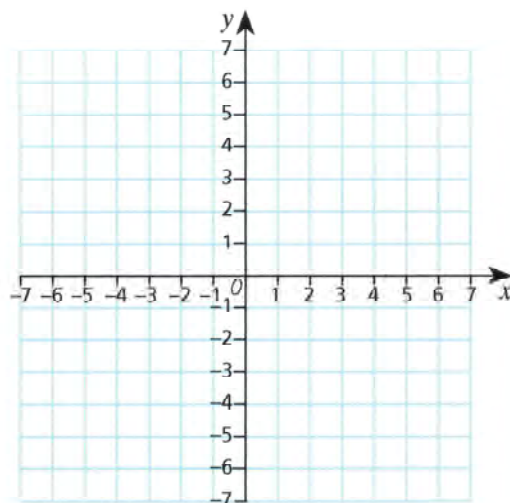
Graphing linear equations

Drawing graphs of equations like $y = 2$ and $x = -4$

- 1 Draw and label the graphs of $x = -5$, $x = 3$ and $x = 6$



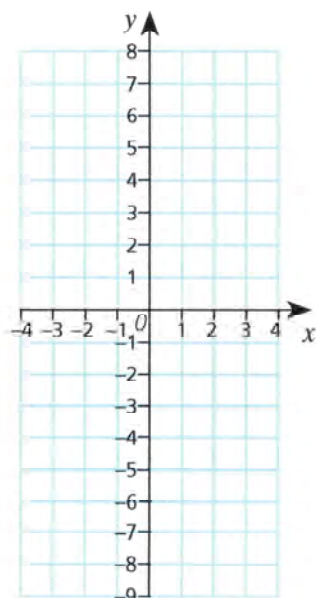
- 2 Draw and label the graphs of $y = -6$, $y = 1$ and $y = 3$



Drawing a graph from a table of values

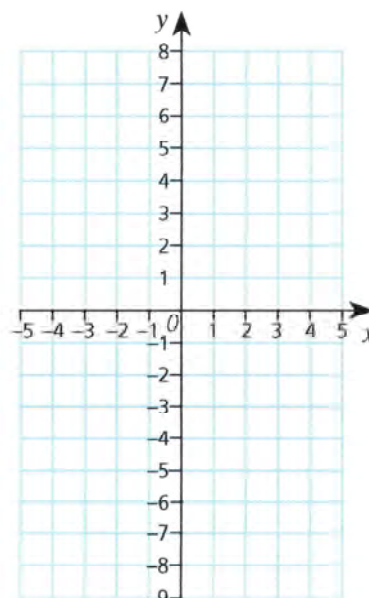
- 3 Draw the graph of $y = 3x + 1$ for values of x between -3 and 2 .

x	-3	-1	0	1	2
y	-8				



- 4 Draw the graph of $y = 2 - x$ for values of x between -4 and 4 .

x	-4				4
y					

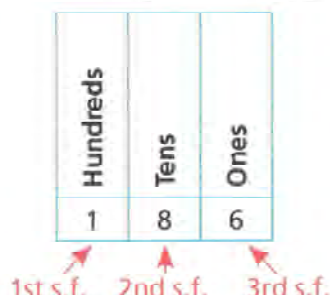


What are significant figures?

The most **significant figure** (s.f.) is the digit with the **highest place value** in a number.

Significant figures are counted left to right from the highest non-zero place value.

186 has 3 significant figures



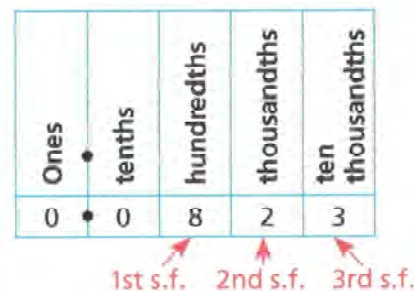
A zero in between two other digits is also significant.

307 has 3 significant figures



For numbers between 0 and 1, count significant figures from the first non-zero digit.

0.0823 has 3 significant figures

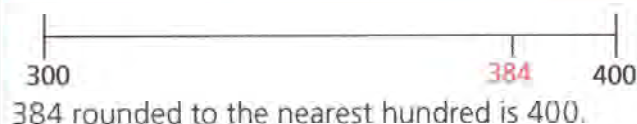


Rounding integers to significant figures

To round a number means to write an approximate value. A rounded number is less accurate, but often simpler to work with.

Round 384 to the nearest hundred.

Look at the hundreds values greater than and less than 384 and decide which value it is closer to.



Remember the rules of rounding. 'Round up' if the digit to the right of the desired place value is greater than or equal to 5.

Rounding to a given number of significant figures means rounding to a certain number of digits rather than to a certain place value or number of decimal places. To round a number to a given number of significant figures, count the number of digits from the highest place value and round to the place value of the desired digit.

a) Round 324 to 1 s.f.

Hundreds	Tens	Ones
3	2	4

The first significant figure is in the hundreds place, so rounding to 1 s.f. means to the nearest hundred.

324 rounded to 1 s.f. is 300

b) Round 4852 to 2 s.f.

Thousands	Hundreds	Tens	Ones
4	8	5	2

The second significant figure is in the hundreds place, so rounding to 2 s.f. means to the nearest hundred.

4852 rounded to 2 s.f. is 4900

c) Round 78 to 3 s.f.

Tens	Ones	tenths
7	8	0

The number 78 only has 2 significant figures. To write it to 3 s.f., fill in the third significant figure with a 0.

78 rounded to 3 s.f. is 78.0

Rounding decimal numbers to significant figures

Rounding numbers with decimals is the same as rounding integers. The exception is with numbers between 0 and 1, in which case the first significant figure is the first non-zero digit.

a) Round 0.00649 to 1 s.f.

The first significant figure is in the thousandths place, so rounding to 1 s.f. means to the nearest thousandth.

0.00649 to 1 s.f. is 0.006

b) Round 1.2093 to 3 s.f.

The third significant figure is in the hundredths place, so rounding to 3 s.f. means to the nearest hundredth.

1.2093 to 3 s.f. is 1.21

c) Round 0.5021 to 2 s.f.

The second significant figure is in the hundredths place, so rounding to 2 s.f. means to the nearest hundredth.

0.5021 to 2 s.f. is 0.50

0.5 would only be to 1 s.f.

Significant figures

What are significant figures?

- 1 Underline the digit that is the third significant figure in the following numbers.

68 124

9439

70 623

0.00573

0.9406

0.10904

Rounding integers to significant figures

- 2 Round these numbers to the given number of significant figures.

	1 s.f.	2 s.f.	3 s.f.
57 271			
843 913 759			
83			
1095			
165 878			
2 475 000			

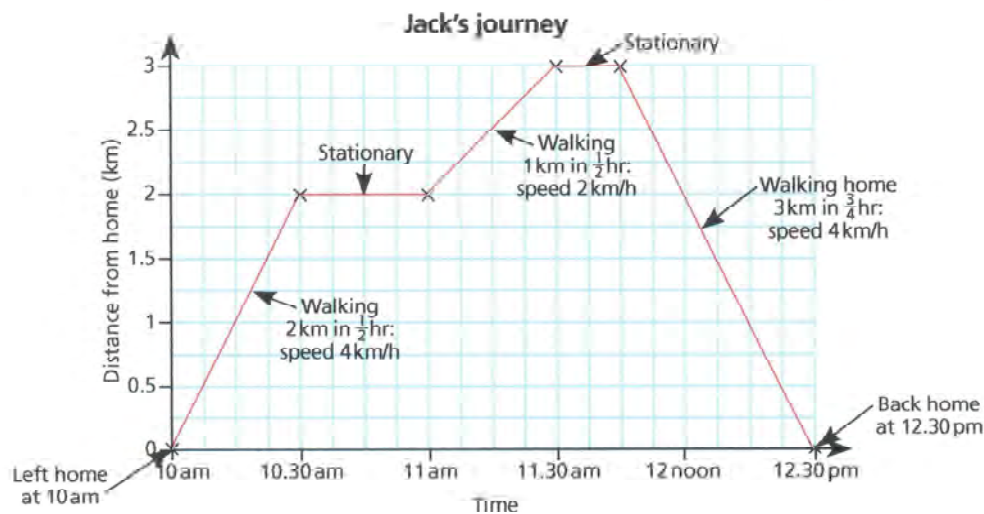
Rounding decimal numbers to significant figures

- 3 Round these numbers to the given number of significant figures.

	1 s.f.	2 s.f.	3 s.f.
0.23696			
0.059 218			
1.056			
0.008			
9.976			
52.601			

Return journeys

A distance-time graph shows time on the x -axis and distance travelled on the y -axis.



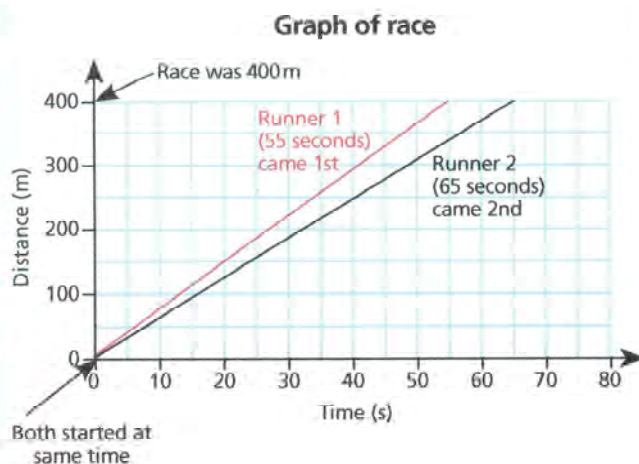
Make sure you understand what the gradient of the line on a distance-time graph represents:

- A **positive gradient** ($\nearrow$) shows that an object/person is **moving away from the starting point**.
- A **horizontal line** means that an object/person has **stopped** moving.
- A **negative gradient** ($\searrow$) shows that an object/person is **moving back towards the starting point**.

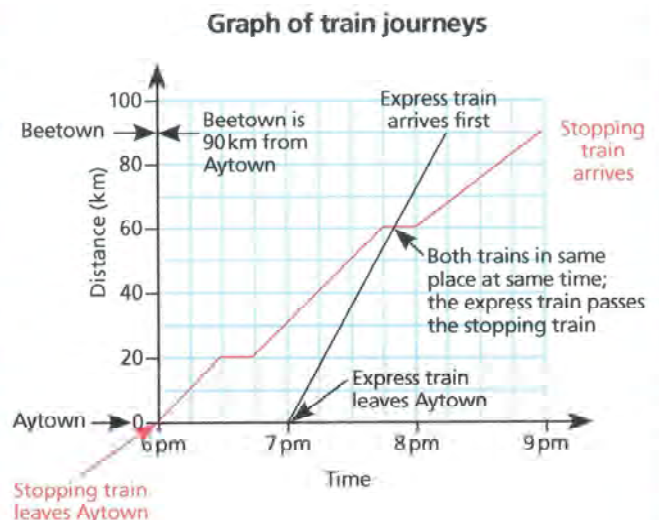
One-way journeys

The steeper the line, the faster the speed of travel.

Here is the distance-time graph for two runners in a race.



Here is the distance-time graph for two trains from Aytown to Beetown.

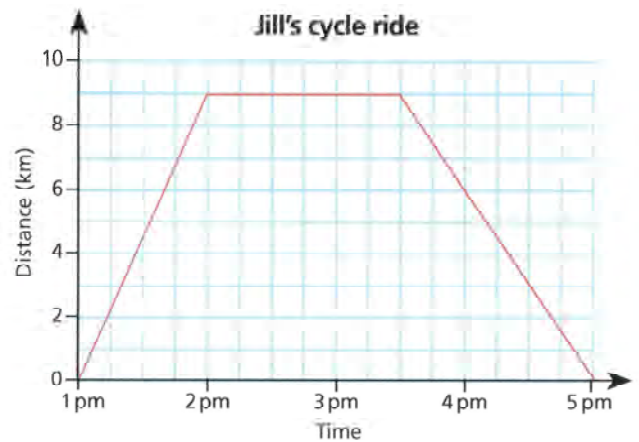


Distance-time graphs

Return journeys

- 1 The graph shows Jill's cycle ride from home to her friend's house, and back.

- What is the distance from Jill's house to her friend's house? _____
- How long does Jill stay at her friend's house? _____
- At what speed does Jill cycle on her way to her friend's house? _____
- How long is Jill away from home? _____
- When did Jill cycle fastest: on the way to her friend's or on the way home? Explain how you know. _____



- How far did Jill cycle in total? _____

One-way journeys

- 2 Amit leaves home at 9 am to drive to York. He drives 70 km in 1 hour. Then he stops for a break for 30 minutes. He then drives for another 120 km and arrives in York at 12 o'clock.

- Draw a distance-time graph to represent his journey.

Remember to give your graph a title.

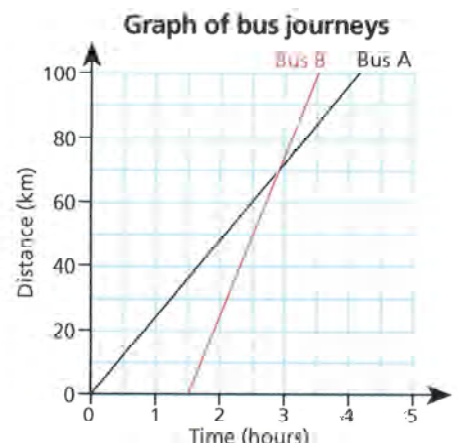
- When was Amit driving faster: before or after his break? _____

- How far is it from Amit's home to York? _____



- 3 The graph shows two bus journeys 100 km long.

- Which bus set off first? _____
- How much later did the second bus set off? _____
- How far had they each travelled when Bus B passed Bus A? _____
- Which bus arrived first at the destination? _____



Drawing a quadratic graph

The equation of a quadratic graph has an x^2 term and no higher power of x .

Draw the graph of $y = x^2 + 4$ for $-3 \leq x \leq 3$

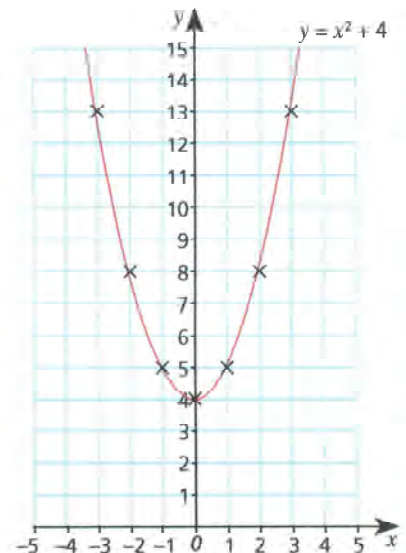
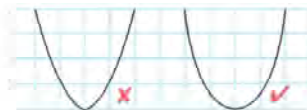
1. Make a table of values. Include the x -values given in the question.

$-3 \leq x \leq 3$

x	-3	-2	-1	0	1	2	3
x^2	9	4	1	0	1	4	9
$y = x^2 + 4$	13	8	5	4	5	8	13

Make a row for x^2

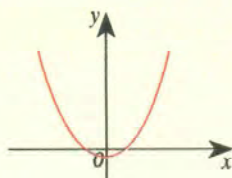
2. Plot the points.
3. Join them with a smooth curve; don't make the bottom of the curve pointed.



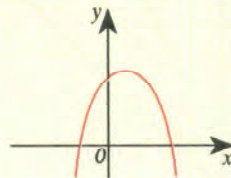
Recognising quadratic graphs

A quadratic graph is a U-shaped curve, called a **parabola**.

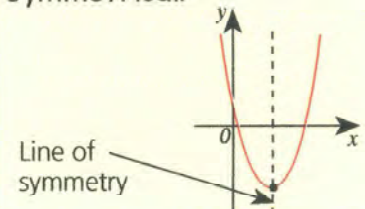
Quadratic graph with a positive x^2 term



Quadratic graph with a negative x^2 term



A quadratic graph is symmetrical.



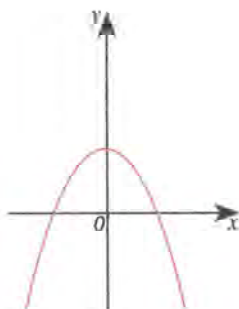
Match each graph below to one of these equations:

$y = x^3$

$y = -x^2 + 2$

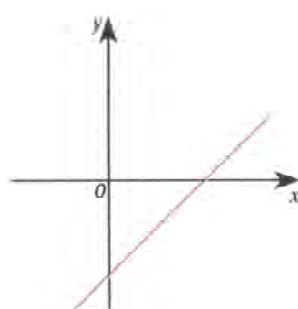
$y = x^2 - 3$

$y = x - 3$



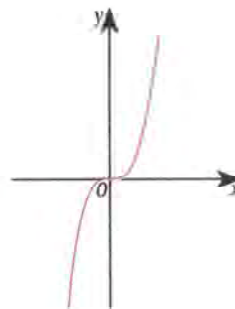
'Upside down' U-shaped curve – the graph is quadratic with a negative x^2 term.

$y = -x^2 + 2$



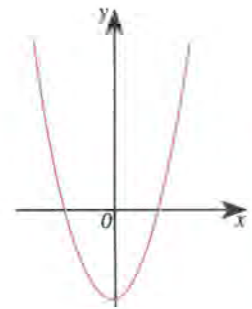
A linear graph has an equation of the form $y = mx + c$

$y = x - 3$



First identify the graphs that you can. This one has the equation that is left over.

$y = x^3$



U-shaped curve – the graph is quadratic with a positive x^2 term.

$y = x^2 - 3$

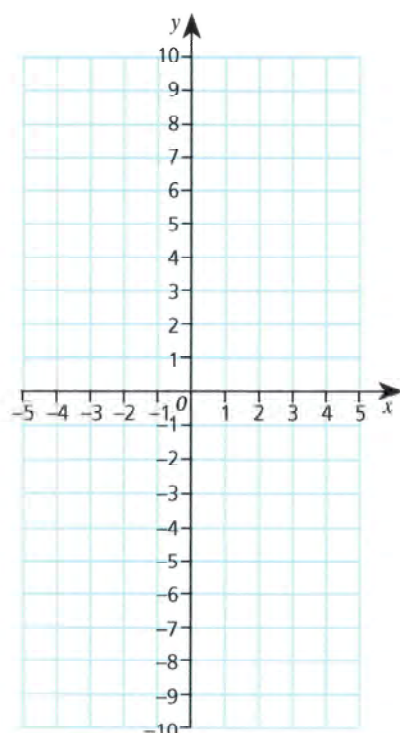
Quadratic graphs

Drawing a quadratic graph

1 Draw the graphs of the following for $-3 \leq x \leq 3$:

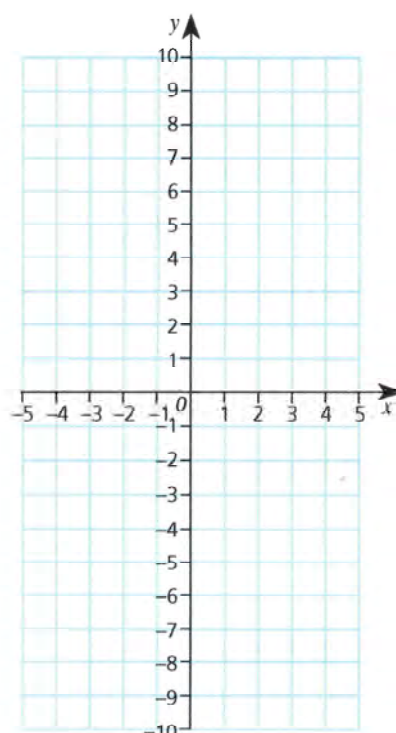
a) $y = -x^2$

x	-3			0			
x^2	9						
$y = -x^2$	-9						



b) $y = x^2 + 1$

x	-3			0			
x^2	9						
$y = x^2 + 1$	10						



Recognising quadratic graphs

2 Match each graph to its equation.

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

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

$$y = -2x - 1$$

$$y = x^2 + 2$$

