Standard form

Standard form is used to write very large and very small numbers.

$5{\cdot}36 \times 10^{4}$

Means move the decimal point 4 places to the right

$53600 = 53\,600$

$8{\cdot}31 \times 10^{-3}$

Means move the decimal point 3 places to the left

$00831 = 0{\cdot}00831$

In standard form a number is written in the form
$a \times 10^{b}$
Where a is a number between 1 and 10 and b is an appropriate power of 10

Using a calculator with numbers in standard form

Use the EXP or EE key

Example $3{\cdot}82 \times 10^{4} \times 4{\cdot}26 \times 10^{6}$

Calculator keys:

3 · 8 2 EXP 4 x

4 · 2 6 EXP 6 =

The calculator display shows
$1{\cdot}62732\ ^{11}$
This means $1{\cdot}62732 \times 10^{11}$

Questions

1 Write 8.4×10^{3} as an ordinary number

2 Write 3.24×10^{-2} as an ordinary number

3 Write 3820 in standard form

4 Write 0.00236 in standard form

5 $7{\cdot}3 \times 10^{8} \div 6{\cdot}4 \times 10^{-7}$

Answers

1 $8400 = 8400$

2 $00324 = 0{\cdot}0324$

3 Note: In standard form the decimal point is always after the first whole number.

3820 The decimal point has moved 3 places to the left.
We write the number in standard form as $3{\cdot}82 \times 10^{3}$

4 $0{\cdot}00236$ The decimal point has moved 3 places to the right.
We write the number in standard form as $2{\cdot}36 \times 10^{-3}$

5 7 · 3 EXP 8 ÷ 6 · 4 EXP 7 +/− = Answer $1{\cdot}140625 \times 10^{15}$

Common error:
Do not put x 1 0 into your calculator. EXP does this.

Another common error is to write $1{\cdot}140625^{15}$.
This will lose marks. You must write $1{\cdot}140625 \times 10^{15}$

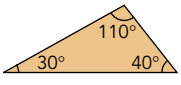
Similarity

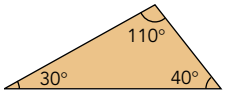
This usually appears on the exam paper. Just recognise the shapes, put them the same way round, then find the scale factor (ie the relationship between the sizes of the shapes).

Similarity

An easy method is shown below.

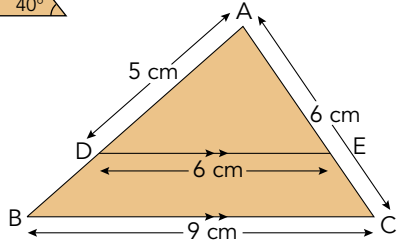
Two triangles are similar if the angles of one triangle are equal to the angles of the other triangle, eg:





Question

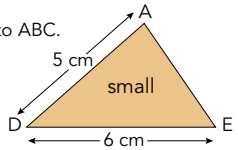
Find the length of AB and AE.

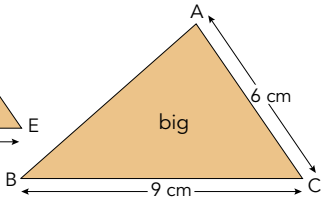


Answer

DE is parallel to BC. Therefore ADE is similar to ABC.

1 Draw the two triangles separately.





2 Identify the big triangle and the small triangle.

3 Find two sides with lengths given which are in the same position on each triangle. In this example DE and BC.
DE = 6 cm, BC = 9 cm

4 The scale factor (SF) from small to big is $\frac{9}{6}$ ie $\frac{\text{big}}{\text{small}}$.
To convert any length on the small triangle to a length on the large triangle, multiply by SF $\frac{9}{6}$.
eg AD (small triangle) x SF $\frac{9}{6}$ = AB
5 cm x $\frac{9}{6}$ = 7.5 cm

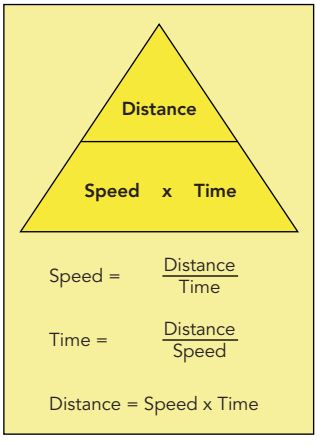
5 The scale factor from big to small is $\frac{6}{9}$ ie $\frac{\text{small}}{\text{big}}$.
To convert any length on the large triangle to a length on the small triangle, multiply by SF $\frac{6}{9}$.
eg AC (large triangle) x SF $\frac{6}{9}$ = AE
6 cm x $\frac{6}{9}$ = 4 cm

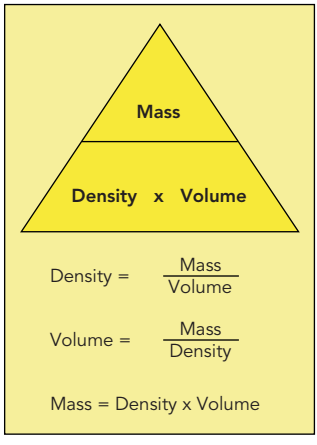
Congruency: If two shapes are congruent then they are identical. The angles of one shape are equal to the angles of the other shape **and** the sides of one shape are equal to the sides of the other shape.

Compound measures

Speed and density are compound measures because we give the speed in m/s or km/h, ie two units. If mass is given in kg and volume in m^3, the density will be given in kg/m^3.

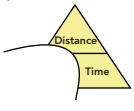
The following formulae must be memorised:





You may have used these formulae in Science.

Suppose you want to know what speed equals. Cover up speed. This shows:



Therefore Speed = $\frac{\text{Distance}}{\text{Time}}$

You will use this method in trigonometry (that is sin, cos, tan) on page 68.

Questions

1 A car takes 8 hours 10 minutes to travel 343 kilometres. Calculate the average speed.

2 A man walks at a speed of 24 metres in 10 seconds. Calculate his speed in kilometres per hour.

3 Mass is given in g, volume is given in cm^3. What units are used for density?

Answers

1 Decide if you require the answer in kilometres per hour or kilometres per minute.
If you choose kilometres per hour change 8 hours 10 minutes into hours.
10 minutes is $^{10}/_{60}$ of an hour.
Therefore 8 hours 10 minutes = $8^{10}/_{60}$ hours.
Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{343}{8^{10}/_{60}}$ = 42 kilometres per hour.

2 24 metres in 10 seconds

(multiply by 6)	144 metres in 1 minute
(multiply by 60)	8640 metres in 60 minutes (ie 1 hour)
(divide by 1000)	8.64 kilometres in 1 hour
	The speed is 8.64 kilometres per hour.

3 g/cm^3

Probability (and, or)

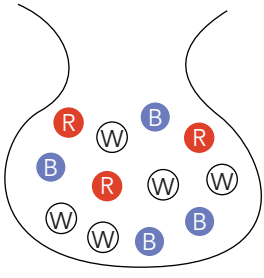
This page shows ways to calculate probablility.

A bag contains three red sweets, four blue sweets and five white sweets. A boy is blindfolded. He chooses a sweet. What is the probability he chooses:

a A red sweet

b A blue sweet

c A red sweet or a blue sweet?



Method

a $\frac{3}{12}$ ← There are three red sweets in the bag
← There are twelve sweets in the bag

b $\frac{4}{12}$ ← There are four blue sweets in the bag
← There are twelve sweets in the bag

c If a question states 'or' we must add

Probablilty of a red sweet or Probability of a blue sweet

$\frac{3}{12}$ + $\frac{4}{12}$

(use the fraction key $a\frac{b}{c}$ to add the fractions)

3 $a\frac{b}{c}$ 1 2 + 4 $a\frac{b}{c}$ 1 2 =

Answer $\frac{7}{12}$

Questions

1 What is the probability of choosing a white sweet?

2 What is the probability of choosing a red sweet or a white sweet?

Answers

1 $\frac{5}{12}$ ← There are five white sweets in the bag
← There are twelve sweets in the bag

2 Probability of a red sweet or Probability of a white sweet

$\frac{3}{12}$ + $\frac{5}{12}$

Calculator keys:
3 $a\frac{b}{c}$ 1 2 + 5 $a\frac{b}{c}$ 1 2 =

Answer $\frac{2}{3}$

82 Using cumulative frequency diagrams to compare distributions

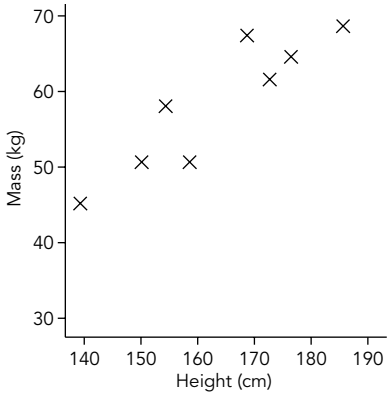
This table shows the heights of 100 boys aged 15 at Downland School:

Height (cm)	Frequency
150 to 160	17
160 to 170	21
170 to 180	23
180 to 190	18
190 to 200	21

Draw a cumulative frequency diagram to show this information. Use the median and interquartile range to compare the boys at Downland School with the boys at Upton School in the previous question.

83, 84 Scatter diagrams

This scatter diagram shows the height and mass of eight girls aged 15:



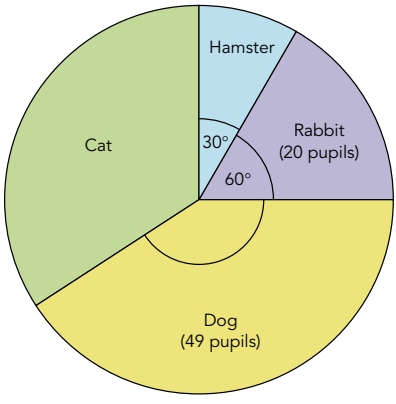
1 Describe the relationship shown by this graph.

2 Draw a line of best fit.

3 Use your line of best fit to estimate the mass of another 15 year old girl who is 170 cm tall.

85 Understanding pie charts

This pie chart shows the favourite pets of Year 11 pupils.



1 How many pupils are in Year 11?

2 How many pupils chose "hamster"?

3 What is the angle for "dog"?

4 How many pupils chose "cat"?

5 What is the angle for "cat"?

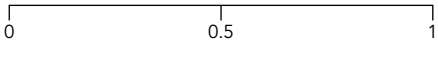
86 Drawing pie charts

Show this information in a pie chart:

Favourite sport	Number of pupils
Swimming	7
Fishing	12
Tennis	12
Football	9

87 The probability scale

Show the probability of the following events on the probability scale:



1 Shaking a six on a die. Mark with an A.

2 Shaking an even number. Mark with a B.

3 Shaking a number greater than 7. Mark with a C.