Numeracy Across the Curriculum

ART & DESIGN

Symmetry

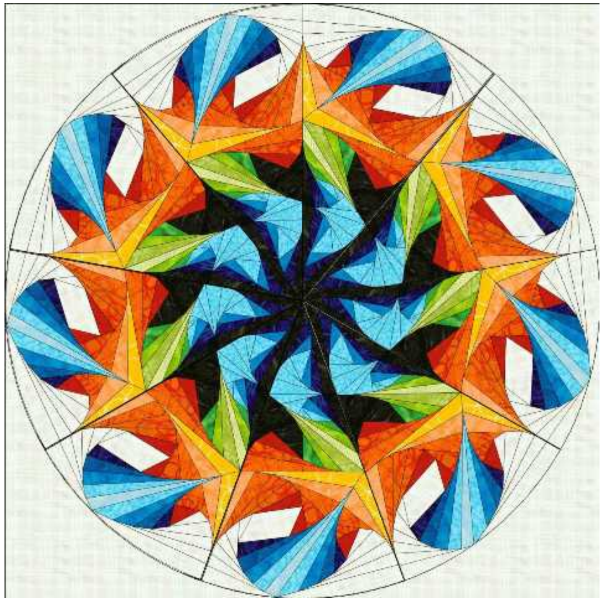
A **line of symmetry** is a line which divides a picture into two parts, each of which is the mirror image of the other. Pictures may have more than one line of symmetry.

ART & DESIGN

Symmetry

The number of positions a figure can be rotated to, without bringing in any changes to the way it looks originally, is called its **order of rotational symmetry**.

Rotational Symmetry Order 3



Rotational Symmetry Order 9

Rotational Symmetry Order 4

Numeracy Across the Curriculum

ART & DESIGN

Ratio

A ratio tells you how much you have of one part compared to another part.
It is useful if you are trying to mix paints accurately and consistently.

<u>An example</u>

You can make different colours of paint by mixing red, blue and yellow in different proportions.

For example, you can make green by mixing 1 part blue to 1 part yellow.

To make purple, you mix 3 parts red to 7 parts blue.

How much of each colour do you need to make 20 litres of purple paint?

.... litres of red and .... litres of blue

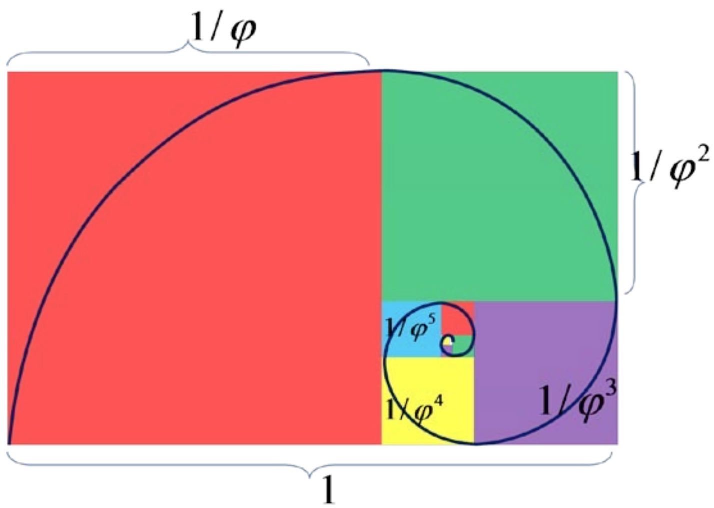
ART & DESIGN

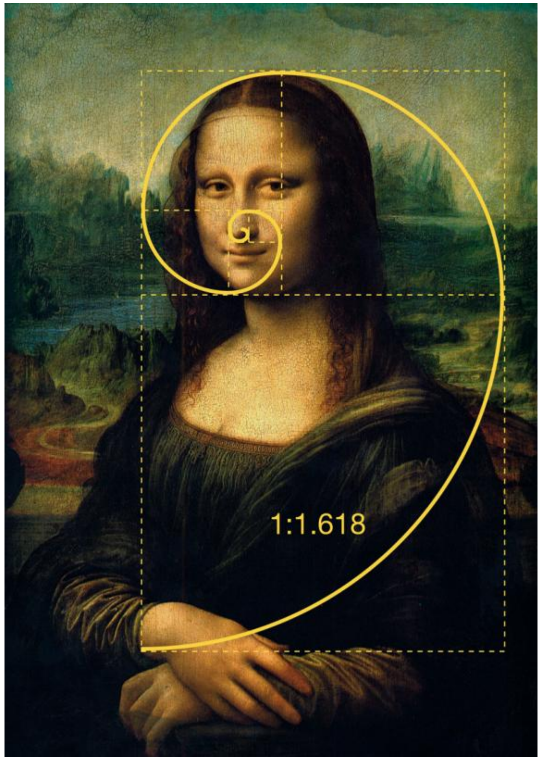
Ratio

Many artists and architects have proportioned their works to approximate the **Golden Ratio** believing this proportion to be aesthetically pleasing. This is sometimes given in the form of the **Golden Rectangle** in which the ratio of the longer side to the shorter side is the golden ratio.

The golden ratio is given by the Greek letter phi (φ) where:

$$\varphi = \frac{1 + \sqrt{5}}{2} = 1.6180339887...$$

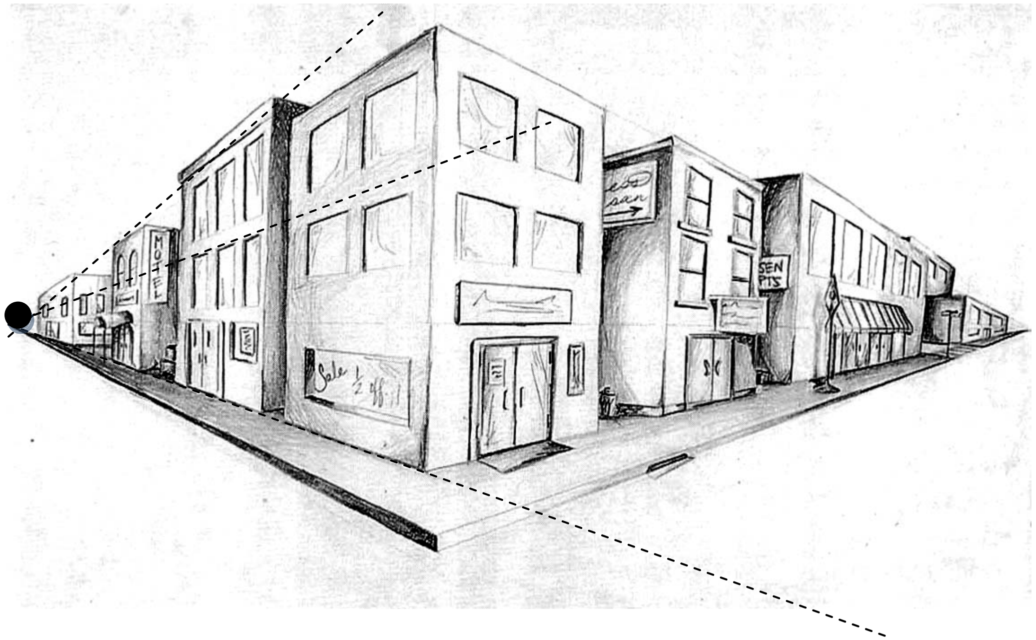


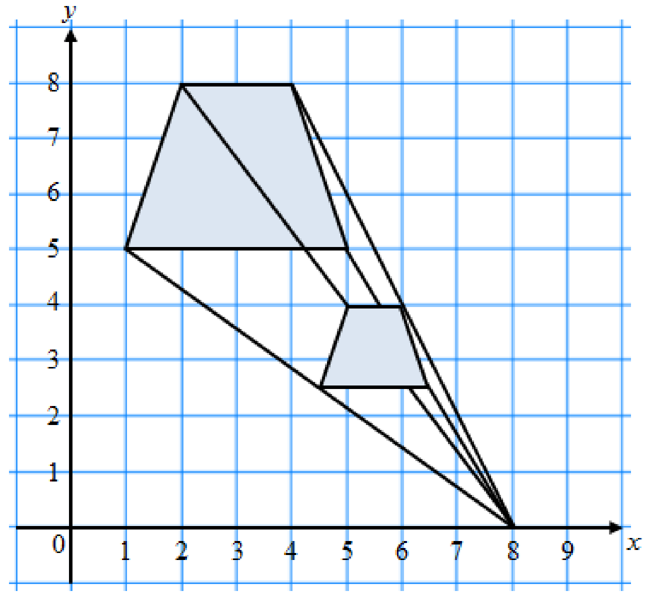


Numeracy Across the Curriculum

ART & DESIGN

Perspective, Enlargement and Scale Factor





Perspective in art and design is an approximate representation, on a flat surface, of an image as it is seen by the eye.

Lines radiating from a vanishing point are used to draw in detail on the picture.

In maths we use a centre of englargement [(8,0) in this case] and a scale factor [2 in this case] to carry out englargements.

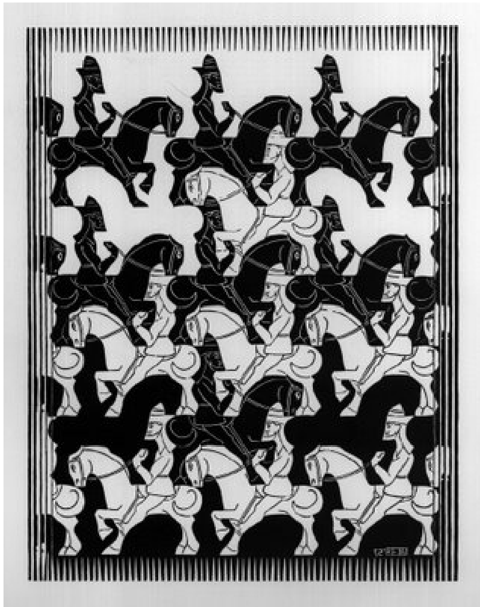
Can you see the similarities and differences in the processes involved?

ART & DESIGN

Tessellations

Tessellation is the process of creating a two-dimensional plane using the repetition of a geometric shape with no overlaps and no gaps.

Escher was famous for creating detailed drawings using different tessellations.



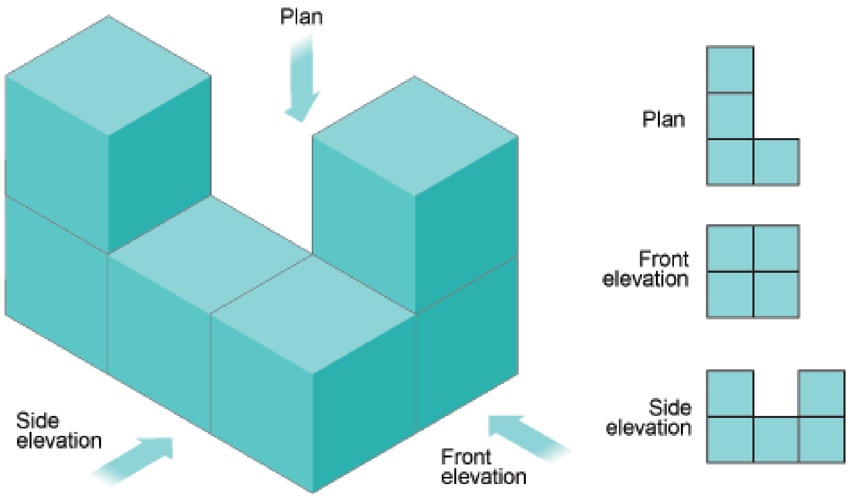
ART & DESIGN

Cubism

George Braque

Violin and Candlestick

1910



Cubism is an early-20th-century avant-garde art movement. In Cubist artwork, objects are analysed, broken up and reassembled in an abstracted form—instead of depicting objects from one viewpoint, the artist depicts the subject from a multitude of viewpoints to represent the subject in a greater context.

In Maths we also draw objects from different viewpoints using plans, elevations or isometric drawing. These are often compared on the same page in order to give a full understanding of what the 3D shape looks like.

How do these mathematical techniques compare with the artistic ones used in Cubism?

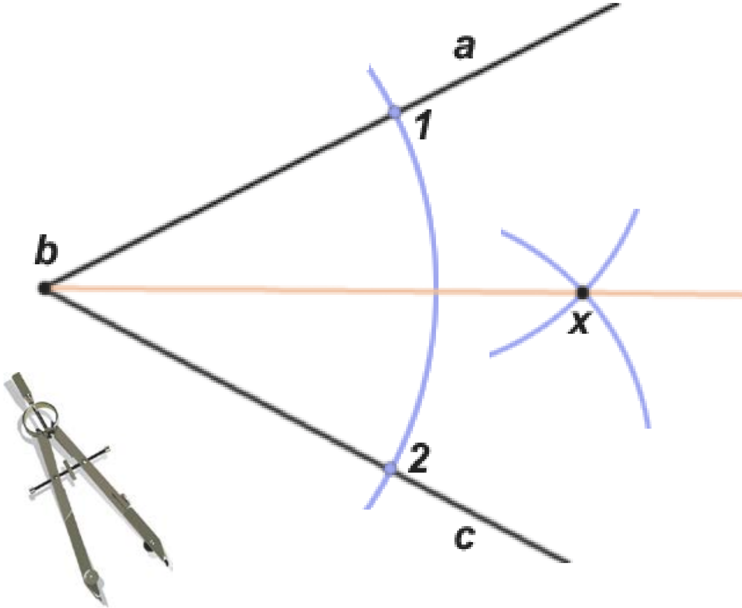
Numeracy Across the Curriculum

ART & DESIGN

Constructions

Construction methods in art are organised techniques, systems, logical practices, planning and design in the creation of structure.

There is also a branch of art called Constructivism that originated in Russia in 1919 and saw art as a practice for social purposes.



In geometry **constructions** refer to the drawing of various shapes using only a compass and straightedge.

No measurement of lengths or angles is allowed.

Typical **constructions** include drawing the perpendicular bisector of a line, creating a 60° angle and bisecting an angle (see diagram above). Could you use geometrical constructions in art lessons to support your designs? What would be the advantages and disadvantages of doing this?

Numeracy Across the Curriculum

ENGLISH

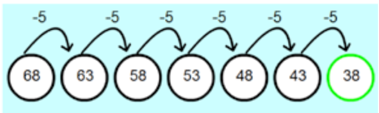
Using mathematical vocabulary correctly

It is important to make sure you can **spell** mathematical words and use them in the correct context.

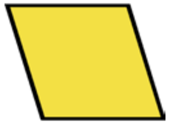
Here are some of the mathematical words that people often spell incorrectly.

Addition

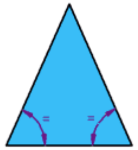
Sequence



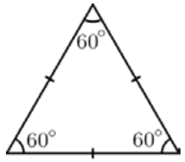
Parallelogram



Isosceles triangle



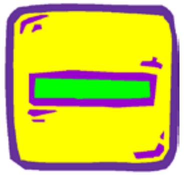
Equilateral triangle



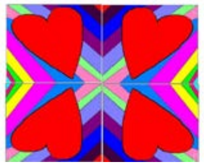
Probability

Trapezium

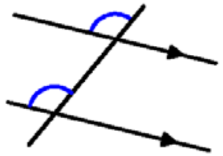
Negative



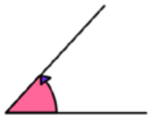
Symmetry



Corresponding angles



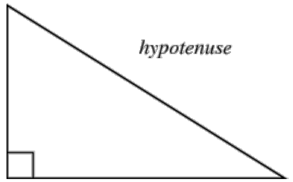
Angle



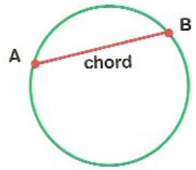
Circumference

Function

Hypotenuse



Chord

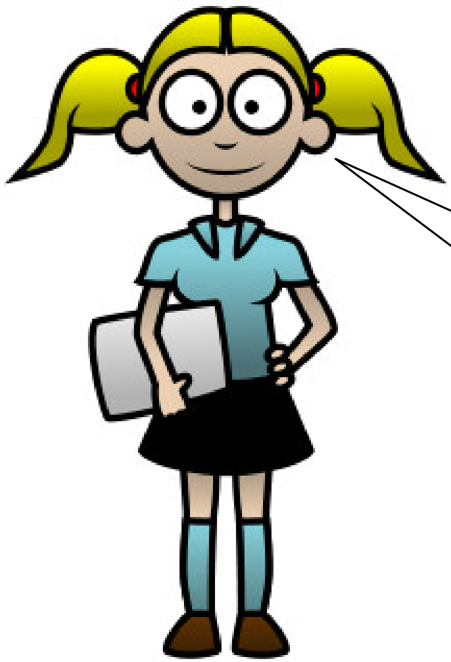


ENGLISH

Explaining and Justifying Methods and Conclusions

It is important to be able to explain your mathematical thinking to others. This not only helps others understand how you have worked things out, but improves your understanding of what you have done. Look at the example below. The highlighted words are good ones to use in mathematical arguments.

Find the value of the expression $\frac{2y+8}{2}$ when y = 7



If y is equal to 7, **then** 2y must be equal to 14. This is **because** 2y **means** 2 multiplied by y and 2 multiplied by 7 is 14. **Therefore** 2y plus 8 will equal 14 plus 8 which is 22. **It follows that** 2y plus 8 divided by 2 will therefore be 11, since 22 divided by 2 is 11.

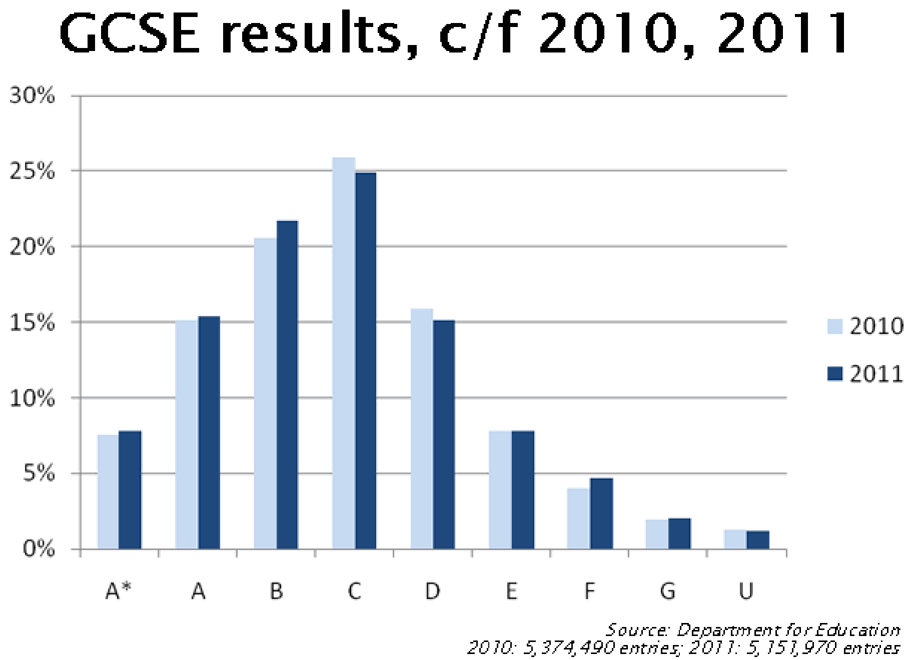
ENGLISH

Interpreting and Discussing Results

An important branch of mathematics is statistics, which involves the collection, presentation and evaluation of data. You can use your skills in English to clearly interpret and discuss results you get from collecting data in your maths lessons.

This graph compares the percentage of students achieving different GCSE grades in 2010 with those in 2011.

The **modal** grade for both years was a grade C. In 2011 there was an **increase** in the percentage of students achieving grades A*, A and B and a **decrease** in the percentage of students achieving a Grade C or D.

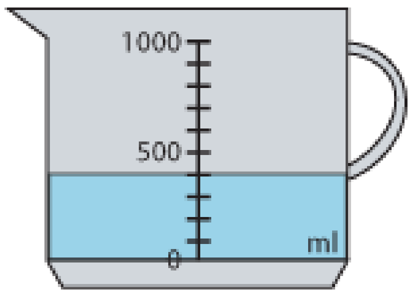


Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (FOOD)

Reading Scales

You need to work out how much each division is worth when reading scales.



There are 5 divisions between 0 and 500

Each division is worth

500 ÷ 5 = 100

So the scale reads 400 ml

Using the outside scale (g)…

There are 10 divisions between 0 and 50

Each division is worth

50 ÷ 10 = 5

So the scale reads 70g

Using the inside scale (oz)…

There are 4 divisions between 0 and 1

Each division is worth

1 ÷ 4 = 0.25

So the scale reads 2.5oz

Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (FOOD)

Proportion

You use proportion with recipes in order to work out how much of each ingredient you need to serve a different number of people from the number given in the recipe.

<u>Flapjacks</u>

(Serves: 10)

120g butter

100g dark brown soft sugar

4 tablespoons golden syrup

250g rolled oats

40g sultanas or raisins

How much of each ingredient would you need to serve 25 people?

First work out how much you need to serve 1 person, then multiply it by 25

This recipe is for 10 people.

To find out how much of each ingredient you need for one person, just divide by 10.

For 25 people:

Butter = 120 ÷ 10 x 25

= 300g

Sugar = 100 ÷ 10 x 25

= 250g

Syrup = 4 ÷ 10 x 25

= 10 tablespoons

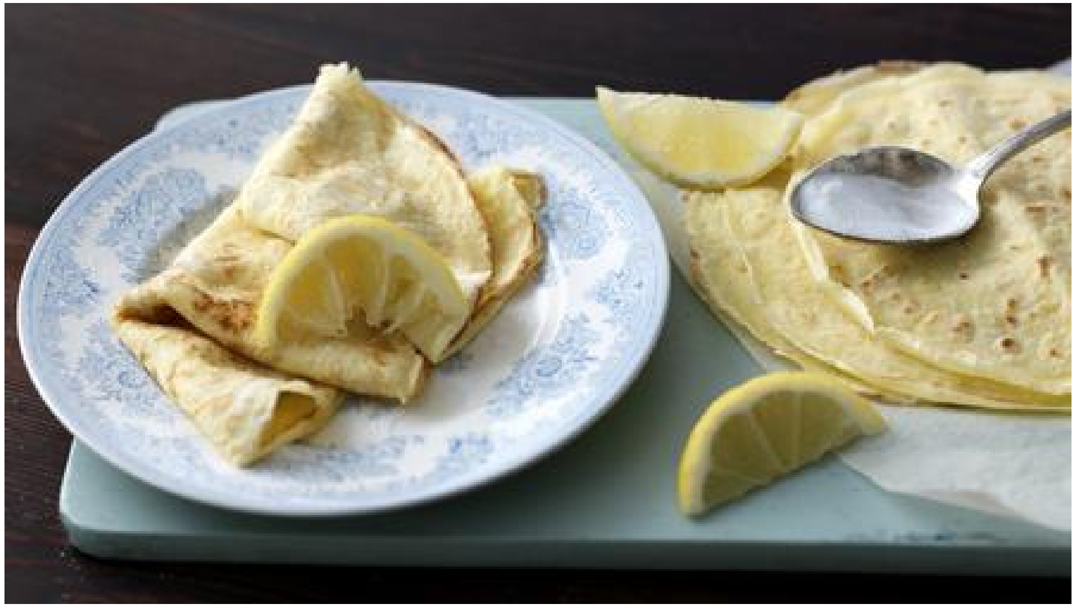
Oats = 250 ÷ 10 x 25

= 625g etc.

DESIGN & TECHNOLOGY (FOOD)

Ratio

Sometimes recipes are given in the form of ratios. This allows you to make as much or as little as you want, as long as the ingredients stay in the same ratio to one another.



Pancakes

For every 100g flour, use 2 eggs and 300ml milk

The ratio of flour (g) to eggs to milk (ml) is

100 : 2 : 300

So to make double the quantity of pancakes, we just double the amount of each ingredient

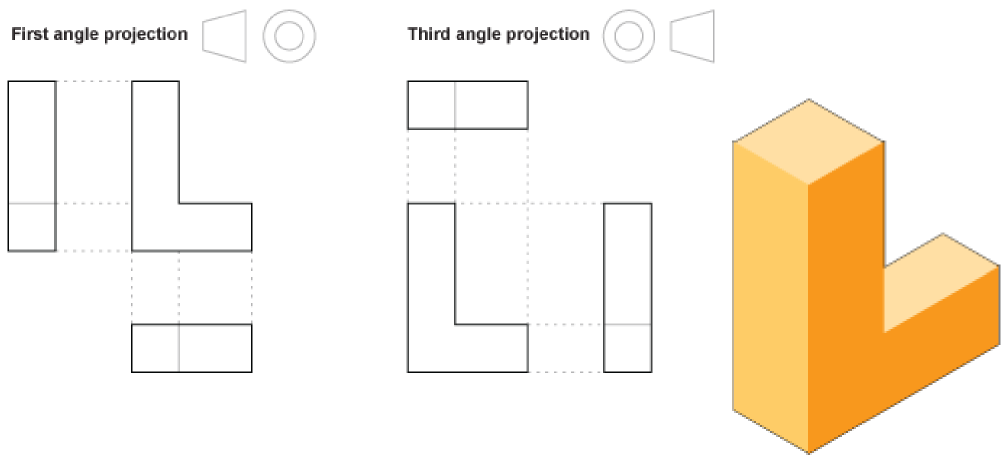
200 : 4 : 600

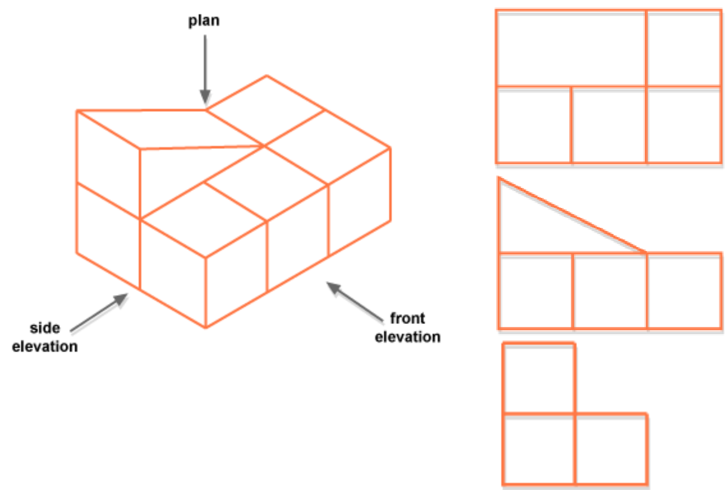
That's 200g flour, 4 eggs and 600ml of milk

DESIGN & TECHNOLOGY (RESISTANT MATERIALS)

Technical drawings of 3D designs

Technical drawing is an important skill in Design and Technology. Your working drawings should include all the details needed to make your design. In mathematics you will also need to produce accurate drawings which show the exact details of 3D shapes using 2D diagrams.





Plan view

Front elevation

Side elevation

In D&T, orthographic projection is used to show a 3D object using a front view, a side view and a plan. Orthographic projection may be done using **first angle projection** or **third angle projection**.

In maths we use the same method to show 3D shapes – the views are described as **plan view**, **front elevation** and **side elevation**. An arrow on the 3D image shows which direction is the front.

Numeracy Across the Curriculum

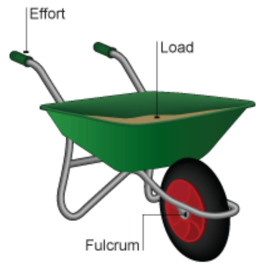
DESIGN & TECHNOLOGY (SYSTEMS AND CONTROL)

Ratio

Ratio is how much you have of one thing compared to another.

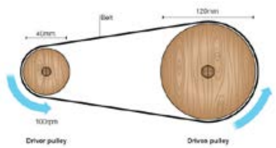
For levers

Velocity ratio = $\dfrac{\text{distance moved by effort}}{\text{distance moved by load}}$



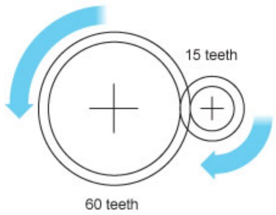
For pulley systems

Velocity ratio = $\dfrac{\text{diameter of driven pulley}}{\text{diameter of driver pulley}}$



For gears

Gear ratio = $\dfrac{\text{number of teeth on driven gear}}{\text{number of teeth on driver gear}}$



In **D&T** the main ratios you use are the **velocity ratio** in levers and pulley systems and the **gear ratio** when using gears. When you use ratios in D&T they are normally in the form of a calculation involving division.

In **maths** we also use ratios to compare quantities.

If there are 15 screws and 12 bolts in a bag, we would say that the **ratio of** screws **to** bolts is

15 : 12

which can be **simplified** to

<u>5 : 4</u>

We also use ratios to share amounts. For example, share a mass of 500 kg in the ratio 2 : 3.

Total number of parts = 2 + 3 = 5

200 ÷ 5 = 40

2 x 40 = 80 and 3 x 40 = 120

<u>80 kg : 120 kg</u>

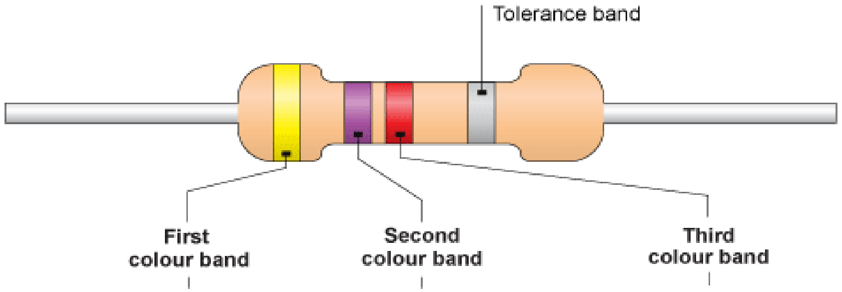
Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (ELECTRONICS)

Percentages

Percentages are used in many aspects of our daily lives.

One example in D&T when you may come across them is when dealing with resistors.



First colour band	
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

Second colour band	
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

Third colour band
Silver multiply by 0.01
Gold multiply by 0.1
Black multiply by 1
Brown multiply by 10
Red multiply by 100
Orange multiply by 1,000
Yellow multiply by 10,000
Green multiply by 100,000
Blue multiply by 1,000,000

The first three bands on a resistor tell you the resistance.

In this case yellow then violet then red means

Resistance = 4 7 x 100 = 4700 ohms = 4.7 kilo-ohms

The fourth band tells you the tolerance i.e. what accuracy the resistance can be guaranteed to. A red band denotes a tolerance of 2%, gold a tolerance of 5% and silver a tolerance of 10%.

In this case the silver band denotes a tolerance of 10%, this means the actual resistance could be 10% higher or lower than the value given.

To find 10% of a number we divide by 100 (to find 1%) and then multiply by 10.

$4.7 \div 100 \times 10 = 0.47$

So the possible range of the resistance is,

$4.7 - 0.47\ k\Omega \leq \text{resistance} \leq 4.7 + 0.47\ k\Omega$

$4.23\ k\Omega \leq \text{resistance} \leq 5.17\ k\Omega$

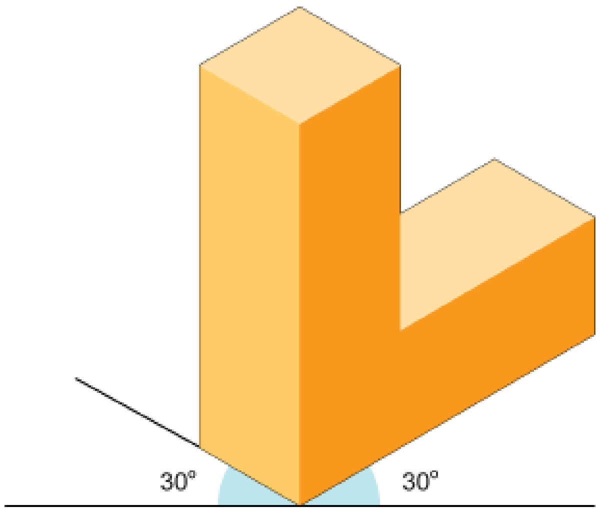
DESIGN & TECHNOLOGY (GRAPHICS)

Isometric Drawings

In **D&T** a representation of a 3D solid on a 2D surface is called a projection.

Isometric projection uses vertical lines and lines drawn at 30° to horizontal.

Dimensions are shown accurately and in the correct proportion. Isometric projection distorts shapes to keep all upright lines vertical.



In **maths** isometric drawings are also used to represent 3D shapes on a 2D surface.

Isometric drawings are drawn on **isometric paper** which uses dots to indicate where lines should go. Upright lines are always drawn vertically, as they are in D&T, with other lines drawn using the diagonal lines between dots.

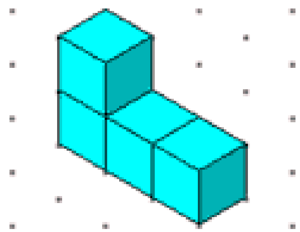


Figure 1

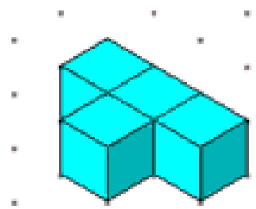


Figure 2

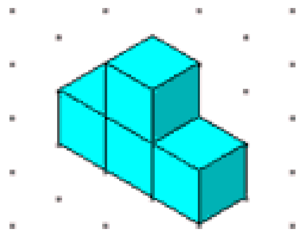


Figure 3

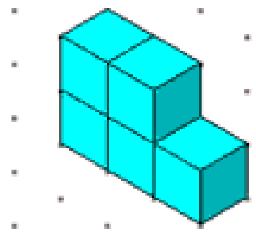
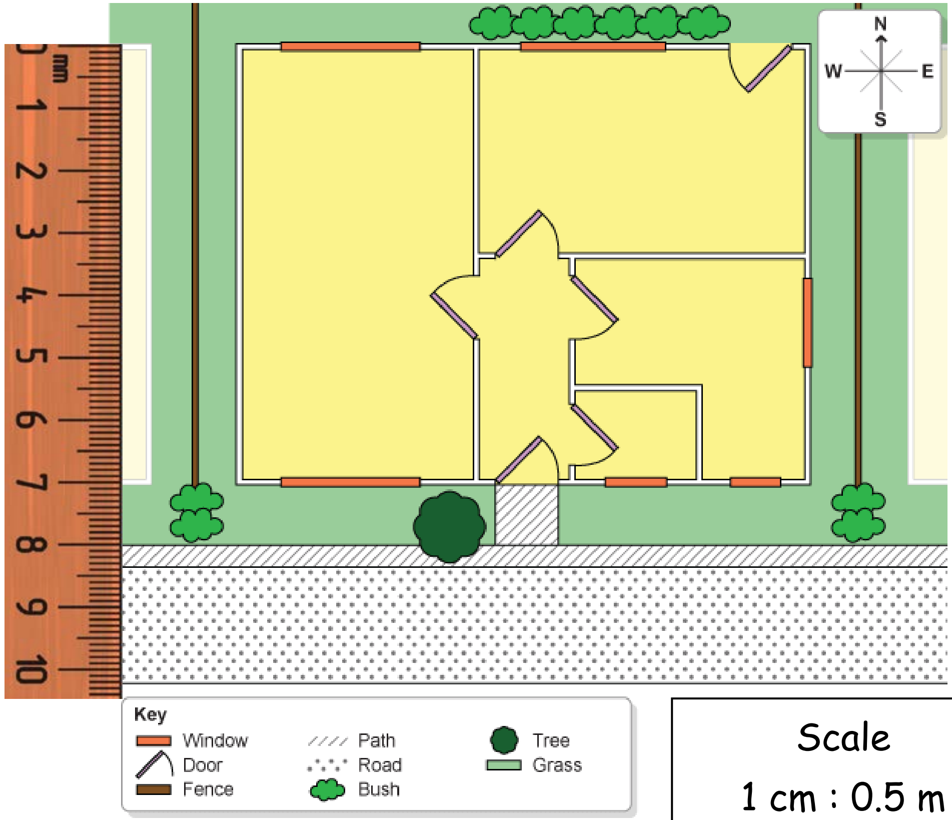


Figure 4

DESIGN & TECHNOLOGY (GRAPHICS)

Scale and Scale Factor

In D&T plan drawings, showing a view from above looking down, are often used for room plans, site plans and maps. They should include compass directions, a key and a scale.



Scale

1 cm : 0.5 m

The scale on this plan drawing tells us that each centimetre on the drawing, represents 0.5 metres of the actual length of the building.

1 m = 100 cm therefore 0.5 m = 50 cm

So the actual building's dimensions are 50 times bigger than those on the drawing, i.e. the scale factor is 50.

From North to South the length of the building on the drawing measures 7 cm. Therefore to work out how long this is in reality we simply multiply by 50.

$7 \times 50 = 350$ cm = 3.5 m

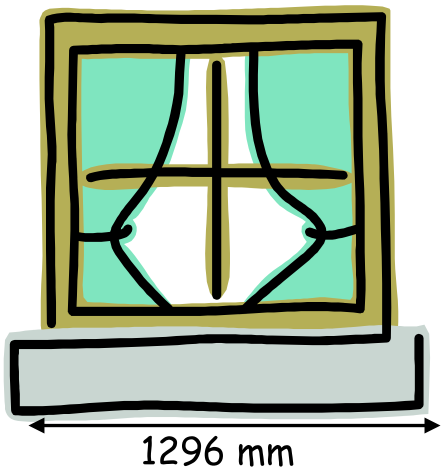
DESIGN & TECHNOLOGY

Accuracy and Rounding

In both Design and Technology and Mathematics it is at times necessary to give measurements to a certain degree of accuracy. This is usually done by rounding to a given number of decimal places or significant figures. Sometimes you may be asked to round to the nearest whole unit.

The measuring equipment you use will determine what accuracy you can measure something to.

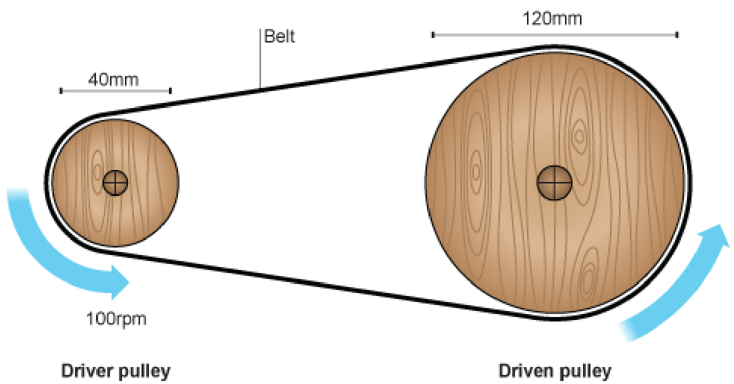
This length has been measured as 1286mm to the nearest mm.



1286 mm = 128.6 cm = 129 cm to the nearest cm

1286 mm = 1.286 m = 1 m to the nearest m

Answers to calculations will often need rounding in order to make them easier to interpret.



Output speed = Input speed ÷ Velocity ratio = 100 ÷ 3

= 33.3333….. rpm

= <u>33.3 rpm</u> (to 1 d.p.)

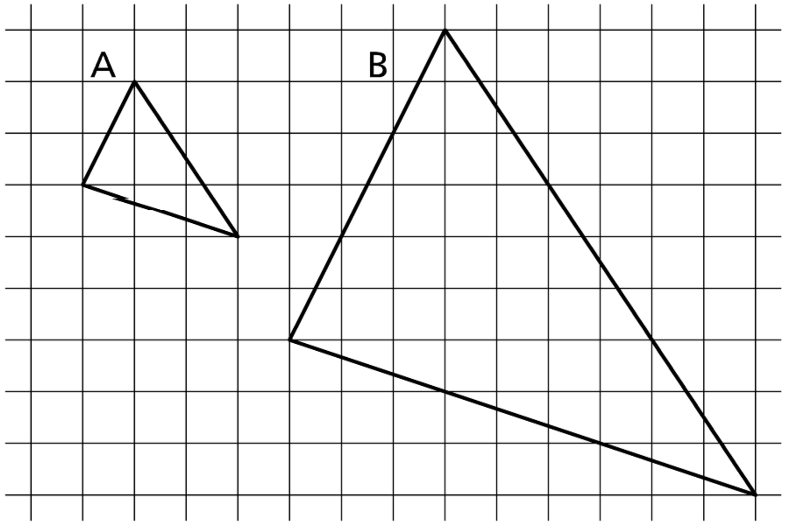
Numeracy Across the Curriculum

DESIGN & TECHNOLOGY (TEXTILES)

Using scale and proportion

In textiles scale and proportion are used to refer to relative measurements. Designs on paper need to be enlarged by a given scale factor whilst keeping the measurements in the same proportion to each other in order to create a pattern from which to make them.

The proportion of a pattern on a textile to the object on which it is to be used is also important. You would generally use fabric with a smaller scaled pattern for a cushion than you would for a sofa.

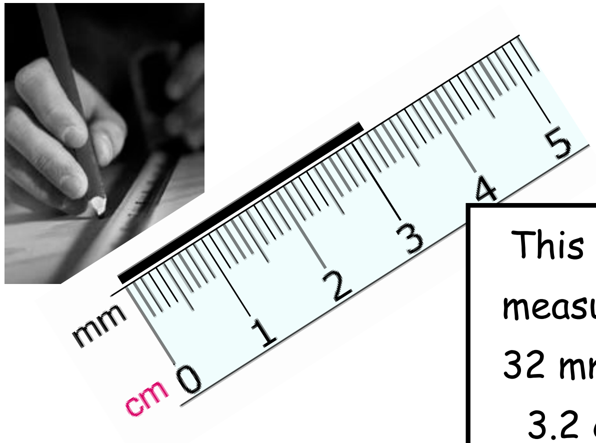


In maths scale and proportion are also used to define the size of one object relative to another.

Look at these two triangles. Triangle A has been enlarged by scale factor 3 to create triangle B. This means that all the side lengths of triangle B are 3 times as big as those in triangle A. (Notice how the interior angles of the triangles stay the same)

DESIGN & TECHNOLOGY

Measuring and Estimation

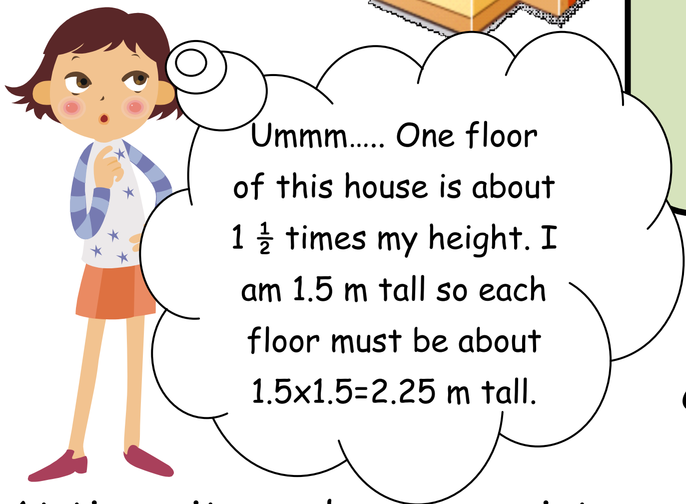


This line measures 32 mm or 3.2 cm

Being able to measure things accurately is an important skill in both D&T and mathematics.

Remember that you can measure lengths in metres, centimetres or millimetres:

1 m = 100 cm and **1 cm = 10 mm**



At times it may be appropriate to estimate the size of something – especially if you do not have time to measure it accurately.

Estimate

$3.6 \times 241 \approx 4 \times 200 = 800$

Accurate Calculation

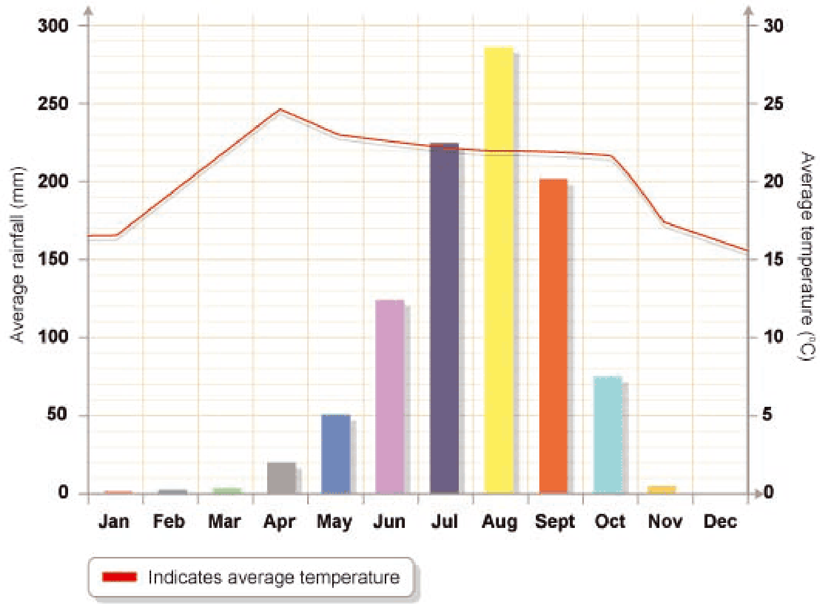
$3.6 \times 241 = 867.6$

Estimation can also be used to carry out calculations quickly – simply round each number involved to one significant figure and then work out the calculation.

GEOGRAPHY

Representing Data

The 3 main ways you might represent data are in a bar chart, a pie chart or a line graph.



This **climate graph** shows average annual rainfall and temperature throughout the year for a particular area.

A bar chart is used here to show the rainfall. Note how there are equal spaces between the bars. You should always leave spaces between the bars if the data is not numerical (or is numerical but is not continuous).

A line graph is used here to show the temperature and how it changes over the year. Line graphs should only be used with data in which the order in which the categories are written is significant.

Points are joined if the graph shows a trend or when the data values between the plotted points make sense to be included.

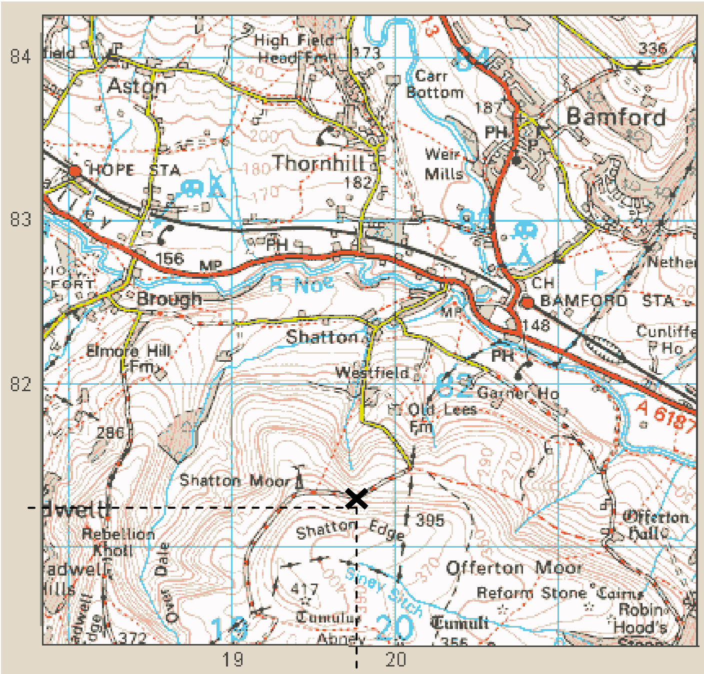
With any kind of graph take care to label your axes carefully and accurately.

Numeracy Across the Curriculum

GEOGRAPHY

Grid References and Coordinates

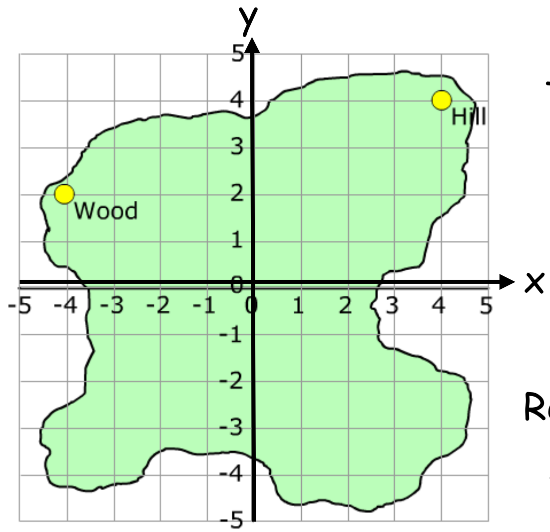
Grid references give the position of objects on a map. Coordinates give the position of points on a 2D plane.



In **geography grid references** are given using the number **across** the bottom of the map first (**Easting**) followed by the number **up** the side of the map (**Northing**).

The grid reference of the point shown would be <u>**19**</u>7<u>**81**</u>4

In **maths** we use coordinates to describe the position of a point on a plane. The **x-coordinate** (given by moving **across** the horizontal axis) is given first followed by the **y-coordinate** (given by moving **up or down** in the direction of the vertical axis).



Here the coordinates of the hill and the wood are given by:

Hill: (4 , 4)

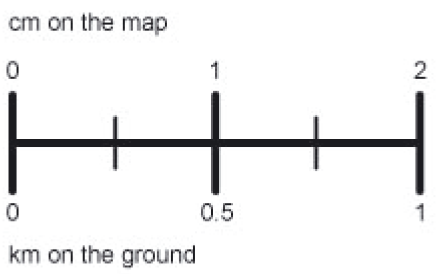
Wood: (-4 , 2)

Remember: Always give the x-coordinate before the y-coordinate.

GEOGRAPHY

Scale

In **Geography** the **scale** of a map is the ratio between the size of an object on the map and its real size.



This scale is for a 1:50 000 scale map.

1 cm on the map represents 50 000 cm on the ground.

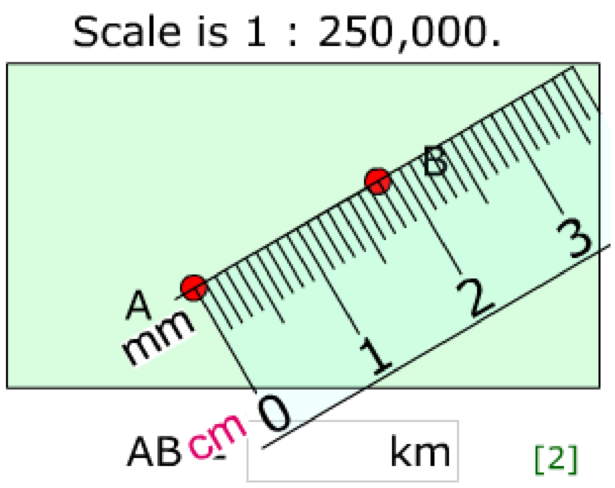
50000 cm = 500 m = 0.5 km

Ordnance Survey maps have different scales.
Travel maps, for long distance travel, have a scale of 1:125 000 where 1 cm represents 1.25 km.

Explorer maps, for walking, have a scale of 1:25 000 where 1cm represents 250 m.

Landplan maps, used by town planners, have a scale of 1:10 000 where 1cm represents 100 m.

In **Maths** we use **scale** in a similar way.



AB = 1.8 x 250 000 = 450 000 cm = 4 500 m = <u>4.5</u> km

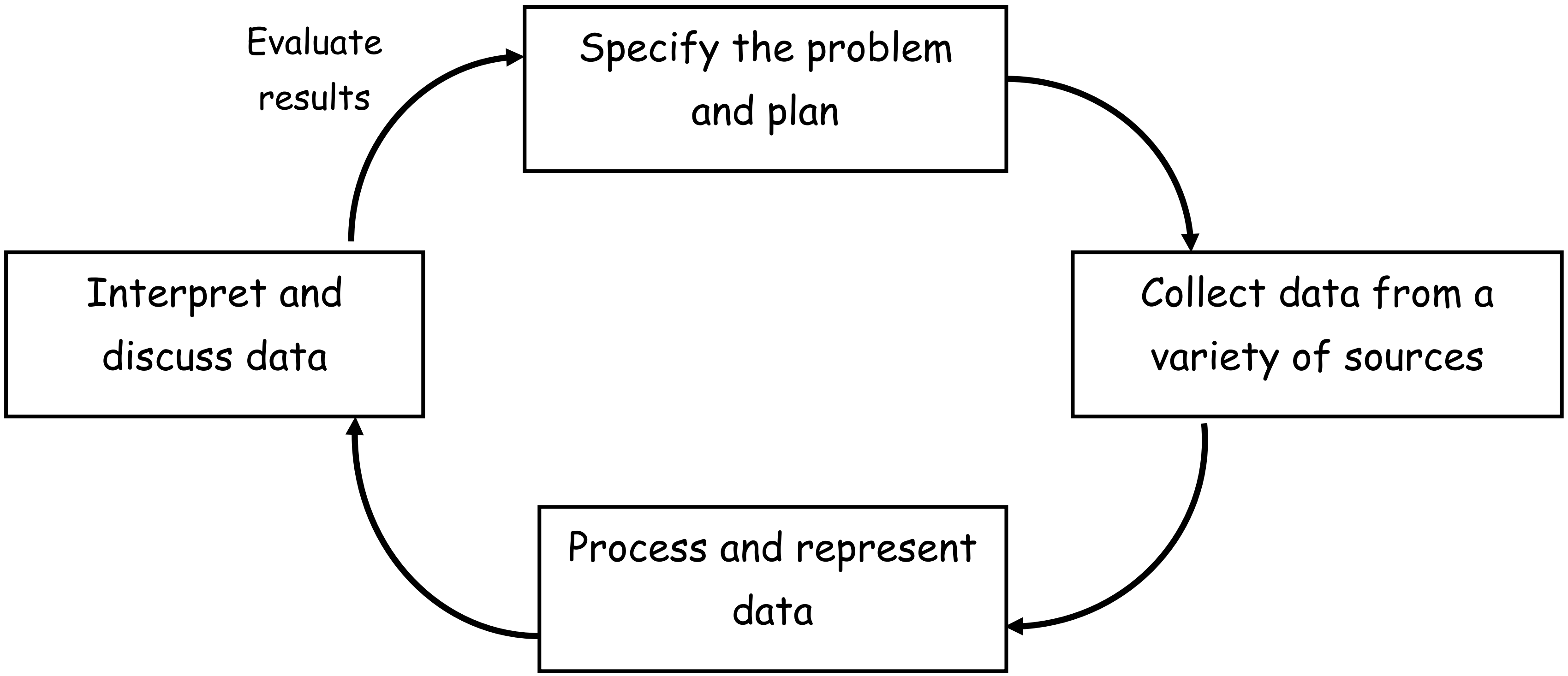
Similarly to find what length to draw an object on a diagram you would divide the real length by the scale factor. A distance of 6 km in real life would be represented by:

6 ÷ 250 000 = 0.000024 km = 0.024 m = 2.4 cm

GEOGRAPHY

The Handling Data Cycle

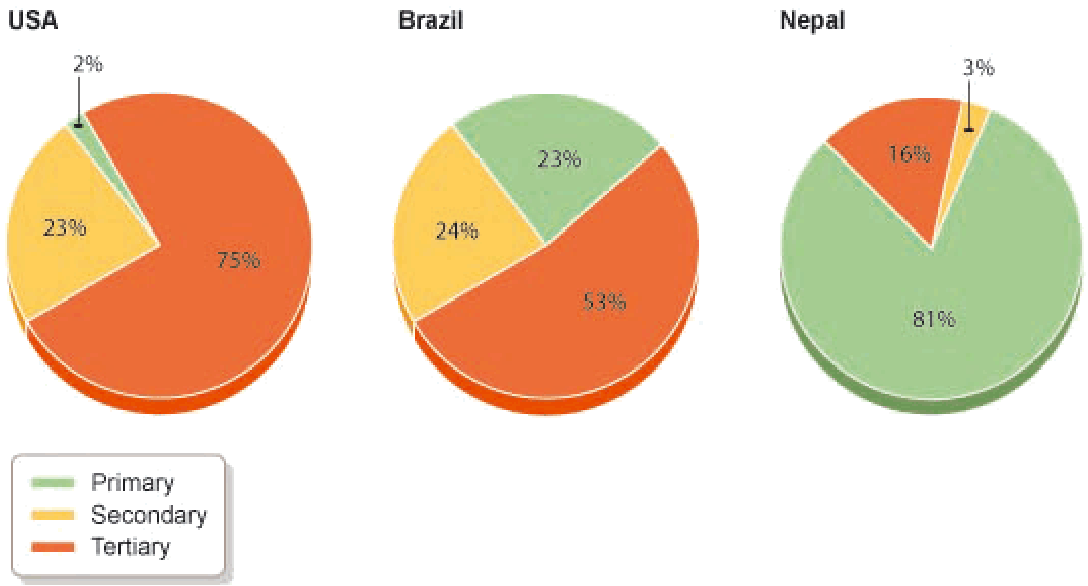
The handling data cycle is used when collecting and analysing data. You might use it for a controlled assessment or on a field trip in Geography. In maths you would use it for a statistical investigation. It's important to be aware of each of the stages to make sure that vital steps aren't missed out.



GEOGRAPHY

Representing Data

The 3 main ways you might represent data are in a bar chart, a pie chart or a line graph.



The **pie charts** show the differences in the split between primary, secondary and tertiary employment in USA, Brazil and Nepal. Make sure to include a **key** whenever you draw pie charts and to label your charts clearly.

These pie charts use data in the form of percentages. Percent means "out-of-100." In a percentage pie-chart the circle is divided into 100 equal parts and shared out between the groups. Since there are 360° in a full turn, each percent of the pie chart uses:

$$360° \div 100 = 3.6°$$

So for a sector representing 23% you would need to measure a sector of:

$$23 \times 3.6° = 82.8°$$

You would then round this to the nearest whole degree, i.e. 83°

ICT

LOGO

Logo is a simple computer programming language which can be used to control devices. For example, a small robot known as a turtle can be moved around the floor using logo.

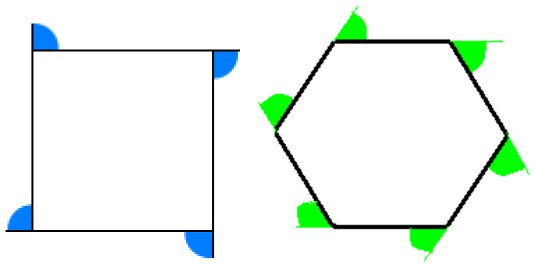
Command	Action
FORWARD 10	Move forward 10 steps
BACK 20	Move backward 20 steps
LEFT 90	Turn anticlockwise 90°
RIGHT 60	Turn clockwise 60°
PENDOWN	Lower pen and begin drawing
PEN UP	Raise pen and stop drawing

This table summarises the main commands used in LOGO.

LOGO can be used to draw different mathematical shapes.

Example 1: Square

FORWARD 10
RIGHT 90
FORWARD 10
RIGHT 90
FORWARD 10
RIGHT 90
FORWARD 10
RIGHT 90



For a regular hexagon each interior angle is 120° and each exterior angle is 60°.

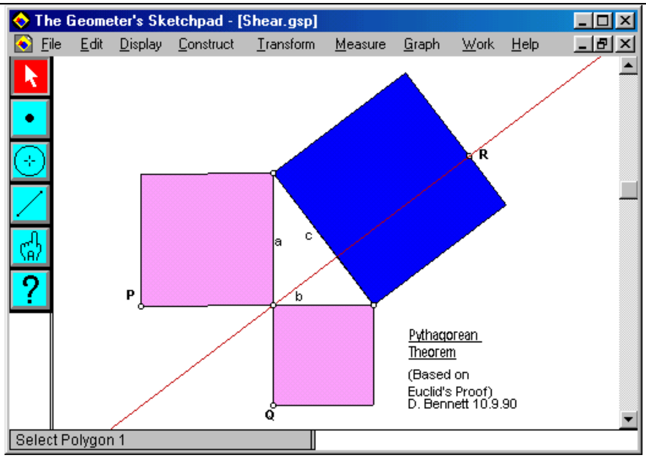
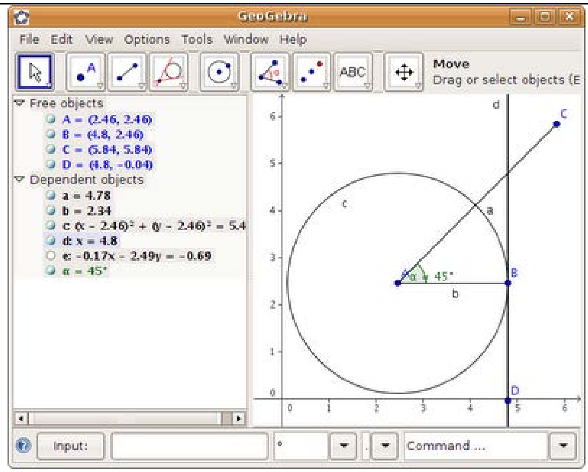
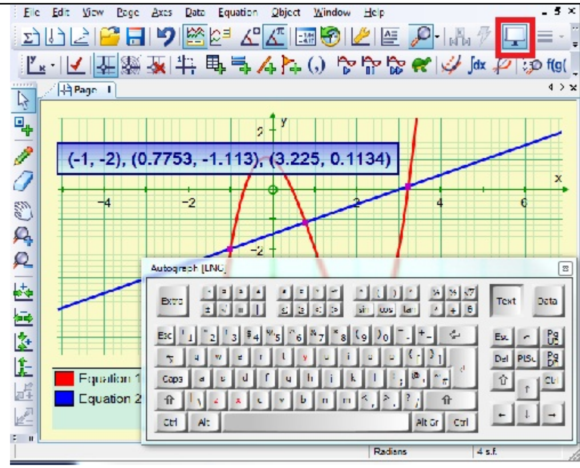
Example 2: Regular hexagon

FORWARD 10
RIGHT 60
FORWARD 10
RIGHT 60
FORWARD 10
RIGHT 60
FORWARD 10
RIGHT 60
FORWARD 10
RIGHT 60
FORWARD 10
RIGHT 60

ICT

Dynamic Geometry Software

Dynamic geometry software refers to computer programs which allow you to create and then manipulate geometric constructions. The main ones used in maths are shown below.

Geometer's Sketchpad	**GeoGebra**	**Autograph**
		

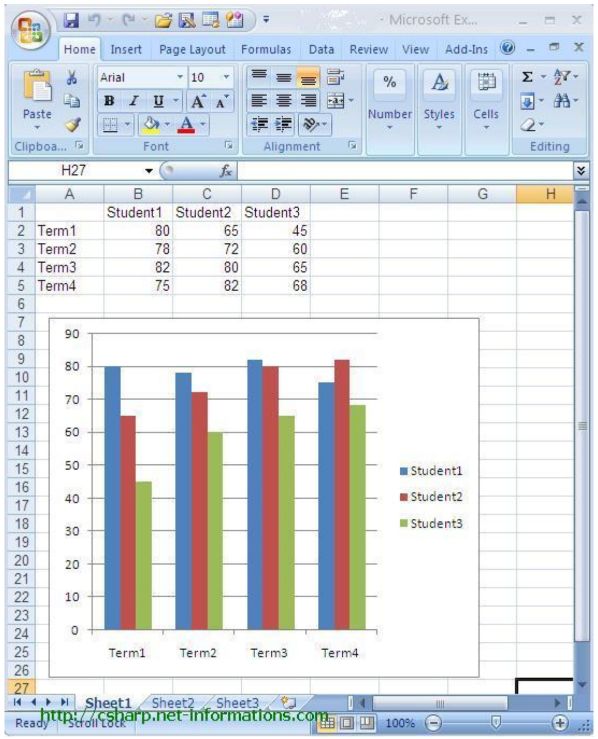
All three software programs allow you to plot graphs from equations and manipulate them. They also allow you to create geometric shapes and carry out transformations on them. GeoGebra is a free piece of software that you could download at home. Autograph is used mainly with our 6th form students.

ICT

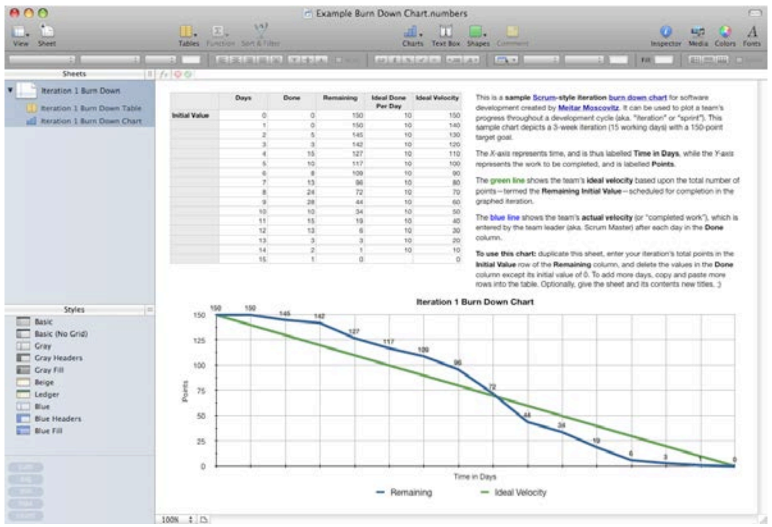
Representing Data

Once data has been inputted into a Spreadsheet, it can be represented in different types of charts and graphs.

PCs (Using Excel)



MACs (Using Numbers)



For both software packages the steps to creating a chart or graph are similar.

1. Input your data
2. Select your data
3. Insert a chart or graph
4. Edit the preferences on your chart or graph

Any charts or graphs you create can then be put into presentations.

ICT

Using formulae in spreadsheets

Using formulae in spreadsheets allows you to work out a fixed calculation for a range of inputs. At this school you will mainly use spreadsheets within Excel.

Example: A bank gives compound interest at a rate of 2% per annum on its current accounts. How much money will the following people have after 1 year? 2 years? 3 years?

Name	Deposit	Year 1	Year 2	Year 3
Leonora Voss	£4,000.00	£4,080.00	£4,161.60	£4,244.83
Nigel Prior	£3,500.00	£3,570.00	£3,641.40	£3,714.23
Desmond Rowe	£2,705.00	£2,759.10	£2,814.28	£2,870.57
Rodney Eyre	£2,346.00	£2,392.92	£2,440.78	£2,489.59
Rufus Travers	£4,687.00	£4,780.74	£4,876.35	£4,973.88
Digby Broomhead	£7,538.00	£7,688.76	£7,842.54	£7,999.39

To find 2% of a number we multiply by 0.02.

To increase a number by 2% we multiply by 1.02.

To input a formula into a cell in a spreadsheet you must always start with an "=" sign. To multiply you use the "*" symbol.

Therefore in cell C2 you would type:

=B2*1.02

[This increases the value in B2, i.e. Leonora's deposit, by 2%]

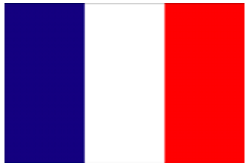
And in cell D2 you would type:

=C2*1.02 etc.

Numeracy Across the Curriculum

MFL

Mental arithmetic in other languages

	Français 	**Español** 	**Deutsch** 
1 + 2 = 3	Un **plus** deux **fait** trois	Uno **más** dos **es** tres	Eins **plus** zwei **macht** drei
9 - 4 = 5	Neuf **moins** quatre **fait** cinq	Nueve **menos** cuatro **es** cinco	Neun **minus** vier **macht** fünf
6 x 7 = 42	Six **fois** sept **fait** quarante-deux	Seis **multiplicado por** siete **es** cuarenta y dos	Sechs **mal** sieben **macht** zwei und vierzig
100 ÷ 20 = 5	Cent **divisé par** vingt **fait** cinq	Cien **dividido por** veinte **es** cinco	Hundert **durch** zwanzig **macht** fünf

Numeracy Across the Curriculum

MUSIC

Time and speed

In **maths** you learn that:

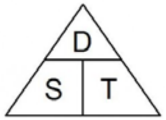
1 hour = 60 minutes

and

1 minute = 60 seconds

and that

$$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}}$$



In **music**, **tempo** is the **speed** or pace of a given piece. It can be given as a number of beats per minute (BPM). A particular note value is specified as the beat, and marking indicates that a certain number of these beats must be played per minute.

For example, in this piece the tempo is 120 semi-quavers a minute

Tempo has a significant effect on the mood or difficulty of a piece.

Metronomes can be used to help you keep the number of beats per minute fixed as you play a piece.

Genre	BPM
Hip Hop/Rap/Trip-Hop	60-110
Acid Jazz	80-126
Tribal House	120-128
House/Garage/Euro-Dance/Disco-House	120-135
Trance/Hard-House/Techno	130-155
Breakbeat	130-150
Jungle/Drum-n-Bass/Happy Hardcore	160-190
Hardcore Gabba	180+

This table shows how a DJ might change the BPM of a track in order to change its genre.

MUSIC

Equivalent fractions

In music each different type of note is worth a different fraction of a whole beat. Depending on which notes you use you get different rhythms in your music. Composers are able to match different rhythms by working out which combinations of notes are equivalent to each other.

Symbol	𝅝	𝅗𝅥	♩	♪	𝅘𝅥𝅯	𝅘𝅥𝅰	𝅘𝅥𝅱
Name	Semibreve	Minim	Crotchet	Quaver	Semiquaver	Demi-semi-quaver	Hemi-demi-semi-quaver
Fraction of a beat	**1**	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{32}$	$\frac{1}{64}$

Now think about rhythm using equivalent fractions…

$\frac{1}{2} = \frac{2}{4} = 2 \times \frac{1}{4}$ so 𝅗𝅥 lasts for the same time as ♩ ♩

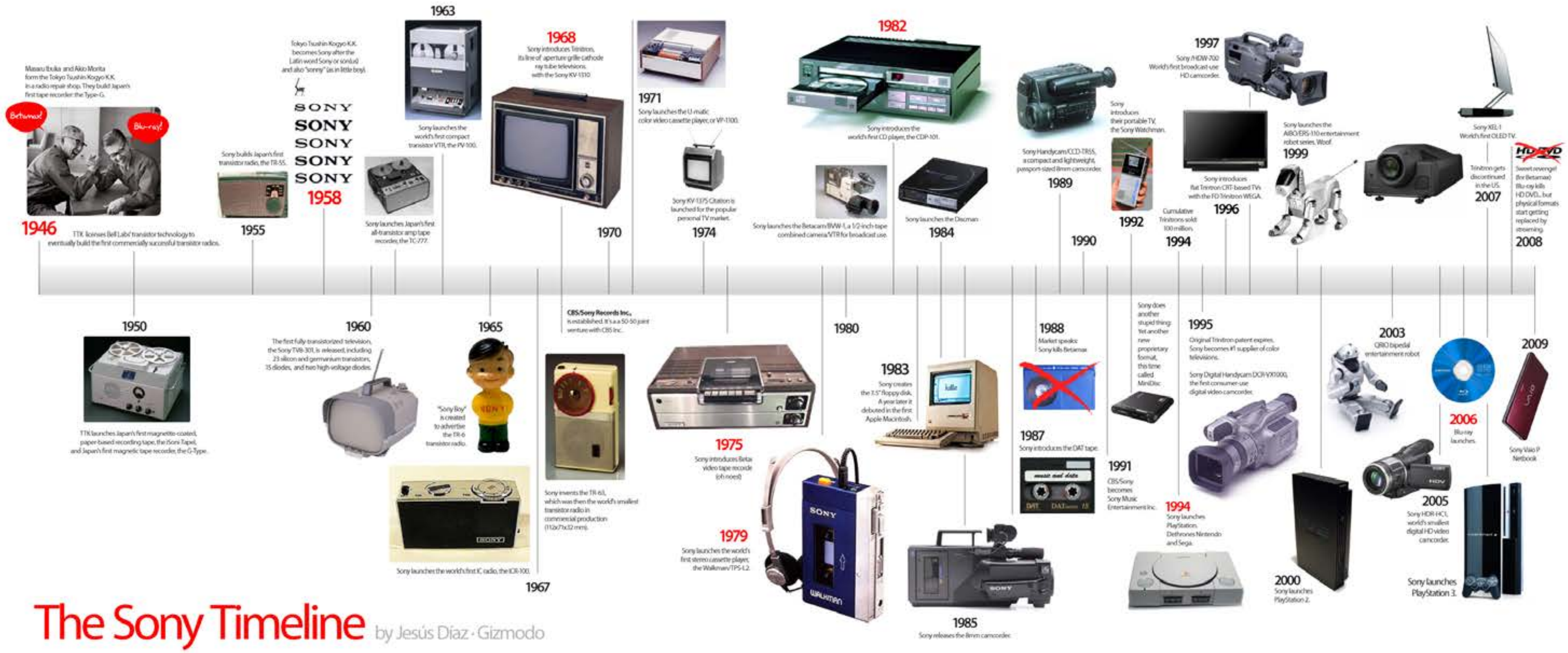
Also $\frac{1}{4} = \frac{4}{16} = 4 \times \frac{1}{16}$ so ♩ lasts for the same time as 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯

Using equivalent fractions can you work out which other combinations of notes last the same time?

Numeracy Across the Curriculum

HISTORY

Timelines and Sequencing Events



In history, timelines allow you to place events in their correct historical order. From them you can see how far apart different events occurred in history. To work out how many years ago something occurred you simply take the year it happened away from the current year. For example the world's first CD player was produced in 1982.

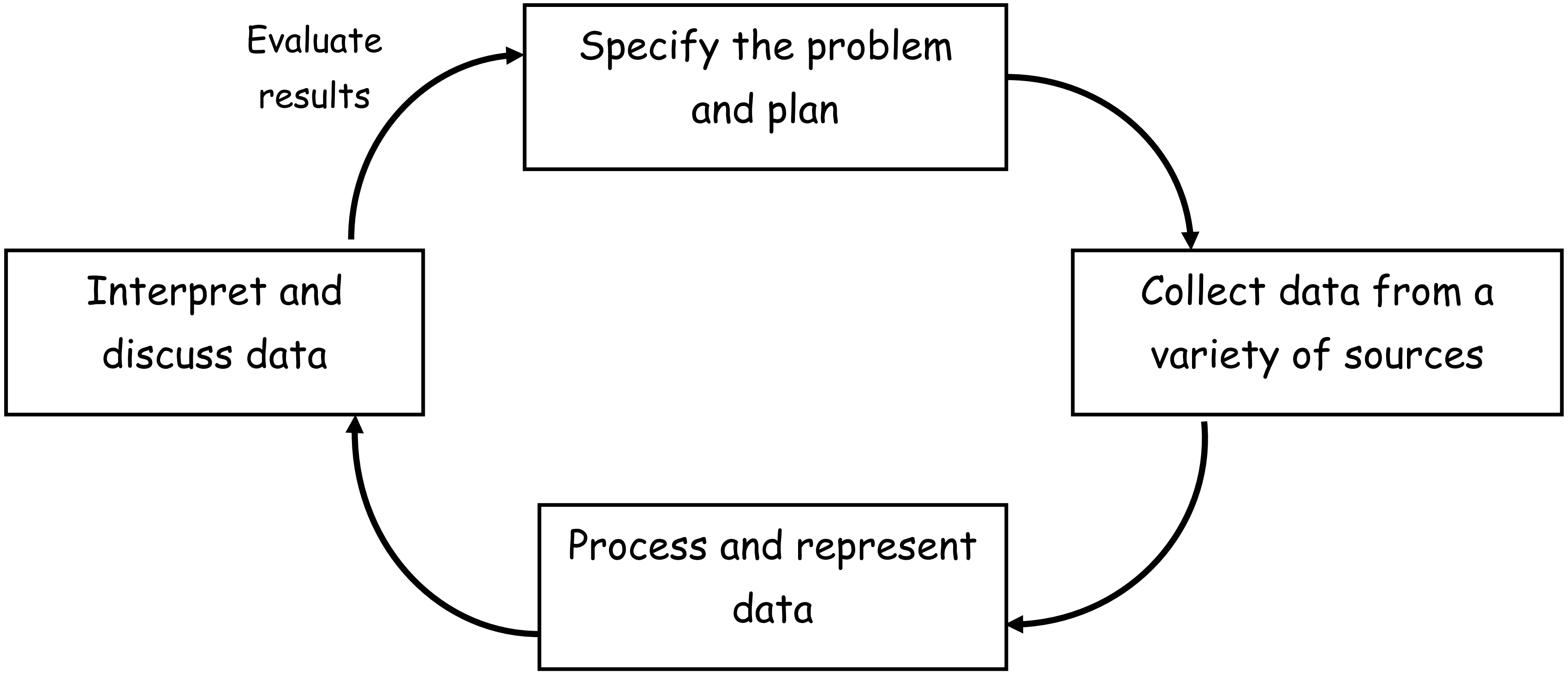
If the current year is 2012, this would be 2012 – 1982 = 30 years ago.

HISTORY

The Handling Data Cycle

The handling data cycle gives you a guide on how to carry out a statistical investigation. Whatever the data you are collecting, the cycle allows you to gain a thorough understanding of its significance.

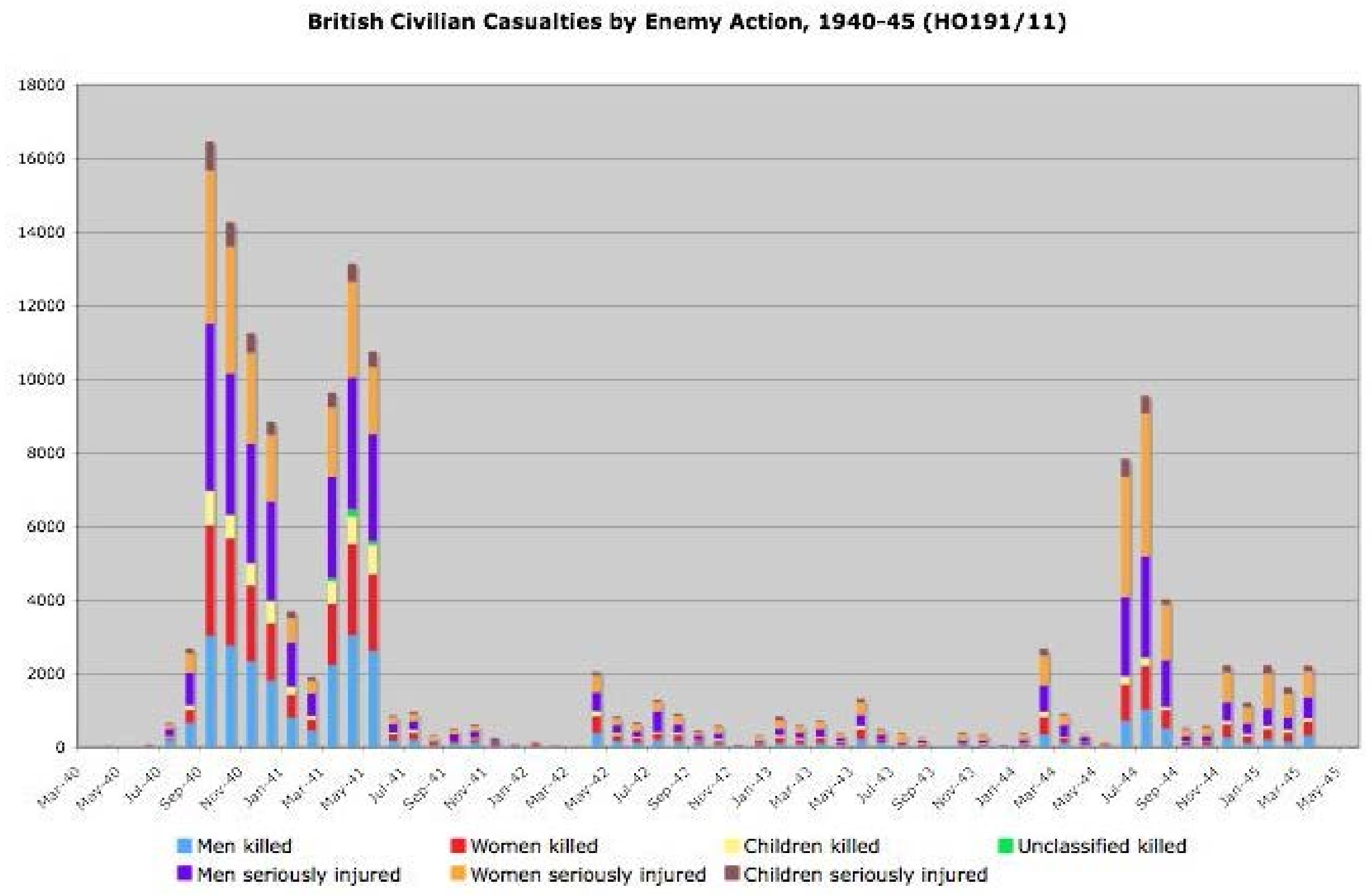
For example in History you might looking at the effects the great depression had on the American people. What kind of data would you need to collect? How might you process and represent it?



Numeracy Across the Curriculum

HISTORY

Using Charts and Graphs



Charts and graphs can provide extremely useful historical information. It is important that you are able to interpret them correctly.

This **stacked bar chart** shows the British civilian casualties in the Second World War.

You need to use the **key** and the **scale** on the left hand side to interpret how many of each type of casualty occurred each month.

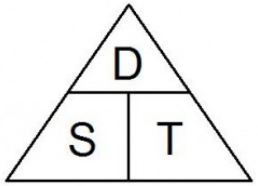
Numeracy Across the Curriculum

Physical Education

Time, Distance and Speed

In maths you learn that:

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$



In PE you will need to consider speed when working out how fast someone runs, cycles or swims a given distance. Comparing speeds allows you to analyse performance.

Speeds can be given in different units including metres per second (m/s) and kilometres per hour (km/h).

Ussain Bolt took Gold in the 100 metres at the 2012 London Olympics in 9.63 seconds.

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{100\text{ m}}{9.63\text{ s}} = 10.4\text{ m/s}$$

Ellie Simmonds won Gold in the SM6 200 metres medley at the London 2012 Paralympics with a time of 3 minutes 6.97 seconds.

There are 60 seconds in a minute so

3 min = 3 x 60 s = 180 s

Total time = 180 + 6.97 = 186.97 s

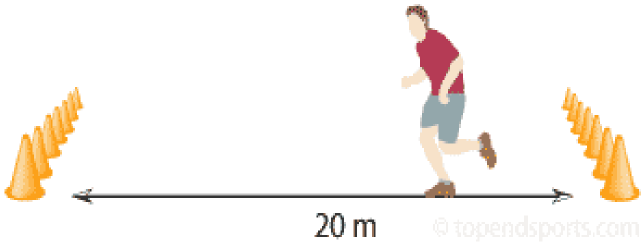
$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{200\text{ m}}{186.97\text{ s}} = 1.1\text{ m/s}$$

Numeracy Across the Curriculum

Physical Education

Collecting and Analysing Data

In PE you will often have to collect and analyse data to assess your performance.



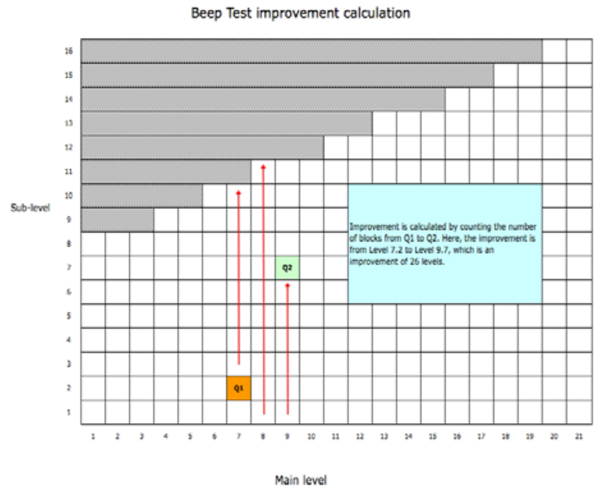
In PE the multi-stage fitness test, also known as the **bleep test**, is used to estimate your maximum oxygen uptake or VO_2 max. The test is an accurate test of your Cardiovascular fitness.

The test involves running continuously between two points that are 20 m apart from side to side. These runs are synchronized with beeps played at set intervals.

As the test proceeds, the interval between each successive beep reduces, forcing you to increase your speed until it is impossible to keep up.

At the end of the test you get a bleep score or level.

Jobs require different bleep scores to meet their physical requirements. For an Officer in the British Army, males need a minimum score of 10.2 while females need a minimum score of 8.1.



As your fitness improves you would expect your bleep test score to improve.

Charts can be used to see how many levels you have improved by between tests.

Numeracy Across the Curriculum

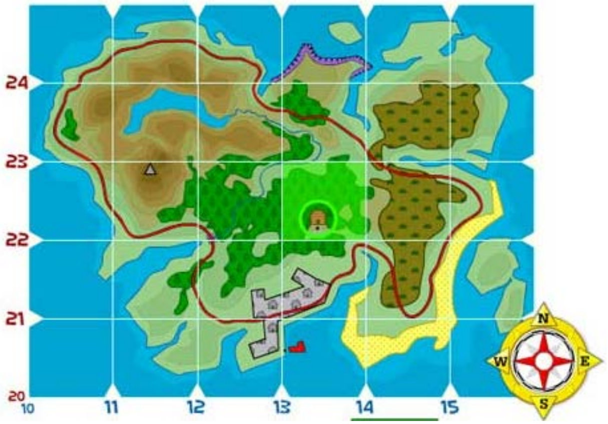
Physical Education

Map References and Bearings

Physical Education isn't just limited to what you do in PE lessons. At school you have the opportunity to participate in the Duke of Edinburgh Award Scheme which gives you the chance to go on expeditions where you will need to plan your own route using maps. Map reading links strongly with your maths lessons involving work on coordinates and bearings.

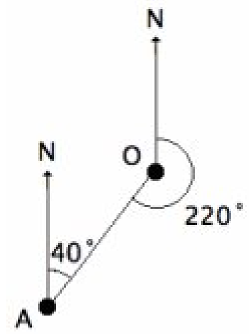
Maps use grid references in the same way coordinates are used in maths.

Read along the horizontal scale first and then along the vertical scale.



On this map the square shaded light green would be given by the four figure grid reference 1322. The specific location of the temple within it would be given by a six figure grid reference, 133223.

<u>3 figure-bearings</u>



Bearings tell you what direction one object is from another.

They are always measured clockwise from North and given using 3 figures.

Here the bearing of O from A is 040°.

The bearing of A from O is 220°.

Numeracy Across the Curriculum

Physical Education

Using Averages - Mean, Mode and Median

An athlete's performance will vary from event to event depending on their level of fitness at the time and the conditions they are competing in. It is useful to measure performance on different occasions and use an "**average**" measurement to give a more balanced indication of their overall performance.

In the javelin at the London Olympics 2012 Barbora Spotakova won Gold.

She threw four throws

Attempt	Mark (m)
1	66.90
2	66.88
3	66.24
4	69.55

What was her average throw?

There are three main types of average: mode, median and mean.

The **mode** is the most common value. Since all her throws were different there is no mode for this data.

The **median** is the middle value. First put the values in ascending order:

66.24 , 66.88 , 66.90 , 69.55

Then find the middle value. When there are 2 middle values use the number half way between them.

$$\textbf{Median} = \frac{66.88 + 66.90}{2} = \underline{66.89\text{ m}}$$

The **mean** is found by adding up all the values and then dividing by how many values there are.

$$\textbf{Mean} = \frac{66.24 + 66.88 + 66.9 + 69.55}{4} = \underline{67.4\text{ m}}$$

Which average best indicates her performance? Why?

Numeracy Across the Curriculum

PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

Discussing Numbers

Numbers come up in conversations in everyday life all the time. You should use your mathematical knowledge in order to refer to them accurately.

Numbers

"Across England, **48,510** households were accepted as homeless by local authorities in 2011."

48,510 = Forty eight thousand, five hundred and ten

Percentages

"About **6%** of Britain's population is gay or lesbian."

6% = Six per cent

Fractions

"About **1/10** of the population of the USA is left-handed."

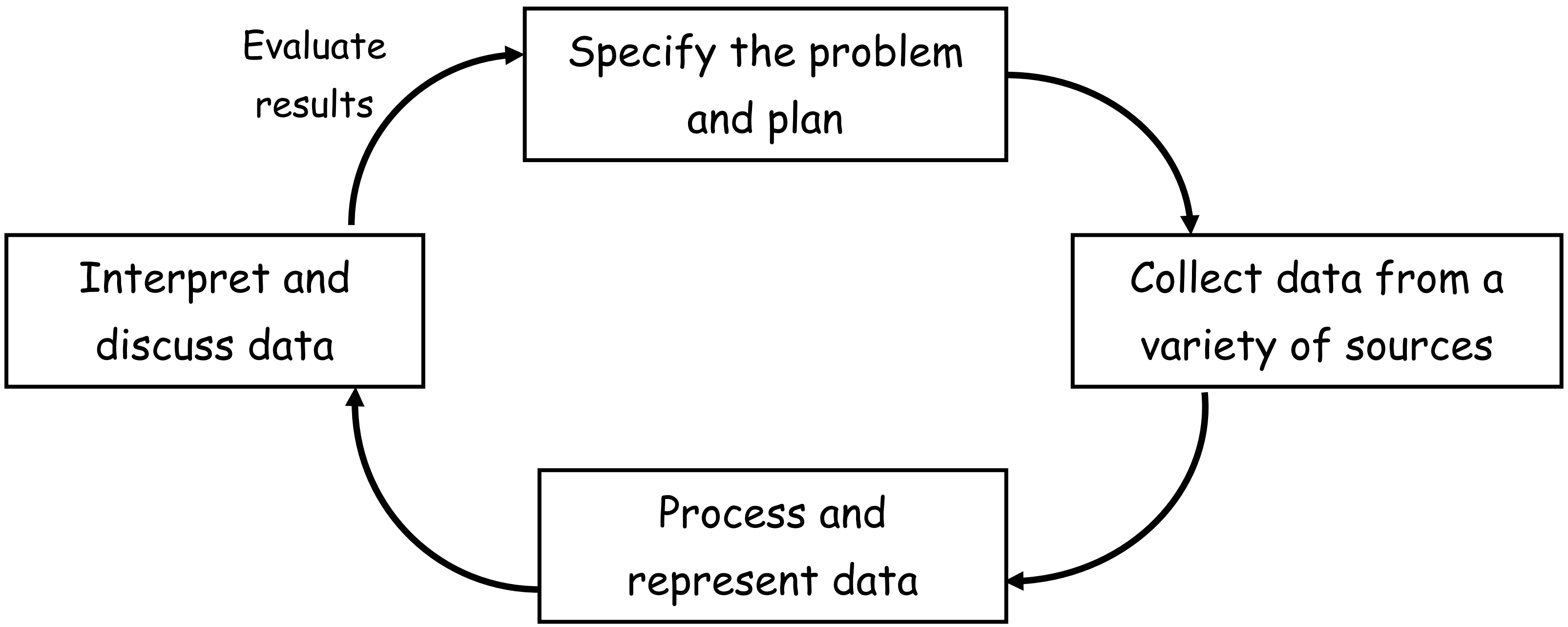
1/10 = "one tenth" or "one in ten"

PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

The Handling Data Cycle

The handling data cycle gives you a guide on how to carry out a statistical investigation. Whatever the data you are collecting, the cycle allows you to gain a thorough understanding of its significance.

For example in Religious Education you might want to investigate the effect someone's religion has on their view of death. What data might you collect? Who would you collect it from? How would you do this? How would you illustrate your findings? What would you expect to conclude?

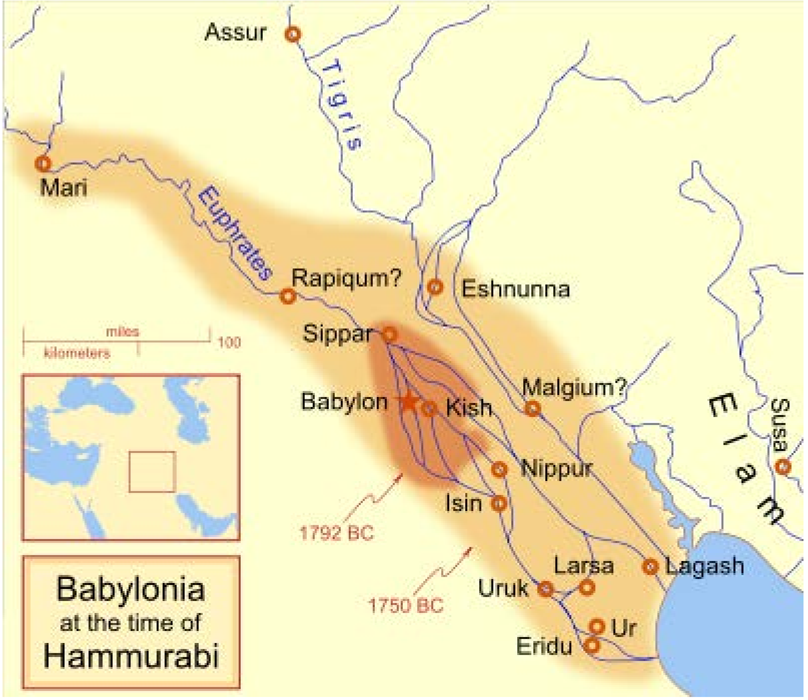


PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

Mathematics in Other Cultures

Ancient Babylonians

Babylonia was situated in the area that is now the Middle East. The Babylonian civilisation existed from about 2300 BC to 500 BC.



The Babylonians divided the day into 24 hours, each hour into 60 minutes and each minute into 60 seconds. This form of counting has survived for over 4000 years.

The Babylonians had an advanced number system with a base of 60 rather a base of 10.

Perhaps the most amazing aspect of the Babylonian's calculating skills was their construction of tables to aid calculation. Two tablets found dating from 2000 BC give the squares of numbers up to 59 and the cubes of numbers up to 32.

The table gives $8^2 = 1,4$ which stands for

$$8^2 = 1, 4 = 1 \times 60 + 4 = 64$$

Numeracy Across the Curriculum

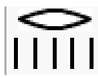
PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

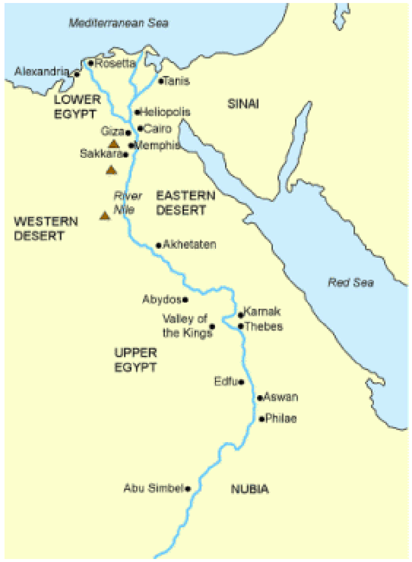
Mathematics in Other Cultures

Ancient Egypt

The Ancient Egyptian civilisation existed from about 3000BC to 300BC.

The Egyptians were very practical in their approach to mathematics and their trade required that they could deal in fractions. Egyptians used mainly **unit fractions** i.e. fractions with a numerator equal to one.

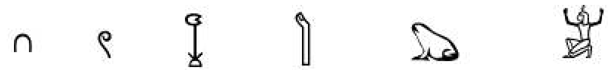
1/2	1/3	1/4	1/5
			



The Egyptians worked out that the year was 365 days long and used this for a civil calendar. Eventually the civil year was divided into 12 months, with a 5 day extra period at the end. The Egyptian calendar was the basis for the Julian and Gregorian calendars.

The ancient Egyptians used a number system with base 10.

Larger numbers had special symbols



10, 100, 1000, 10000, 100000, 1 million

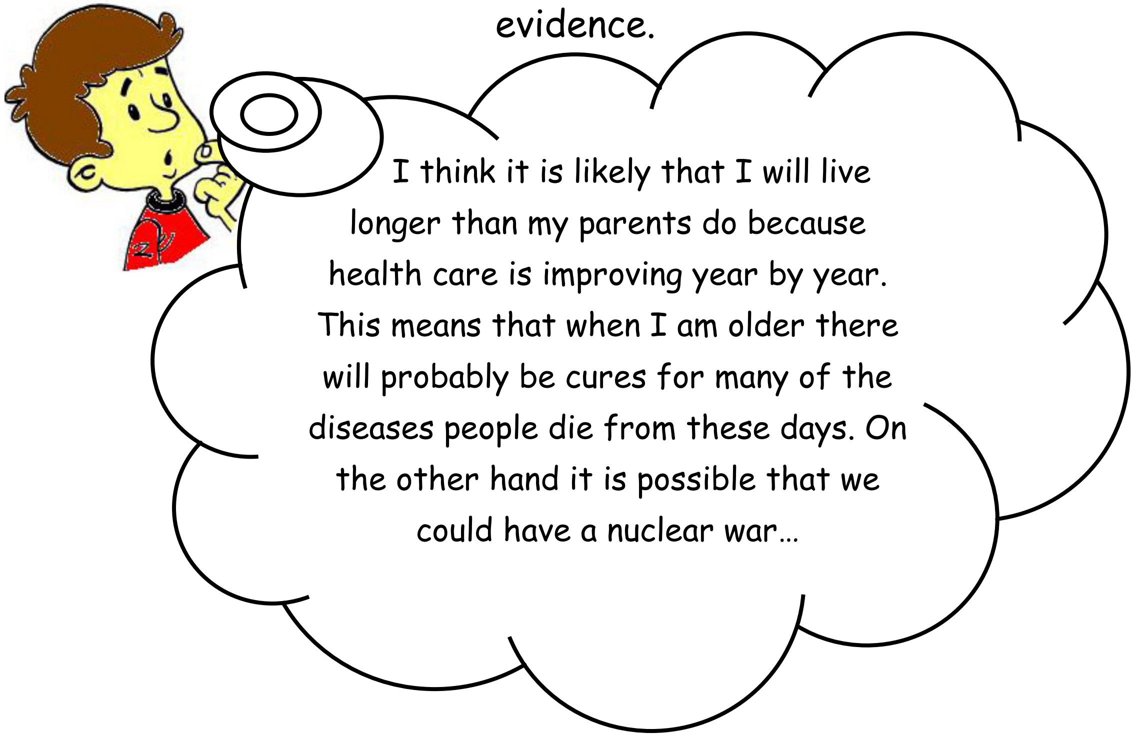
Can you find the numbers on this tablet indicating how many of each item this man wished to take to the afterlife?

PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

Probability, Risk and Chance

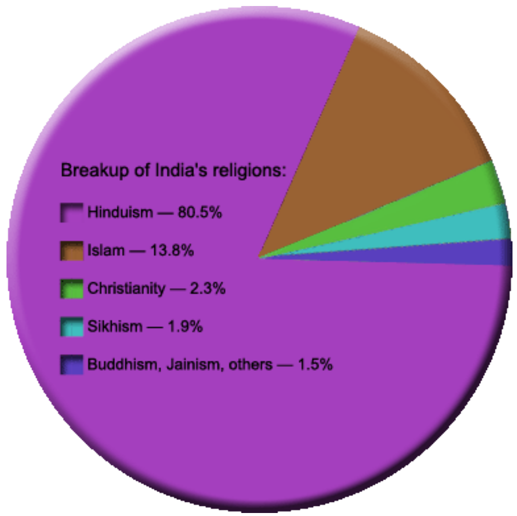
What's the chance of you becoming infected with HIV? What's the risk of a baby being stillborn? How likely is it that you will live longer than your parents do? All these questions are connected with probability.

Probability can be discussed in different ways. Sometimes you simply use words such as "likely", "impossible" or "certain" making sure to back up your opinions with evidence.



You can give a more objective viewpoint if your probabilities are backed up by numbers.

From this Pie Chart you can see that 80.5% of India's population are Hindu.



If an Indian citizen was picked at random from a database you could estimate the probability that they were Hindu as 80.5%.

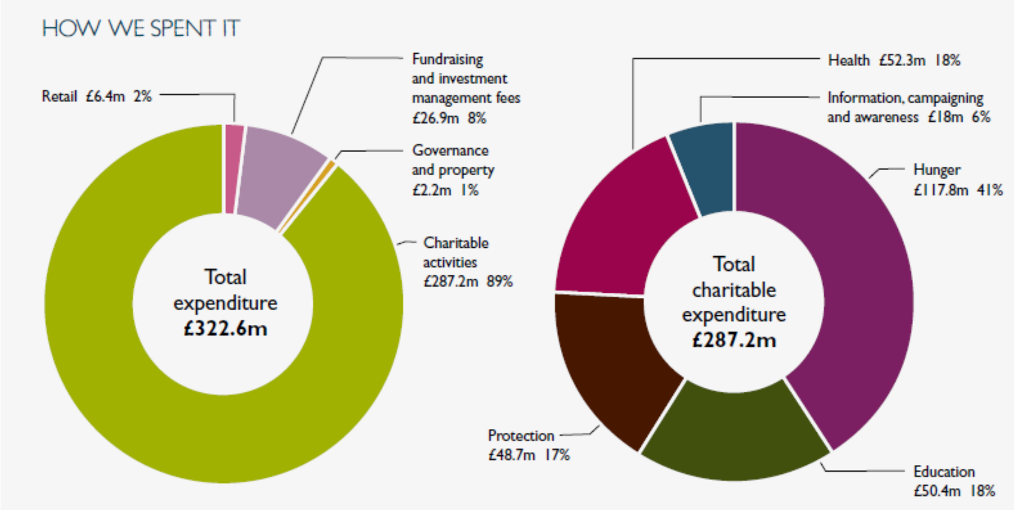
It would also be fair to say that they would be unlikely to be Buddhist.

Numeracy Across the Curriculum

PSHE, RELIGIOUS EDUCATION & CITIZENSHIP

Interpreting Charts and Graphs

Being able to interpret and discuss the information in charts and graphs is an important skill. Many organisations use charts and graphs to illustrate issues that are relevant to their work.



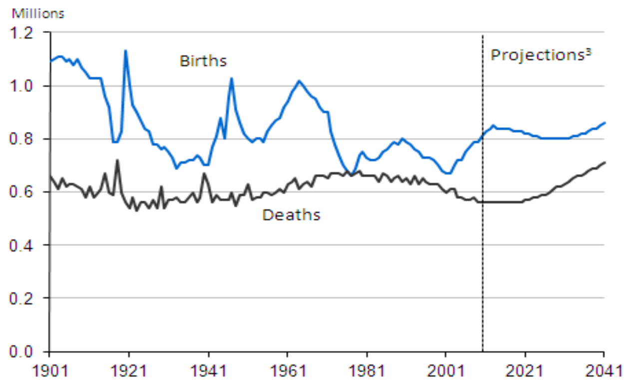
These charts are from the Save the Children website. They show how the charity spent the money they received in 2011.

They are a form of Pie Chart. Pie charts are good at allowing you to compare the relative size of different things. Notice how the Pie Chart is clearly labelled to give you as much information as possible.

This line graph is from the Office of National Statistics and shows the birth and death rates since 1901 in the UK.

Look at the dips and peaks in the birth rate, by comparing these with the dates below can you suggest reasons why they occurred?

Line graphs are very useful at showing trends over time.



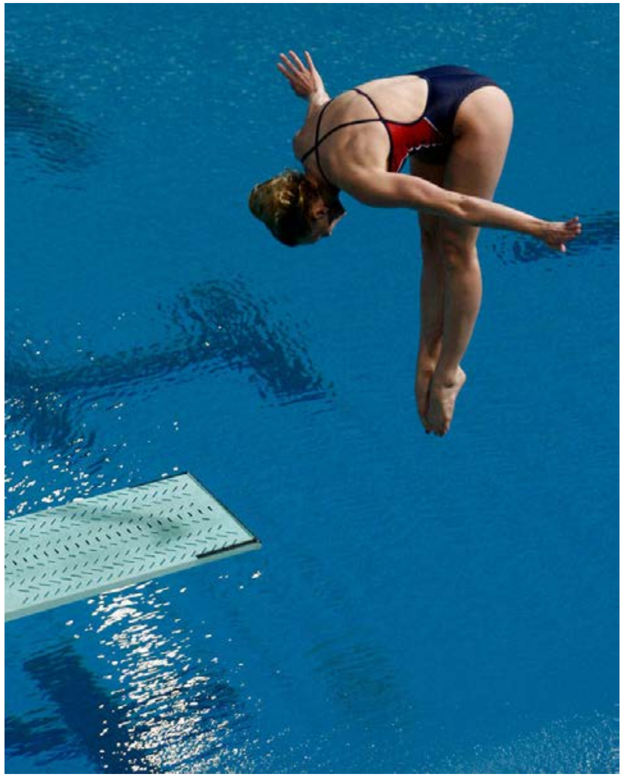
Numeracy Across the Curriculum

SCIENCE

Substituting into Formulae

In both your maths and science lessons you will be expected to substitute into formulae. In formulae different variables are represented by letters.

Substitution simply means putting numbers where the letters are to work something out.



Example

A diver who has a mass of 50 kg dives off a diving board 3.0 metres above the water level. What is her kinetic energy when she reaches the water?

[Formula 1] Kinetic energy gained = gravitational potential energy lost

= weight × height

You must calculate her weight to use in this equation

[Formula 2] Weight = mass × gravitational field strength

[Substitution] Weight = 50 kg × 10 N / kg

Weight = 500 N

Kinetic energy gained = weight × height

[Substitution] Kinetic energy gained = 500 N × 3 m

= 1500 J

Numeracy Across the Curriculum

SCIENCE

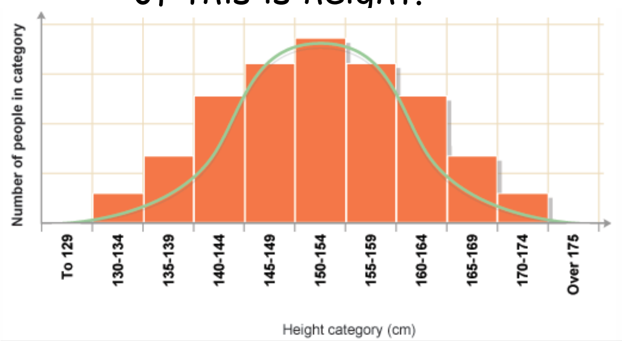
Continuous and Discrete Data

Continuous data

Continuous data can take any value in a range.

An example of a **continuous variable** is mass, for example the mass of iron in a mixture of iron filings and sulphur powder. The iron could have a mass of 3.6 g, 4.218g, 0.24g etc. depending on the mixture concerned.

In biology, a characteristic of a species that changes gradually over a range of values shows **continuous variation**. An example of this is height.



Discrete data

Discrete data can only take certain fixed values.

The pH of a solution is a **discrete variable**. The pH of a solution can take integer values of pH from pH 0 for a very strong acid to pH 14 for a very strong alkali. Solutions with pH 7 are said to be neutral.

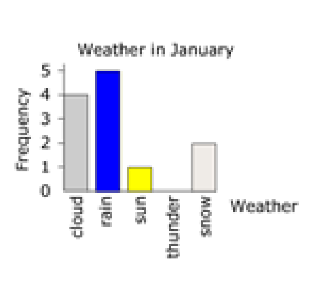
In biology a characteristic of any species with only a limited number of possible values shows **discontinuous variation**. An example is blood group – there are only 4 types of blood group (A, B, AB and 0), no other values are possible.

Numeracy Across the Curriculum

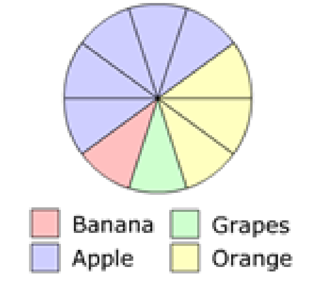
SCIENCE

Handling Data

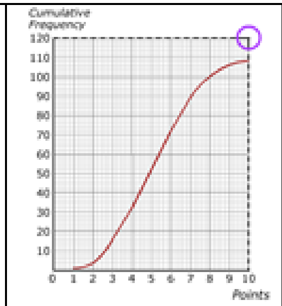
Most charts and graphs you use in science you will also use in maths. Here are some examples.



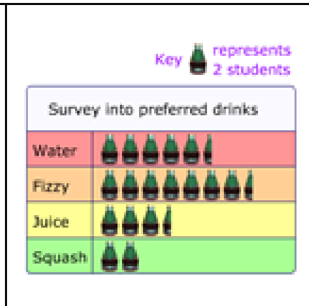
Bar Chart



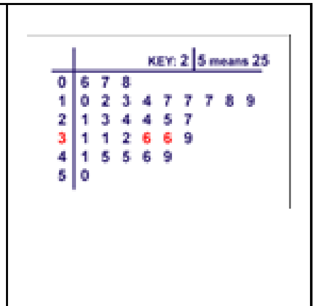
Pie Chart



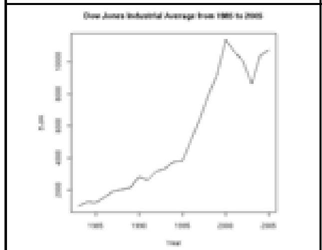
Cumulative frequency graph



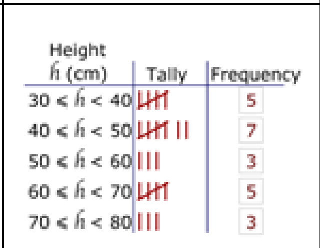
Pictogram



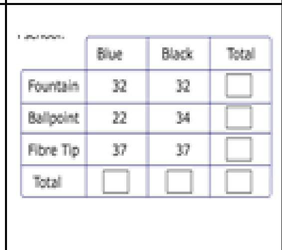
Stem and leaf diagram



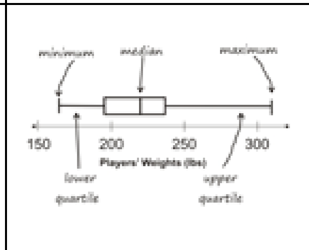
Line Graph



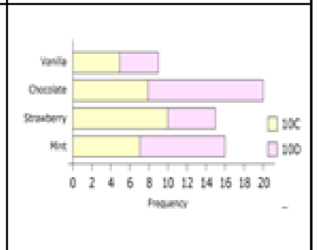
Grouped frequency table



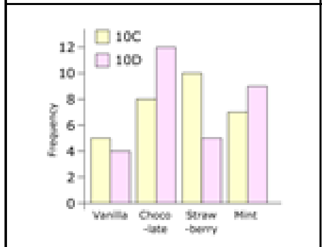
Two-way table



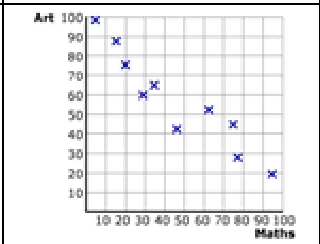
Box plot



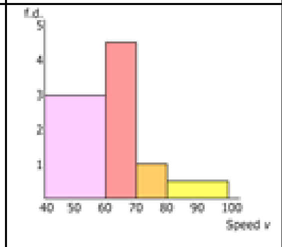
Stacked bar chart



Duel bar chart

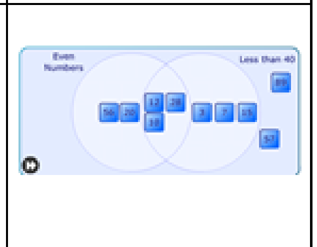


Scatter graph



Histogram

Tally chart



Venn diagram

Numeracy Across the Curriculum

SCIENCE

Converting between Metric Units

There are two main types of units:

Imperial Units	**Metric units**
(Stones, pints, miles etc.)	(kilograms, litres, metres etc.)
Old system of units	Modern system of units

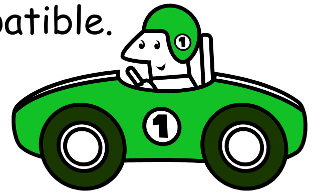
Metric units follow the decimal system. To convert between them you multiply or divide by multiples of 10.

For example 1 kg = 1000 g

So 3.4 kg = 3.4 x 1000 = 2400 g

And 24 g = 24 ÷ 1000 = 0.024 kg

When working out calculations it is important that the units you are using are compatible.



$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

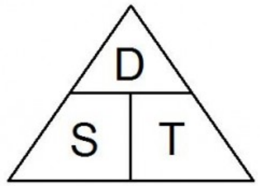
If the speed is in kilometres per hour then the distance needs to also be measured in kilometres and the speed needs to be measured in hours.

What is the average speed in km/h of a car if it travels 4600 metres in 15 minutes?

4600 m = 4600 ÷ 1000 = 4.6 km

15 minutes = 15 ÷ 60 hours = 0.25 hours

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{4.6}{0.25} = 18.4 \text{ km/h}$$



Numeracy Across the Curriculum

SCIENCE

Manipulating Algebraic Formulae

Manipulating algebraic formulae allows you to rearrange formulae so that you can work out the value of different variables. This is also known as "changing the subject of a formula."

The Power Equation

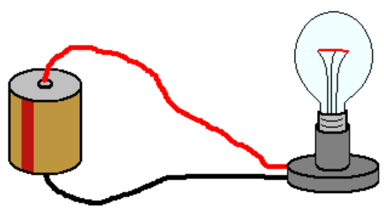
$P = IV$

P = power (watts)
I = current (amps)
V = voltage (volts)

e.g. If a bulb generates 24 watts with a current of 2 amps flowing through it, what is the voltage across it?

$$P = IV$$

[Rearranging] $V = \frac{P}{I}$



[Substituting] $V = \frac{24}{2} = \underline{12 \text{ volts}}$

Equations of Motion

$v = u + at$

v = final velocity (m/s)
u = initial velocity (m/s)
a = acceleration (m/s^2)
t = time (s)

e.g. A ball is rolled along the ground for 20 seconds. Its initial velocity is 10m/s and its final velocity is 45m/s. What is its acceleration?

$$v = u + at$$

[Rearranging] $v - u = at$ therefore $\frac{v - u}{t} = a$

[Substituting] $a = \frac{v - u}{t} = \frac{45 - 10}{20} = \underline{1.75 \text{ m/s}^2}$

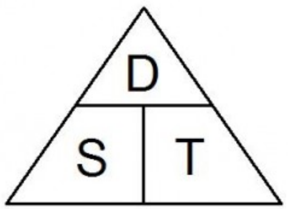
Numeracy Across the Curriculum

SCIENCE

Compound measures

A compound measure is made up of two (or more) other measures.

Speed is a compound measure made up from a measure of length (kilometres) and a measure of time (hours).

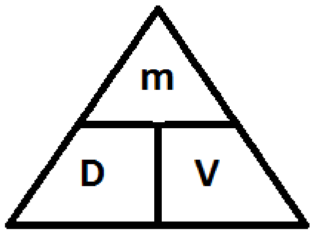


$$\textbf{Speed} = \frac{\textbf{Distance}}{\textbf{Time}}$$

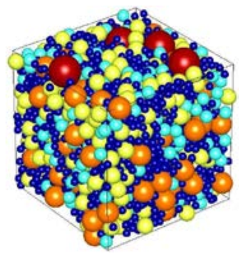
Triangles are often used to show the relationship between the compound measure and the measures it is made up of.

Density is made up from a measure of mass (grams) and a measure of volume (cubic centimetres).

Density tells you how compact a substance is.



$$\textbf{Density} = \frac{\textbf{Mass}}{\textbf{Volume}}$$



The triangle can be used to rearrange the formula.

For example in this case:

$$\text{Mass} = \text{Density} \times \text{Volume}$$

and

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$