Mathematics Vocabulary Dictionary (Reception – Year 6)

Welcome to the MathSphere Vocabulary Dictionary which explains the meaning of almost all the words and terms to be found in the English Primary Maths Curriculum. Some terms stand alone and are defined within their own entry in the dictionary. Others are best explained in the context of a major topic and the user is referred to the title of the major topic where the relationship between the required entry and related entries is to be found. For example, words such as '**metre'**, '**kilogram'** and '**litre'** will be found under the major topic of '**Metric System**'.

Many of the simplest of words have been included, even though their meaning is obvious to any adult, because their inclusion provides us with the opportunity to explain the contexts in which these simple words are used. The word 'divisibility', for example, is introduced early on to simply mean the process of dividing one number into another with no remainder, but later children will use it for divisibility tests which require a much greater facility with number.

The numbers following each entry in brackets give the year in which the word is expected to be first introduced to the child. This may be very ambitious target for many children!

Historically, mathematics arose originally from an attempt to try to describe and measure the world around us. This may no longer apply for mathematical geniuses who talk a language 99% of the population are not privy to, but at the age of the children we are concerned with, it is as true today as it always was. Recognizing this fact helps us to help children learn the vocabulary they need as it is all around them. There is always something that is l**arger, smaller, heavier** than something else. The world is full of **symmetrical** objects. We use **hours, minutes, seconds, days** and **months** all the time. The important thing is to use them with the children at every opportunity, slowly building their knowledge and understanding. Children love new words – don't be afraid to use them. Good luck!

12-hour clock **(5)**

A clock that shows the time on a **12** hour face and also the way of writing time followed by **a.m.** or **p.m.** e.g. **11.45 p.m**. Although we often omit the a.m. and p.m. when it is clear whether we are referring to before noon or after noon, these should be included if there is any possible doubt.
A.m. stands for the Latin phrase '*ante meridiem'* (before noon) and p.m. stands for '*post meridiem'* (after noon). Noon is therefore neither a.m. nor p.m. Midnight is also confusing since it is both the beginning and end of the day. To avoid doubt it is better to say **12.00 noon** and **12.00 midnight** as appropriate. In cases where it could be crucial if it was not clear on which day the midnight fell such as legal contracts, insurance policies, airline flights, **12.00 midnight** is mostly avoided and **11.59 p.m.** and **12.01 a.m.** are used instead.

All these are good reasons for using the **24-hour** clock when any confusion could arise.
Historical note. It is interesting to notice that clocks that display the time in Roman Numerals normally use **IIII** instead of **IV** for the number four. This is said to be because Henry VIII once designed a clock and used IIII instead of **IV** by mistake. When he gave the design to his clock makers they were so terrified of him that no-one dared to point out his error and they made the clock using **IIII**. This has since become a tradition.

24-hour clock **(5)**

The method of writing time using four digits with midnight at the beginning of the day being 00.00 (the separator between the hours and the minutes is not necessary, but is often included for clarity).
If the hour is below **10** a leading zero is included as in **03.40, 09.00** etc. Times up to **12.00** are obviously before noon and times from **12.00** to **24.00** are after noon (although **24.00** itself is nearly always written as 00.00 to indicate the start of a new day).

No a.m. or p.m. are used as they are now redundant. Whilst the **24**-hour clock removes much of the confusion of the **12-hour** clock, there is still the problem of **00.00** – does this refer to the midnight at the beginning of the day or at the end. In cases where it could be crucial if it was not clear on which day the midnight fell such as legal contracts, insurance policies, airline flights, **00.00** is mostly avoided and **23.59** and **00.01** are used instead.

In August **1852**, Charles Shepherd built and installed his Galvano-Magnetic clock at the Royal Greenwich Observatory. This was a true **24** hour clock, built as a normal round **12-hour** clock, but with **24** numbers.

2D **(4)**

See the major topic TWO DIMENSIONAL SHAPES

3D **(4)**

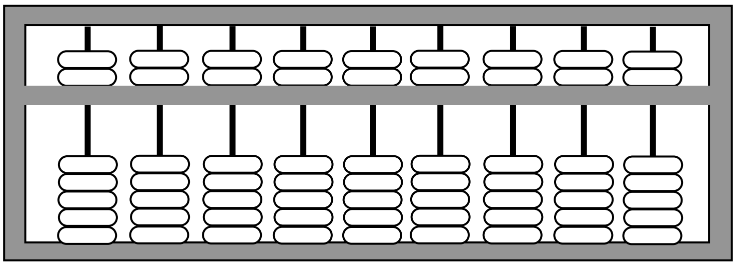
See the major topic THREE DIMENSIONAL SHAPES

A.M. **(3)**

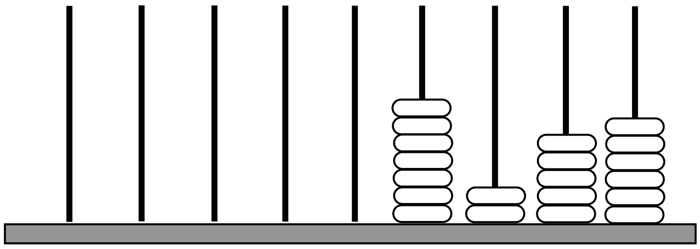
See *'12-hour clock.'*

Abacus (Plural 'Abaci') **(1)**

a) A calculating device from the east constructed of beads sliding on rods. There were several types in use over the centuries, one of which had a pair of beads and a group of five beads on each wire, the pair and group of five being separated by a wooden strip:

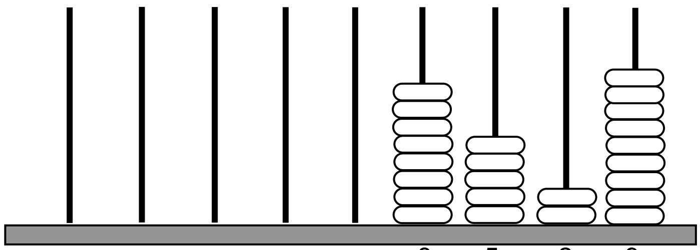


b) In classrooms today a simpler type is used in which children drop beads onto rods. The process of grouping ten beads to make one bead in the next column to the left or decomposing one bead to ten beads in the next column to the right can be clearly seen.



This abacus shows **7 256**. **7 2 5 6**

To add, say, **1 273** to this number, add put three more beads on the units wire, making **9**. Put seven more beads on the tens wire, making **12** altogether. As this is more than nine, remove ten from this wire and add one more to the hundreds wire, making **3.**
Add two more beads to the hundreds, making **5**. Finally, add one more to the thousands column, making **8**. The final total, **8 529** is now shown thus:

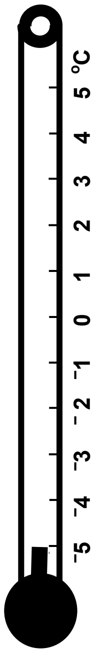


8 5 2 9

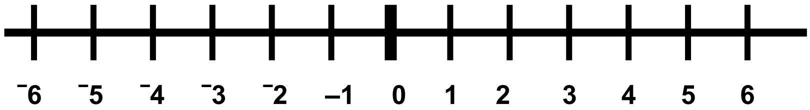
Above/below zero **(4)**

Numbers above **zero** are referred to as *‘positive’* and numbers below are referred to as *‘negative’*. We normally draw a number line from left to right which is a little confusing when trying to teach the idea of above and below zero. A thermometer placed vertically sometimes works better for above and below.

A thermometer with positive and negative temperatures.

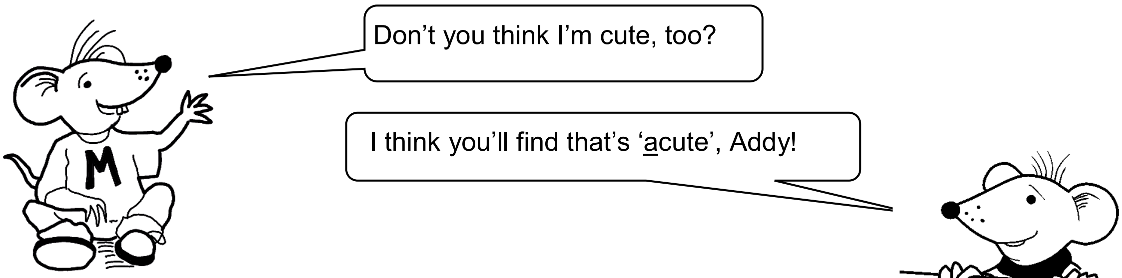


A number line with positive and negative numbers.



Acute **(5)**

An angle that is less than a right angle or $\mathbf{90^0}$.



Add **(R)**

An instruction to combine two numbers in such a way as to give the total.

Addition **(2)**

The process of combining two quantities to find the total. In the early stages the conservation of number plays a part. Children need to realize that no matter how objects are moved about, their number does not change, the extension of this being that when two numbers are added, their total remains the same no matter in which order they are added or how they are moved about.

After **(R)**

a) Refers to time as in, *‘Lunch is after breakfast’, ‘Three o’clock is after two o’clock’.*

b) Refers to numbers on a number line as in, *‘Twelve is after ten.’*

Afternoon (R)
The period following on from noon.

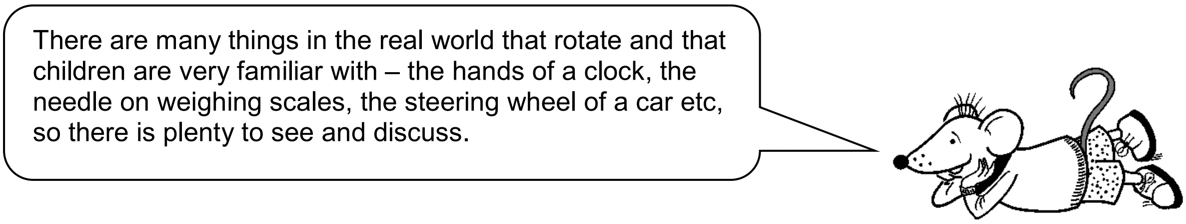
Altogether (R)
The result of an addition sum as in, *'Tom has four cakes, Julie has three. They have seven cakes altogether.'* This raises the interesting point of the abstraction of numbers from real situations. Four plus three is seven whether it seven cakes, seven cars or just plain seven. It takes a while for the abstraction from working with objects to working with pure numbers to occur. In fact, the process needs to be repeated later such as when dealing with negative numbers. Children may be very proficient with adding and subtracting positive numbers, but when they move on to adding and subtracting negative numbers they often need a practical example such as temperatures or bank balances to cling to.

Always (1)
The idea that some things always happen. *'The sun rises ever day.' 'Mrs Jones always takes the register on school days.'*

Amount (3)
Used first to indicate an amount of money – the total of all those coins and notes. Later used in all sorts of ways to indicate the amount of a rotation, the amount of liquid in a measuring cylinder etc.

Analogue clock/watch (2)
See Digital/Analogue

Angle - greater/smaller angle (3)
The most important concept children need to learn about angles is that an angle is a measure of a rotation and any way we have of referring to an angle (half turn, right angle, $\mathbf{50^0}$ etc) is simply a reference to this rotation. One angle is therefore greater or smaller than another if it represents a greater or smaller rotation.



Angle measurer (4)
A device for measuring angles. The most familiar is probably the protractor, but even this comes in two versions – the $\mathbf{180^0}$ and the $\mathbf{360^0}$ types. There are other types of angle measurers involving two arms, one of which remains stationary while the other rotates.

Anti-clockwise (2)
Rotating in the opposite direction to the hands of a clock. Later this type of rotation will be formalized in describing transformations, so it is important for children to have a good understanding of the concept of rotation and anti-clockwise at primary level.

Apart (R)
Not connected.

Approximate (3)
Often used in estimating: *'The approximate distance from the classroom to the school gate is fifty metres.' 'An approximate value for pi is* ***3****.'*

Approximately (3)
Similar to *'Approximate': 'The pupil was approximately five minutes late.'*

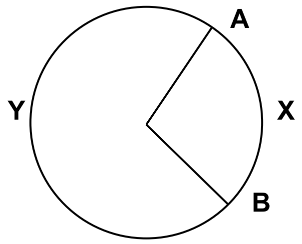
Approximately equal to (≈) (5)
It is the sign that is new here. By now children should have a good idea of the concept of *'approximate'*. How close two things need to be to be approximately equal to each other is a matter of judgement which needs refining over the years. We would probably agree that **48 + 51 ≈ 100**, but would we agree that **39 + 40 ≈ 100** ?

April (2)

See the major topic TIME.

Arc (6)

A part of a curved line, most often part of a circle.



The smaller arc from **A** to **B** via **X** is called the minor arc.
The larger arc from **A** to **B** via **Y** is called the major arc.

Area (4)

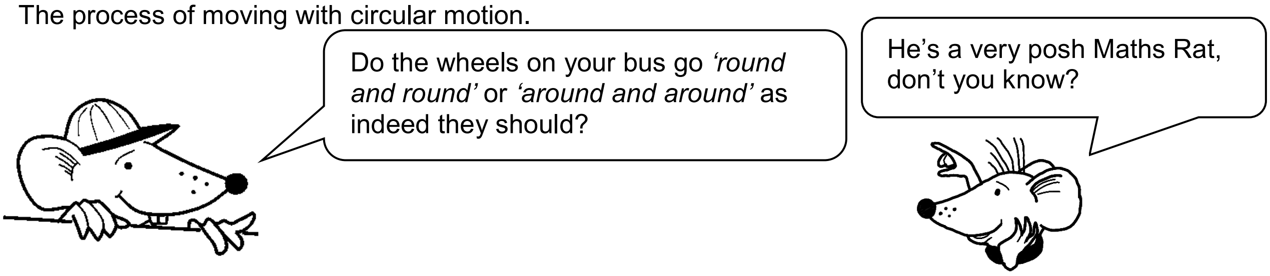
The amount of surface covered by a shape. Before we can measure an area we need to have a unit of area. This is normally defined as a square of a certain size such as the square centimetre. A square is chosen simply because it is convenient to work with, but in principle there is no reason why any other shape could not be chosen. If we were really daft, we could measure areas in circles of radius 2.7 cm.

It is very tempting, especially when time is at a premium, to simply give children some formulae for calculating areas such *'length times width', 'half base times height'*, but these can lead to disaster in later years if children do not really understand what is going on when we measure area as they get them very mixed up. When asked to find the area of a shape, they simply run through a list of formulae, calling them out until the teacher says, 'Well done!'. Big smiles all around, but no-one really knows what is going on!

It is much better to spend more time on the process of covering an area with the unit shape than to teach lots of formulae before the children are ready. Children should be able to find the area of a triangle, for example, from first principles before the process is formalized to *'half height times base'*. They should understand why the product of height and base length needs to be halved. It is only with a really good understanding of these principles that they will be able to go on to understand how to find areas of hexagons, circles etc.

Around (R)

The process of moving with circular motion.



Array (2)

A rectangular block of objects (which may be numbers) with columns and rows.
This idea is first used to develop the idea that multiplication may be performed in either order, i.e. **3 x 4** (four lost of three) is the same as **4 x 3** (three lots of four).

☺ ☺ ☺ ☺
☺ ☺ ☺ ☺ **4 x 3**
☺ ☺ ☺ ☺
3 x 4

This clearly shows that **3 x 4 = 4 x 3**

There are many other uses for arrays such as table squares and timetables.

Arrive (4)

Used initially in timetables but later in calculating average speeds etc. *'A train left Worthing at **12.45** and arrived at Brighton at **13.10** travelling a distance of **18** kilometres. What was its average speed?'*

Arrow **(1)**

a) A simple arrow used to point to positions on a number line.

b) The arrow shape. See the major topic on TWO DIMENSIONAL SHAPE.

As many as **(5)**

Used in questions on proportion.

E.g. ■■■■ ●●●● ■■■■ ●●●● ■■■■ ●●●●

'In this pattern there are as many circles as squares'

Ascend **(3)**

To go up as in ascending a ladder in the game of snakes and ladders.

Ascending order **(5)**

Numbers written in order with the smallest first.

August **(2)**

See the major topic TIME.

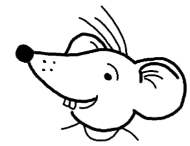
Autumn **(1)**

One of the four seasons. The main idea for children to understand is that the seasons are cyclic; it is impossible to say which is the first season and which the last.

Average **(6)**

One of the three terms: mean, median or mode.

When used in everyday language, 'average' nearly always means 'mean'.



Axes **(3)**

Plural of axis.

Axis **(3)**

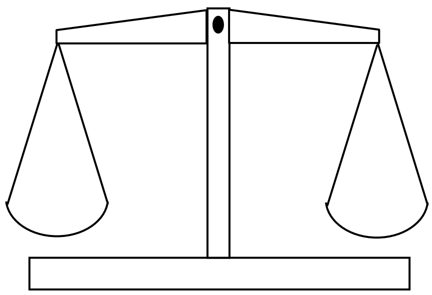
One of the lines on a graph on which the scale is placed. They should always be labelled with a suitable phrase such as '*time'* or *'days of the week'*. When no particular units are involved, the horizontal axis is normally labelled the *'x-axis'* and the vertical one the *'y-axis'*.

Axis of symmetry **(5)**

A line passing through the middle of a shape with reflective symmetry so that the half on one side is a reflection of the other half in the line. Often called the 'mirror line' or *'line of symmetry'.*

Balance **(R)**

A weighing balance, normally the type with two pans, one for the weights and one for the object being weighed.



Balances **(R)**

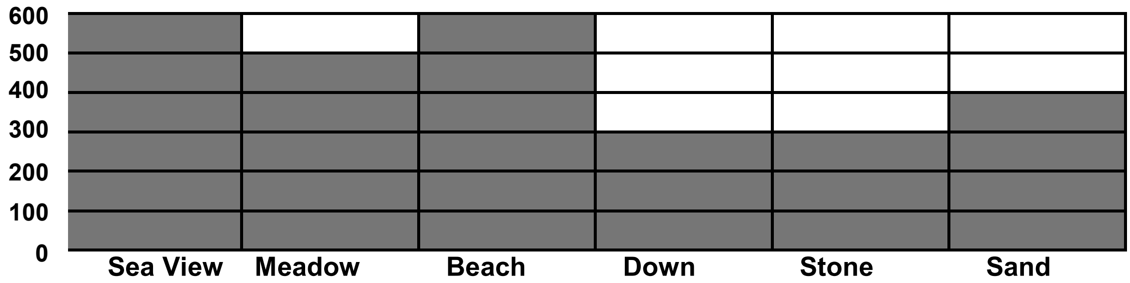
a) Refers to the situation when the mass in one pan of a balance is the same as the mass in the other and the pans are level.

b) In later life refers to the situation in which an equation balances when the value of the left side is equal to the value of the right side.

Bar chart **(3)**

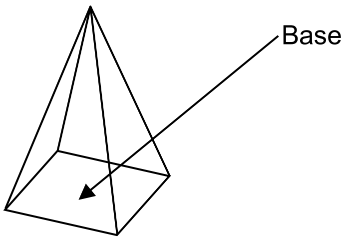
A graph in which frequency is represented by the height of a bar (or length if drawn horizontally).

EG. **Litres of Milk used by small hotels during one week.**



Base **(4)**

The bottom face on a three dimensional shape. This is a little confusing as shapes can be stood on any face, but it is normally obvious to which one we are referring (e.g. on a square based pyramid, the square face is obviously the base).



Bedtime **(R)**

One of the examples used to introduce children to the idea that we do certain activities at certain times of the day and that these times may be shown on a clock and recorded. See major topic TIME.

Before **(R)**

'Before' may be used in at least three different ways:

a) Time – one event happens before another. E.g. *'We have breakfast before going to school'*. Some things are necessarily done before others such as putting on socks before putting on shoes.

b) Number line – One number is said to be before another if it is to the left of it on the number line. This generally refers to the counting process, i.e. *'**15** comes before **16**'.*

c) Position – Used to describe the order of objects. E.g. *'In walking from the school to home, the post office comes before the supermarket'.*

Behind **(R)**

Used to indicate the positional relationship between objects, e.g. *'The computer is behind the book cupboard.'*

Also used in discussing time, e.g. *'Peter is behind Jane in the race'*.

Below **(R)**

Used to indicate the positional relationship between objects, e.g. *'The floor is below the television*'.
Also used to compare numbers, e.g. *'Vida's score was below average'*.

This is later extended to the definition of negative numbers, being those numbers below zero. See the major topic INTEGERS.

Beside **(R)**

Used to indicate the relative position of two objects. Also used to draw attention to consecutive numbers on the number line.

Between **(R)**

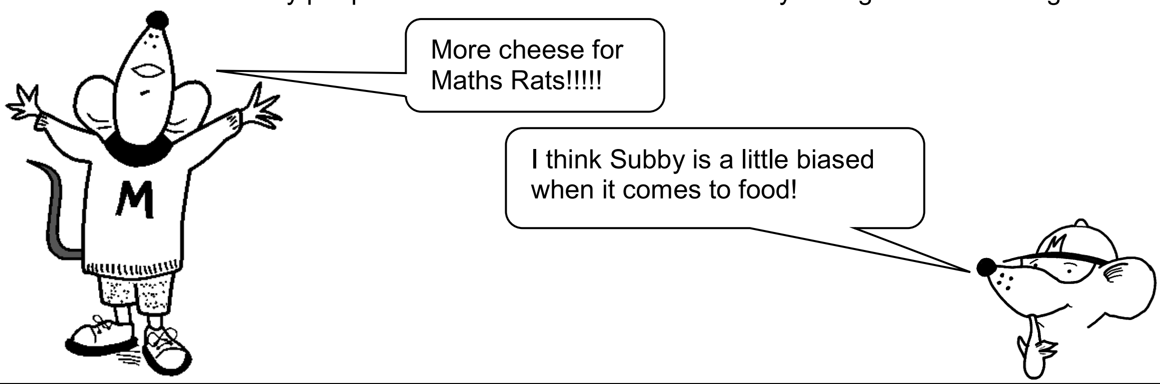
Used to indicate the relative position of three objects, one being between the other two. Also used to draw attention to consecutive numbers on the number line.

Biased **(6)**

Used when something is not considered ‘fair’. Mechanical devices that are used to generate random numbers fairly are considered biased when the numbers produced differ considerable from those expected over a long run. For example, if a normal dice is thrown we would expect roughly the same number of ones, twos etc if the dice were thrown thousands of times. A dice may be made biased by drilling a small hole in one face and inserting a small, but heavy, weight into the hole. This face will tend to land on the underside of the dice more often than is ‘fair’ and the opposite face will therefore show more often than it should.

Similarly a spinner may be biased by making some of the edges longer or shorter than others.
A roulette wheel may be biased by sloping it slightly.

A survey may also be biased and its results therefore suspect. For example, if you were to stand in a high street between **10.00 a.m**. and **1.00 p.m**. on a Thursday and ask people passing which way they would vote in a general election, you would not obtain a good indicator of how the nation generally would vote as your survey would be biased towards retired people, young mothers with babies and so on. You would not be able to interview many people who worked in an office or factory during normal working hours.



Bigger **(R)**

See major topic COMPARATIVE and SUPERLATIVE

Biggest **(R)**

See major topic COMPARATIVE and SUPERLATIVE

Birthday **(R)**

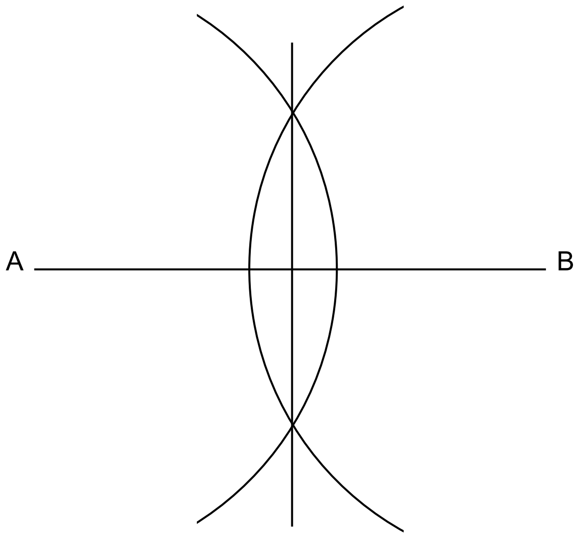
Putting dates like birthdays and Christmas Day on a calendar helps to give children an understanding of how the calendar works and the fact that it is cyclic. On non-leap years, birthdays occur one day later each year (two days for a leap year). This is because there is a remainder of one when **365** is divided by seven.

Bisect (5)

To cut in half: *'Bisect this line'* or *'bisect this angle'* are the more usual uses in teaching mathematics. It is <u>not</u> usual to refer to bisecting a number.

<u>To bisect a line at right angles.</u>

The line to be bisected is **AB**.
Open a pair of compasses to a little over half the length of **AB**



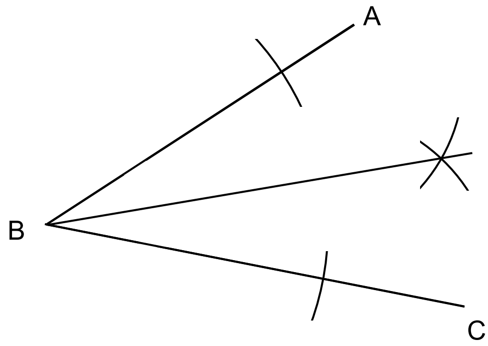
Put the compass point on A and draw an arc in the position shown.
Do not change the compass setting.
Put the compass point on **B** and draw another arc in the second position.
Join the two points where the arcs cross with a straight line.
This line cuts **AB** in half at right angles.

Notice how this construction uses symmetry – whatever we do on the left, we also do on the right.

<u>To bisect an angle.</u>

The angle to be bisected is **<ABC**.

Open a compass a few centimetres and put the compass points on **B**.
Draw two arcs on the lines **BA** and **BC**.



Put the compass point where the first arc cuts the line **BA** and draw an arc between the lines **BA** and **BA**.

Repeat from the point where the second arc cuts the line **BC**.

Draw a line from where these arcs cross to point **B**. This final line bisects the angle **ABC**.

Notice again how symmetry was used in this construction.

Block graph (2)

See *'Bar Chart'*.

Bottom (R)

Normally refers to the underside of a three-dimensional shape. Later we refer to this as the *'base'*.

Bought (2)

Past tense of *'buy'*.

Breadth (4)

Another word for width. Not used so much nowadays but still a good word for children to learn.

British Summer Time **(6)**

British Summer Time is simply Greenwich Mean Time with one hour added on. The clocks go forward at **1 a.m. G.M.T**. on the last Sunday in March and back at **1 a.m. G.M.T**. (**2 a.m. B.S.T.**) on the last Sunday in October. We do this so that in the summer everyone goes about their daily business one hour earlier and arrives home one hour earlier than in winter so that they may enjoy the longer summer evenings at home instead of in the office/school etc.

If you cannot remember which way to set your clocks simply remember *'Spring forward, fall back'* (fall = autumn).

Build **(R)**

Building with bricks etc is an activity that encourages co-ordination, a sense of balance, counting and an understanding of the shape of bricks. Children soon find that building with pyramids is not as easy as building with cubes, but can they explain why?

Buy **(R)**

The process of exchanging money for goods. Children need to understand that goods have value and coins/notes have value that may not depend on their number. Buying is matching the value of the coins/notes to the value of the goods. Money is thought to have been invented about **3 500 – 4 000** years ago. Before that (and for some time afterwards) goods were bartered, i.e. exchanged for other goods, after a good deal of haggling, no doubt.

Calculate **(2)**

An instruction asking for a calculation to be performed.

Calculation **(2)**

The process of performing an operation on numbers. There are basically two types – those involving two numbers such as addition, subtraction, multiplication and division (binary operations) and those involving just one number such as finding the square or square root of a number (unary operations).

Calculator **(5)**

A device (previously mechanical, but now nearly always electronic), used for performing calculations. There are two types: simple and scientific and they give different answers to certain sums, so you need to be careful. The difficulty arises when you chain calculations such as **4 + 6 X 5**. The simple calculator will add the **6** to the **4** and then multiply by **5**, giving **50**. The scientific calculator will know the BODMAS rule, i.e. the rule that determines that multiplication and division should be carried out before addition and subtraction. When you type this problem into a scientific calculator, it waits after you have typed in **4 + 6** to see if the next operations is going to be a multiplication or division. If it is, it calculates **6 X 5** before adding the result to the **4**, giving **34**, the correct answer.

If you can get hold of an older, mechanical type of calculator and learn how to use it, children find them fascinating.

Calendar **(3)**

Children need to understand how we divide up the year and record events that happen in any given year. See major topic TIME.

Cancel **(5)**

The operation of changing a fraction into a simpler equivalent fraction by dividing the numerator and denominator by the same number. See the major topic FRACTIONS.

Capacity **(2)**

The amount that a container will hold. Measured in the imperial system in litres, millilitres or cubic metres and in the imperial system in pints and gallons.

CARDINAL and ORDINAL NUMBERS

Many people are not aware that we use numbers in two completely different ways. When we use numbers in a cardinal sense we are referring to their actual values. This may be in an abstract sense such as **5** plus **3** equals **8** or in a measurement sense such as when referring to **4** litres of milk, a height of **150** metres or a speed of **40** Km per hour. In using numbers in the cardinal sense it is meaningful to perform operations on the numbers such as six eights are forty eight, three litres plus six litres is nine litres, a car covering **160** Km in **4** hours has an average speed of **40** km/hr.

When we use numbers in an ordinal sense we are just using them to refer to the order in which things are placed and it makes little sense to perform operations with them. In this sense, one becomes first, two becomes second, three becomes third and so on. The gold medal is given to the athlete who crosses the line first. It generally makes no sense to add up the positions in a race, for example, and conclude that a third place plus a second place is equal to a fifth place. There is an exception to this and that is when sports people are competing as a team and the average positions are used to determine which teams get the medals. In this case the ordinal numbers indicating finishing positions are then used in a cardinal sense.

Eg. In a cross country race the following positions were achieved by members of three teams:

Name	Team	Position
J Peters	**B**	**3rd**
A Cooper	**A**	**6th**
M Kilroy	**B**	**12th**
H Corbett	**C**	**18th**
L Young	**C**	**20th**
T Fredericks	**B**	**22nd**
R Williams	**A**	**27th**
G Friedman	**B**	**29th**
K Lipman	**C**	**35th**
G Davenport	**A**	**38th**
A Sandel	**A**	**40th**
S Town	**C**	**44th**

Here the numbers are used in an ordinal sense.

Which team performed best based on their finishing position?

Find the average of the positions of the members of each team:

Team **A**: Average = **(6 + 27 + 38 + 40) ÷ 4 = 27.75**

Team **B**: Average = **(3 + 12 + 22 + 29) ÷ 4 = 16.5**

Team **C**: Average = **(18 + 20 + 35 + 44) ÷ 4 = 29.25**

Here the numbers are used in a cardinal sense.

Team B therefore performed the best of these three teams.

Other uses for ordinal numbers include house numbers, receipt numbers and a person's position in a queue such as in a doctor's surgery or at a deli counter.

Carroll diagram **(3)**

See Venn and Carroll Diagrams.

Centilitre **(6)**

One hundredth of a litre. See the major topic METRIC SYSTEM for more details.

Centimetre **(2)**

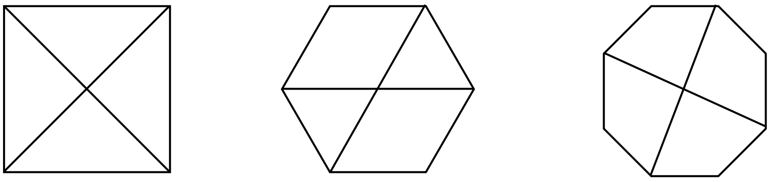
One hundredth of a metre. See the major topic METRIC SYSTEM for more details.

Centre **(1)**

The middle of an object or shape. This can refer to the centre of both two- and three- dimensional shapes. In particular, children should know how to find the centres of squares and circles and, later, hexagons, octagons etc.

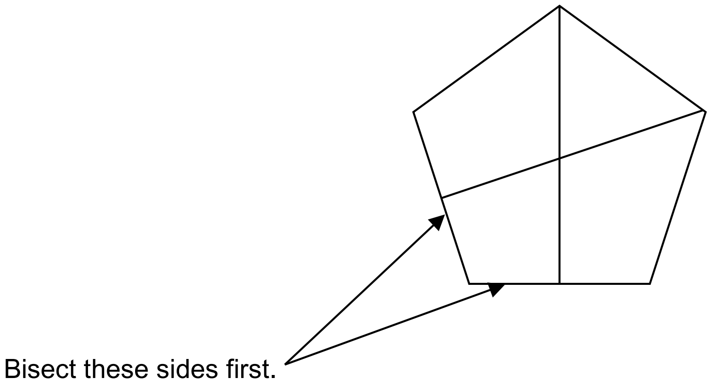
Finding the centre of a regular polygon with an even number of sides.

Simply draw two diagonals, each from one vertex (corner) to the opposite vertex thus:

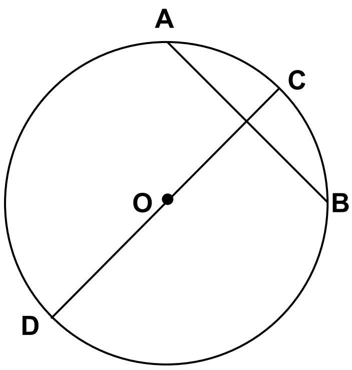


Finding the centre of a regular polygon with an odd number of sides.

Bisect two sides using ruler and compass (see ‘bisect’). Join the centre of these sides to the opposite vertices thus:



Finding the centre of a circle.



Draw a chord **AB** between any two points on the circle. Bisect this line at right angles using ruler and compass to obtain the line **CD**. Now bisect **CD** using ruler and compass to obtain the centre **O**.

Century **(3)**

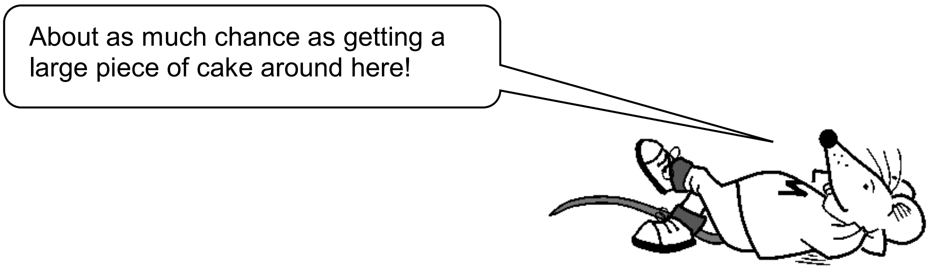
One hundred years. See the major topic on TIME.

Certain **(5)**

Used in probability to indicate that something must happen. E.g.*’ If I throw a normal dice, it is certain that I will get a number one, two, three, four, five or six.’*

Chance **(5)**

Another word for probability. E.g. *'What are the chances of tossing a coin five times and getting at least three tails?'*



Change **(R)**

Refers to the change given in money problems.

Chart **(3)**

A diagram presenting information in the form of a table or graph.

Cheap **(R)**

Inexpensive. Learning the relative value of things and using judgement to decide whether something is dear or cheap.

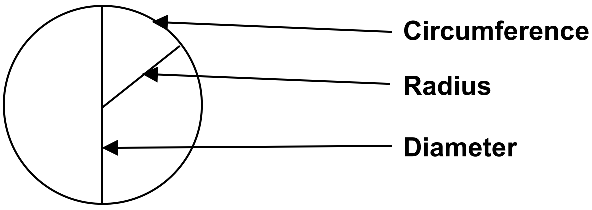
Cheaper **(R)**

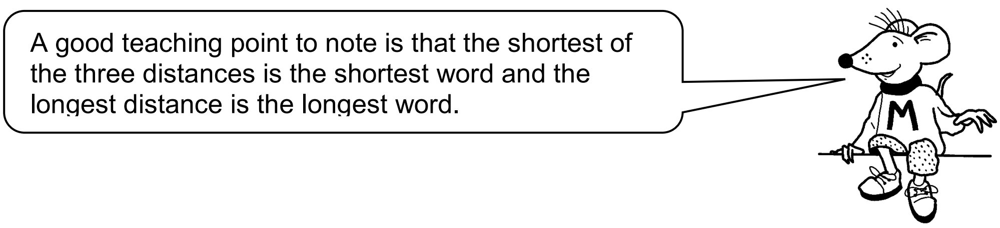
See major topic COMPARATIVE and SUPERLATIVE

Circle **(R)**

A two-dimensional shape, every point of which is the same distance from a fixed point (the centre).

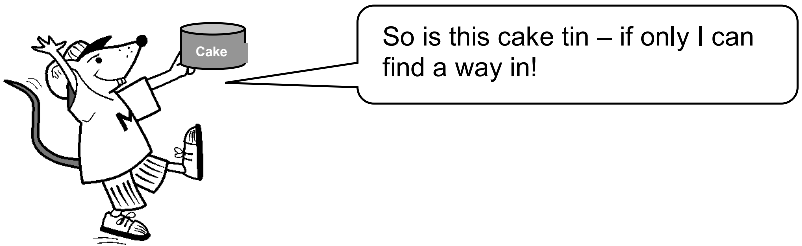
Three related terms are *'radius'* (the distance or the line from the centre to any point on the circumference), *'diameter'* (the distance or the line from one point on the circumference to the opposite point passing through the centre) and *'circumference'* (the curved line or the distance around the circle).





Circular **(2)**

An adjective that describes an object that has the basic form of a circle. *'This coffee pot lid is circular in shape.'*



Circumference **(6)**

The distance around the outside of a circle. Approximately three times the diameter (**π = 3.14159…** times to be more precise). See *'Circle'*.

Classify **(4)**

Group together according to certain rules. Shapes may be classified according to the number of sides or faces, toys may be grouped according to colour and numbers may be grouped according to whether they are multiples of seven, prime or factors of sixty, for example.

Multiple classifications are possible such as finding numbers that are prime and factors of sixty. These may be illustrated on a Carroll or Venn diagram.

Clear key **(5)**

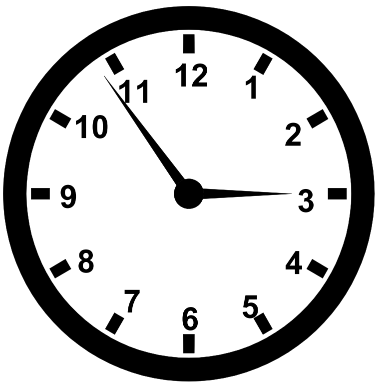
This is a confusing term as there are normally two clear keys on a calculator, one that clears the whole calculator as though you had just turned it on and one that clears the last entry so that small mistakes may be corrected without having to re-type a whole column of number, for example.

The key that clears the whole calculator is often called the '**All Clear**' key and is labeled '**AC'**, but is sometimes labeled just '**C**'. The key that clears the last entry is sometimes labeled '**CE'** but is sometimes also labeled just '**C**'. To confuse matters further, on some calculators one key (which is often labeled '**C→CE**' or similar) is used for both. One press clears the last entry and two presses clear the whole calculator.

It really is time manufacturers standardized these two function as AC and CE or something equally clear. Until that time I am afraid you will just have to read the instructions to see which key does what.

Clock **(R)**

A device for telling the time. There are two types: analogue clocks and digital clocks. Analogue clocks are the older type with a circular numbered dial over which the hands move. Digital clocks are the modern type with a panel showing just numbers.



Analogue Clock

Digital Clock

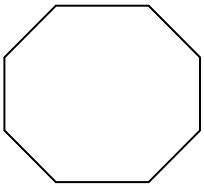
Digital Clocks can show <u>**12 hour**</u> or <u>**24 hour**</u> time.

Clockwise **(2)**

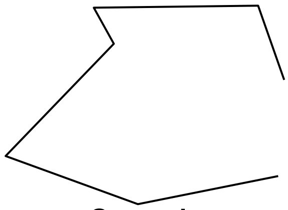
Rotating in the same direction as the hands of a clock. Later this type of rotation will be formalized in describing transformations, so it is important for children to have a good understanding of the concept of rotation and clockwise at primary level.

Closed **(4)**

A shape (often a polygon) that encloses a space, i.e. has a definite inside and outside.



Closed shape



Open shape

Coin **(R)**

One of the system of coins in everyday use. It is important for children to learn that coins have value irrespective of their physical size, colour etc.

Column **(2)**

Rows and columns as used in an array such as a table square. Columns run from top to bottom like the columns in the old Greek or Roman buildings; rows run from left to right as do the seats in a cinema.

Column

Row

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100

COMPARATIVE and SUPERLATIVE

Mathematics is full of interesting vocabulary and a good knowledge of how it all works makes our study of mathematics all the more interesting and precise.

People often use adjectives to describe objects, but sometimes use them incorrectly when comparing one object with another or others.

Most adjectives have a comparative and superlative form. The comparative is used when comparing <u>two</u> objects and the superlative when comparing <u>three or more</u> objects. It is important to teach children this difference early on.

E.g.

Adjective	Comparative form	Superlative form
big	bigger	biggest
wide	wider	widest
tall	taller	tallest

Correct sentences: Graham is bigger than his brother. (Comparing two)
Mary is the tallest in her class. (Comparing more than two)

Incorrect sentences: I measured the height of Massoud and Reza. Reza is tallest.
Josephine has the greater amount of pocket money in her class.

This system can be extended to comparisons of groups. The trick is to think of a group as one object.

Correct sentences: We measured the masses of boys and girls in the class. The boys were heavier. (Comparing two groups)
We studied how people came to school. The number that came by car was greatest. (Comparing more than two groups)

Incorrect sentence: Those that went to the fete had the greatest fun.
(Should be 'greater' since there are two groups – those that went and those that did not)

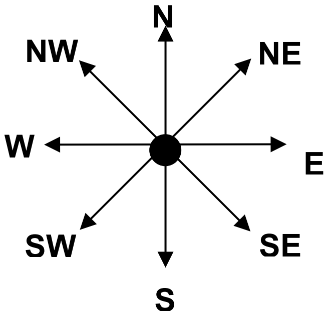
Compare (R)

Children compare an enormous number of things in their world – colours, shapes, number of sides, how high they can jump and so on. The trick is to use these opportunities to develop their linguistic skills and understanding of mathematical terms. For example, when comparing heights jumped, do not be satisfied with the fact that one person jumped higher than another, but discuss the heights in centimetres and how much higher one jumped than the other.

COMPASS POINT

A direction on a compass relative to the North direction. There are, of course, two North Poles, the Geographic North Pole and the Magnetic North Pole. The Geographic is the point where the Earth's axis of spin meets the surface of the Earth and does not move over very long periods of time. The Magnetic is currently situated at a point north of Canada and does move at varying speeds over much shorter time scales. A magnetic compass will, of course, point to the Magnetic North Pole, but for us here in the UK the difference in direction between the Magnetic and Geographic North Poles is a very small angle that need not concern children of primary age.

The compass points children need to know are the eight shown in the diagram below:



Compasses (pair of) **(4)**

The traditional tool for drawing circles, but somewhat dangerous in the wrong hands. Consequently new circle drawing devices have been developed that are much safer. When using the traditional pair of compasses it is a good idea to fix the pencil so that the metal point is level with the pencil point when the compasses are in the closed position.

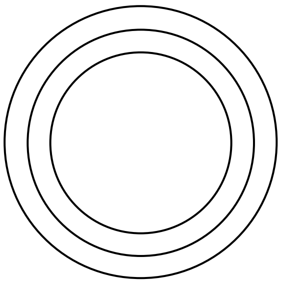
Concave **(4)**

Used to describe a shape that curves inwards, like the inside surface of a mug.
Some mirrors are concave shaped. In this sense it is the opposite of convex.

Concentric **(6)**

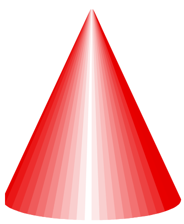
Two or more shapes are said to be concentric if they are of the same shape but different sizes and their centres are in the same place.

E.g. Concentric circles:



Cone **(R)**

A three dimensional shape with a circular base and curved sides reaching a point above the base (often above the centre of the base, but not necessarily).



Congruent **(5)**

Two shapes are congruent if they are exactly the same shape and exactly the same size. In other words, one will fit exactly over the other.

Consecutive **(4)**

Used when one item follows another in a sequence. Can be used for any well defined sequence such as days of the week (Wednesday, Thursday and Friday are consecutive days), but more commonly used for numbers:

E.g. *'**6, 7, 8** and **9** are consecutive integers .'*
*'**5, 7, 9, 11**, and **13** are consecutive odd numbers.'*
*'**17, 19, 23** and **29** are consecutive prime numbers.'*

Constant **(5)**

Generally, a number that does not change. E.g. *'Find the value of* $x^2 + 6$ *when* $x = 1, 2, 3, 4$ *and* **5**. *In this case* **6** *is a constant because it is always added to* x^2*, no matter what value of* x *is chosen'.*

More specifically, it refers to a number that is added repeatedly in a calculator.

Construct **(4)**

Used as an instruction to draw a shape with pre-defined measurements:
E.g. *'Construct a triangle with two sides **6.5 cm** long and the third side **4.7 cm** long.'*

Container **(R)**

Any shape that will hold fluid or solids.

Contains **(2)**

Used to mean *'is held within.'*

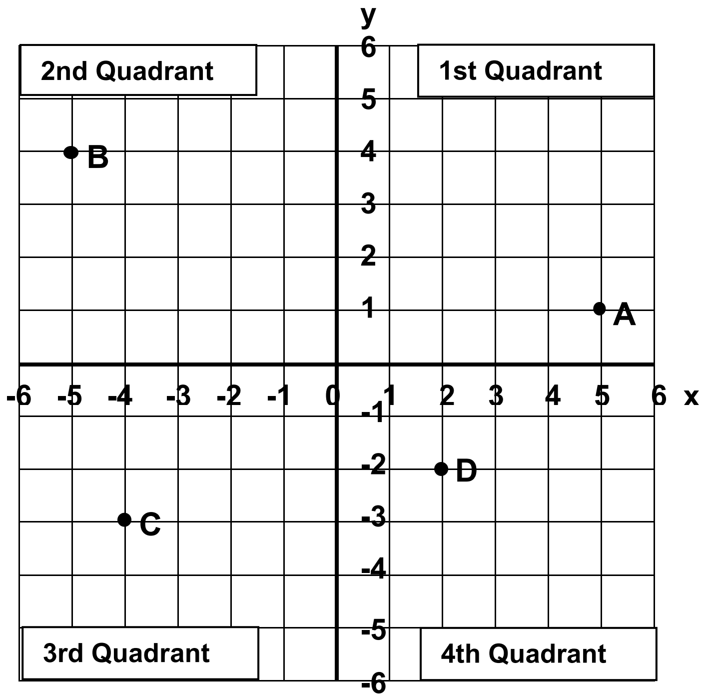
Convex **(4)**

Used to describe a shape that curves outwards, like the outside surface of a mug or ball. Some mirrors are convex shaped. In this sense it is the opposite of concave.

Co-ordinates **(4)**

A system used to specify a point on a grid. Each point is given two numbers (which may be fractions or decimals). These are distances from a set of axes and are written in round brackets with the horizontal distance first and the vertical distance second. The numbers are separated by a comma.

Each quarter of the grid is called a quadrant and these are numbered starting with the top right quadrant and moving in an anti-clockwise direction.



Point **A** has co-ordinates **(5, 1)**. Point **B** has co-ordinates **(–5, 4)**.
Point **C** has co-ordinates **(–4, –3)**. Point **D** has co-ordinates **(2, –2)**.

These axes have been labelled **x** and **y**, but any suitable letters may be used.

In simpler applications, only the 1st quadrant is used.

Corner **(R)**

A place where two or more edges meet.

Count (Counting) **(R)**

a) The practical process of applying a one-to-one correspondence between the objects being counted and the numbers being used to count. Children need to learn several things before they can count properly:

(i) The number of objects is always the same regardless of how they may be arranged (conservation of number).
(ii) The number of objects is always the same regardless of the order in which they are counted.
(iii) The sequence of numbers **1, 2, 3, 4, 5**, etc
(iv) The fact that the 'number' of objects is the last number used when counting them.
(v) Each object is counted once and only once.

This is quite a lot to master. Later we ask children to count objects in twos by counting them in pairs (or threes etc).

b) The process of counting in a vacuum, i.e. without any objects. This is done to reinforce their understanding of the number sequence and can sometimes be done using songs (*'One, two, three, four, five, once I caught a fish alive…'*). We also ask children to count in ones, twos, fives etc without objects to count.

Count back from **(R)**

An introduction to the method of subtraction in which children count back the number to be taken away.

Count on from **(R)**

An introduction to the method of addition in which children count on the number being added.

Cube **(R)**

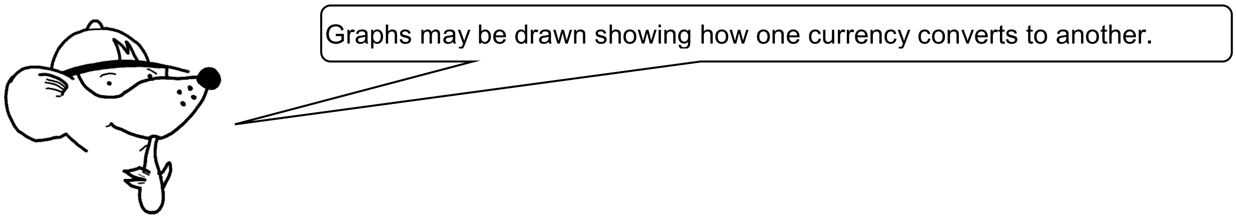
A three dimensional shape with six square faces. See the major topic THREE DIMENSIONAL SHAPES

Cuboid **(1)**

A three dimensional shape with six rectangular faces. A cube is a special case of a cuboid in which all the edges are equal in length. See the major topic THREE DIMENSIONAL SHAPES

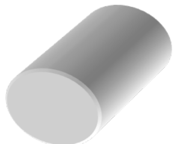
Currency **(5)**

It is important for children to realize that the British pound is only one of many currencies in the world and that the exchange rates vary on a daily basis. Familiarity with the Euro and US Dollar are probably the most important to know for obvious reasons, but it would be good for children to be familiar with currencies from any countries in the world, especially for those from which some members of the class may originate.



Cylinder **(1)**

A three dimensional shape made with circular ends and a curved surface between them.



Cylindrical **(4)**

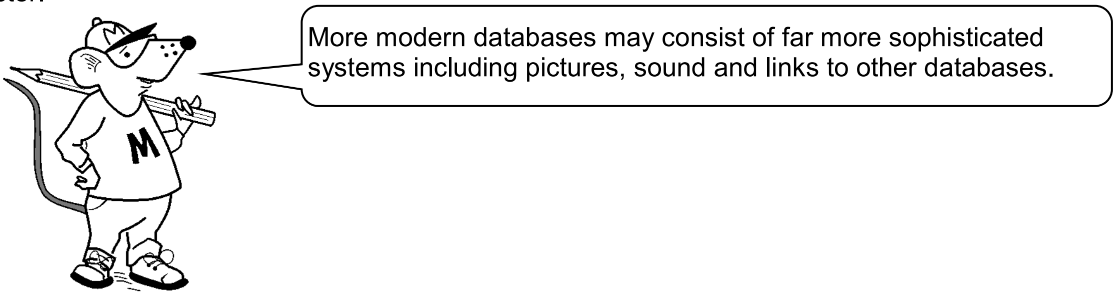
Shaped like a cylinder. *'The package was cylindrical in shape'.*

Data **(4)**

Data is the group of individual items collected in a survey or as the result of an experiment etc. Information is what results when this data is organized in some meaningful way, such as finding averages or ranges, or drawing graphs.

Database **(5)**

A simple database consists of individual records (all the information collected about a particular person or object) subdivided into fields and further subdivided into characters. For example, a databases of addresses has each address as a record, each line of the address as a field and each letter as a character.

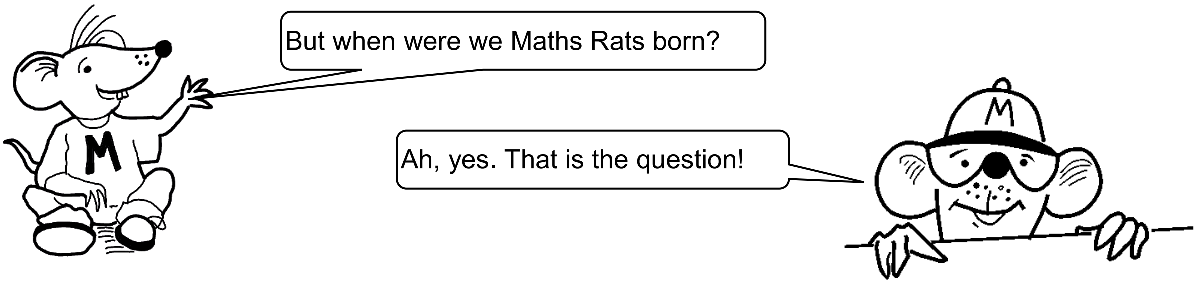


Date **(3)**

A particular day of the calendar. Children need to understand that there are several ways of writing dates: **23rd June 2001, 23.6.2001, 23.06.01, 23/06/01** etc.

Date of birth **(4)**

Part of the process of learning that things have order that may be recorded. It is then possible to work out sums involving these such as, *'How many days is it from Sarah's date of birth to Ahmin's date of birth'.*



Dear **(R)**

Expensive. Learning the relative value of things and using judgement to decide whether something is dear or cheap.

Dearer **(R)**

See major topic COMPARATIVE and SUPERLATIVE

December **(2)**

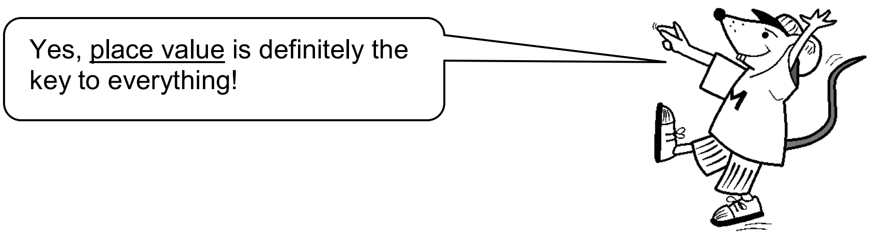
See the major topic TIME.

DECIMAL SYSTEM

It is a simple fact that our modern decimal system we use every day is one of the greatest inventions of mankind and it is important for children to appreciate that it is both an invention and great. Without it much of what we know today would not exist. The decimal number system makes it easy to trade, to do engineering calculations, to build computers and to translate sounds into numbers to give us the modern hi-fi digital world in which we live.

To appreciate this fact we need look no further than the Roman number system. The Romans built a large empire and took under their control some of the greatest minds of the time. They gave us roads, house building techniques, aqueducts and a thousand other useful ideas. What they did not give us, however, were any great developments in mathematics and this was largely due to their clumsy number system.

The invention of the modern system changed all that – so what is it about our system that makes it so productive? The answer can be given in just two words – Place Value.



This is the idea that the value of a particular digit is mainly determined by its position in a number and its position can be anywhere from infinity to the left to infinity to the right of the decimal point (although we rarely attempt to push the system to those extreme limits!).

Every operation may be performed anywhere in the number without having to change the rules. **5 + 2** gives **7** no matter whether we are talking about **5** units and **2** units or **5** millions and **2** millions or **5** thousandths and **2** thousandths.

So let us have a look at some important ideas involved in the decimal system.

Firstly, every number has a decimal point which is always placed to the right of the units column. In practice it is not always necessary to include it, but as soon as children are taught about the decimal point, they should also be taught that every number has one.

Secondly, every number floats in a sea of zeroes extending to infinity in both directions even though we don't write all these zeroes in practice. For example, **45.7** can be written as
….0000000000000000045.700000000000….

Teaching children this emphasises to them that the place value columns are still there even though we never use them all and also helps when multiplying by powers of ten. E.g. **36 x 1000 = 36 000**. Where did those zeroes come from? If we think of **36** as **…000000000036.000000000….** and we move the digits three places to the left, it is easy to see where the zeroes came from.

All the familiar positions in a number have a name. The names are usually written with an upper case letter to the left of the decimal point and with a lower case letter to the right.
The term 'billion' has caused some confusion over the years because in Britain it meant **1 000 000 000 000** i.e. a million million whilst in the U.S.A. it meant **1 000 000 000** i.e. a thousand million. Today we normally use the American version on both sides of the Atlantic. This has also affected the meaning of the term 'trillion' which is now taken to be the old British billion.

Billions	Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Units		tenths	hundredths	thousandths
3	**4**	**7**	**2**	**6**	**8**	**5**	**9**	**4**	**6**	**.**	**5**	**8**	**3**

This display shows all the places children will eventually need to know. This number is:
Three billion, four hundred and seventy two million, six hundred and eighty five thousand, nine hundred and forty six point five eight three.

Notice that when reading the decimal part, we just give the digits in order. This prevents confusion when two numbers have a different number of decimal digits and we wish to compare them. E.g. **0.83** and **0.237**. If we were to say 'zero point eighty three' and 'zero point two hundred and thirty seven', it would sound as though the second number is larger, which, of course, it is not.

Another great advantage of the decimal system is that to multiply by ten we simply move all the digits to the left one place, two places to multiply by a hundred and so on. To divide, we move one place to the right for division by ten, two places for division by a hundred and so on. When multiplying a whole number by ten the digits move one place to the left and a zero from the right of the decimal point moves left to cross over the point and fill in the gap. In the early stages (before children have come across decimals) all you need to say is that the units column is left empty and so we fill it in with a zero.

Under no circumstances say to your children:

a) 'The decimal point moves to the left or right'. (Since the decimal point is always between the units and tenths columns, how can it move?)

b) When you multiply by ten 'add a nought'. This causes great confusion later when decimals are multiplied by ten e.g. **3.2 x 10** is not equal to **3.20** !

At all times emphasize the movement of the digits to the left or right as appropriate when multiplying by ten, a hundred etc.

Decimal (4)

The part of the number which is to the right of the decimal point.

Decimal fraction (4)

Another name for *'decimal'*. This emphasizes the fact that decimals are really fractions of a whole written in a special way e.g. instead of $^3/_{10}$ we write **0.3** .

Decimal place (4)

A digit in the decimal part of the number. E.g. the number **45.238** has three decimal places.

Decimal point (4)

The *'dot'* that separates the whole number part from the decimal part.

Decrease (4)

To reduce in size. Can be used for numbers (*'Decrease **25** by **10**', 'Decrease **40** by **10%**'*) or for shapes (*'Decrease this shape in size by **50%**'*).

Deep (R)

a) The depth of a liquid or something below the liquid's surface such as a fish.

b) The distance from the front of an object (normally a piece of furniture such as a kitchen unit) to the back. E.g. 'kitchen units are now **600 mm** deep'.

Degree (4)

A small measurement of angle or turn. **360°** make one complete turn, so **90°** make a quarter turn or right angle. Protractors are marked in degrees. Some years ago there was an attempt to introduce a metric degree by which **100** made a right angle. These were called *'grads'* and are still seen on some scientific calculators, but never caught on.

Denominator (5)

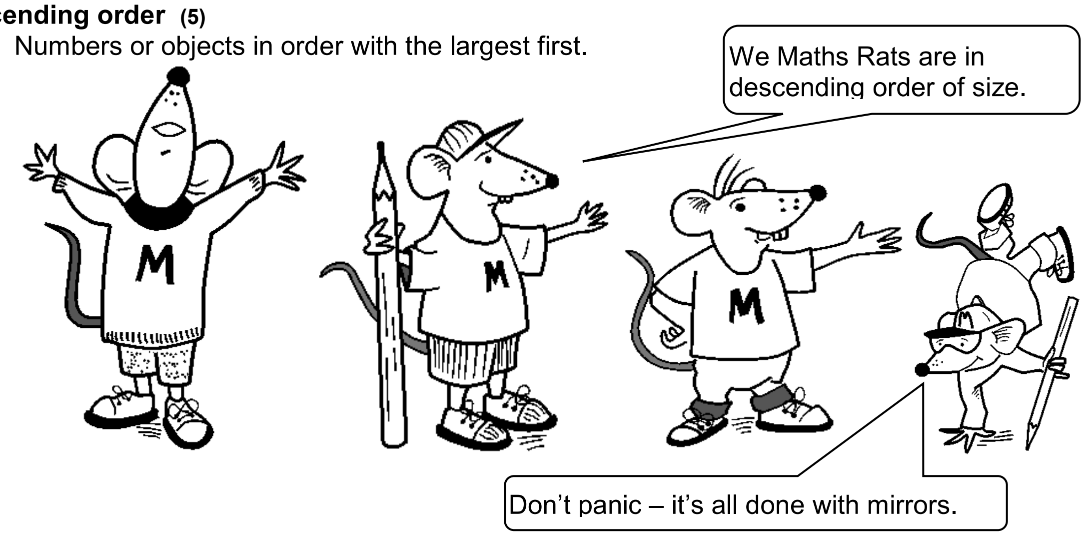
The bottom number in a fraction. The upper number is the numerator. See the major topic FRACTIONS.

Depart **(4)**
To leave. Used mainly in timetables.

Depth **(R)**
The noun of *'deep'*.

Descend **(3)**
To go down as in descending a snake in the game of snakes and ladders.

Descending order **(5)**
Numbers or objects in order with the largest first.



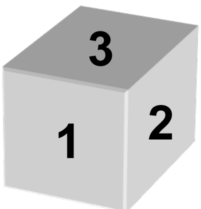
Diagonal **(3)**
A line drawn from one corner to another of a two dimensional shape or from one vertex to another of a three dimensional shape.

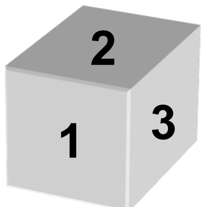
Diameter **(4)**
The distance or the line from one side of a circle to the other, passing through the centre.

Die, dice **(R)**
Strictly speaking, *'dice'* is the plural of the word *'die'*, a cube showing six numbers, one on each face, but not many people seem to know that, so over the years the word 'dice' has been taken to mean a single die as well as many dice. As only mathematics teachers seem to be concerned about this, there seems little chance of reverting to the correct usage of these words.

Dice are also used in games such as snakes and ladders and children should play these games often because, not only do they give practice in counting, they also give a feel for the generation of random numbers which will be useful later in life when they study probability.

Of course, any six numbers may be placed on a dice and it is possible to obtain dice with even numbers, positive and negative numbers etc for use in mathematics lessons. Despite this, the vast majority of dice are produced with the numbers **1** to **6**, but these are not placed randomly. The rule that is in common use is that the numbers on opposite faces of a dice add up to **7**. Surprisingly, there are only two ways of doing this and we can see the difference if we look at one corner of the dice:





In the left dice the numbers increase from **1** to **3** in an anti-clockwise direction. This is known as a left handed dice. In the right dice they increase in a clockwise direction. This is known as a right handed dice. Any dice that obeys the rule that opposite faces add up to **7** may be held in this way to see if it is a left handed or right handed dice. Most commercially produced dice are left handed.

Difference between **(R)**

How many you need to add one number to arrive at another. E.g. the difference between **5** and **18** is **13**. When children first encounter the concept of 'counting on', they want to count the starting number as the first and get an answer which is one too big. They need to be taught that the first number is the starting position and the first number to be counted is the next number.

E.g. *' What is the difference between **4** and **8** ?'*

4 5 6 7 8

Starting point First number to be counted

Digit **(1)**

One of the number **0** to **9** as in *'The number **462** has three digits', 'The fifth digit in **84.38742** is **7**'* and, in secondary mathematics, *'The most significant digit in **63.82** is **6**'*.

Digital/analogue clock/watch **(2)**

As far as young children are concerned, the difference between a digital and an analogue clock or watch is simply that a digital clock has only numbers and an analogue clock has hands that rotate over a numbered scale (normally **1 – 12**, but not always). (See 'Clock' for illustration).

If, however, you are interested in a more technical definition, please read on.

The word analogue is used to describe an object or system which imitates in some way a completely different concept. For instance, the older type of voltmeter with a moving needle shows the voltage connected to it and can move left or right over a numbered scale as the voltage changes. The reading on the scale is not the voltage, but it imitates it in a rather clever way so that we can 'see' the level of voltage being applied. Similarly, the mercury in a thermometer moves up and down as the temperature rises and falls. Again the height of the mercury is not the temperature, but imitates its value and variation. We say the movement of the voltmeter needle is an 'analogue' of the voltage changes and the level of the mercury is an 'analogue' of the temperature changes.

The same applies to a clock, that is the type with a nice round face and moving hands. As the time passes, the hands move around in a corresponding way and enables us to measure the passing of time and say what time of day it is. The snag is that the passing of time is a continuous and smooth happening and so the movement of the hands must be equally smooth. Some clocks do have smoothly moving hands and so are pretty close to proper analogue devices, but some have second hands that 'click' over every second or even minute hands that 'click' over every minute. Strictly speaking, therefore, these are not analogue clocks, but digital – a word used to describe a system in which the measurements are divided into discrete steps with nothing in-between.

But we do not recommend that you try to explain this subtle difference to seven year olds.
Life's a funny thing!

Direction **(R)**

Directions allow a route to be shown in several ways: left, right, up, down etc and the points of a compass. Giving directions to go to the shops or from school to home is good practice. See the major topic COMPASS DIRECTION.

Discount **(5)**

An amount that has been deducted from the original price of an object. It may be given in several ways: the discount in money (*'**£5.00 discount**'*), in percentages (*'**30% discount**'*) or as a fraction (*'**one quarter off!**'*). Often today we see bargains such as *'**three for the price of two**'* which are discounts in disguise.

Display **(5)**

The part of a calculator in which the questions and answers are displayed as we type them in.

Distance apart, between, to, from (3)

In simple cases, distance between two objects is normally given as the shortest distance (as the crow flies). When this is not the case (such as the distance between towns along existing roads) this fact should be stated if it is not already clear from the context. (London to Brighton is **100 Km** along the A23 and M23 etc).

Distribution (6)

The way data is spread over a range of values. E.g. *'The number of people that obtained between **1** and **10** marks, **11** and **20** marks, **21** and **30** marks etc in a test'*.

Divisibility (5)

The idea that one number will divide exactly into another. There are some divisibility tests with which children should be familiar:

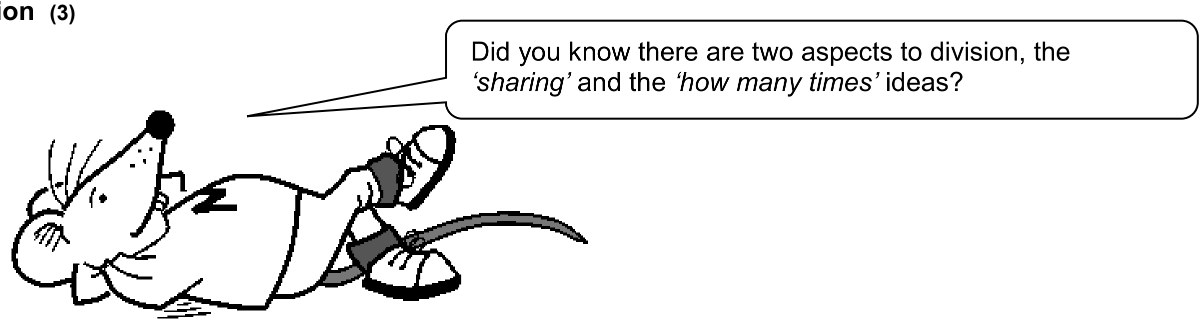
A number is divisible by **2** if the last digit is divisible by **2** (even).
A number is divisible by **4** if the last two digits are divisible by **4**.
A number is divisible by **8** if the last three digits are divisible by **8** etc.
A number is divisible by **3** if the sum of the digits is divisible by **3**. E.g. **276** is divisible by **3** because **2 + 7 + 6 = 15** and **15** is divisible by **3**.
A number is divisible by **9** if the sum of the digits is divisible by **9**.
A number is divisible by **5** if the last digit is **0** or **5**.
A number is divisible by **10** if the last digit is **0**.
A number is divisible by **100** if the last two digits are **00** etc.

Some combinations are possible such as:
A number is divisible by **6** if the last digit is even and the sum of the digits is divisible by **3**.

Divisible by (4)

The fact that one integer will divide exactly into another integer with no remainder.

Division (3)



With the *'sharing'* idea, we take a number of objects and share them between a number of people and see how many they receive each. E.g. divide **12** by **4** is seen as sharing twelve objects between four people. They receive three each.

With the *'how many times'* idea, we see how may times one number may be subtracted from the other until there is nothing left. E.g. divide **12** by **4** is seen as seeing how many times we can take three from twelve until there is nothing left. The answer is obviously three.

Dodecahedron (6)

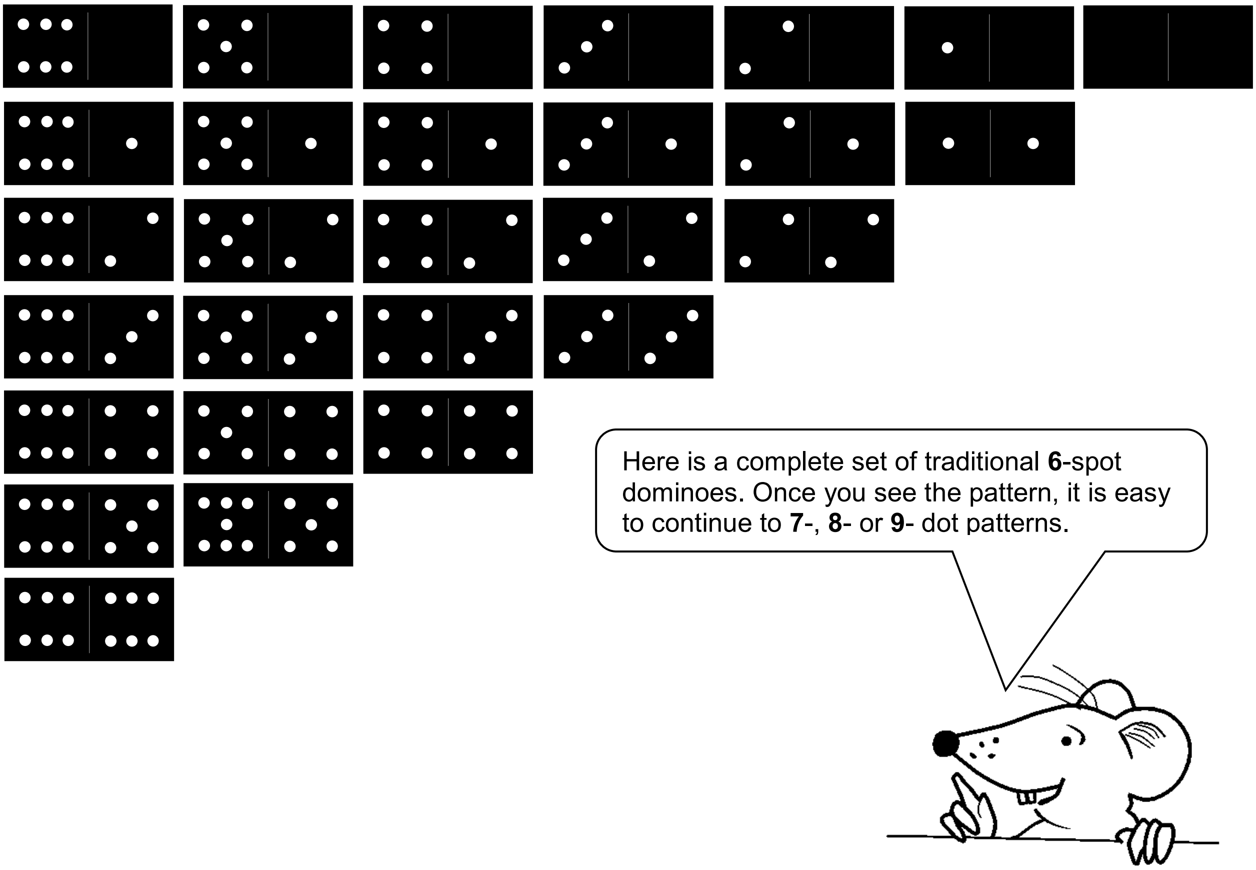
A three dimensional shape made from twelve pentagons. See the major topic THREE DIMENSIONAL SHAPES.

Dominoes **(R)**

Great game to encourage counting and matching. Children should play a lot more of these games. When children are young, the traditional type of dominoes should be used, but later you can make up your own to match, for example, multiplication sums with the answers. On one square you write **3 X 4** and on another square on a different domino, you write **12** or **2 x 6**. It is not difficult to build a complete set of dominoes which can be used to play according to the usual rules.

Other options include equivalent fractions, fraction sums such '**2 x ¾'** , percentages to fractions etc.

But dominoes have another use altogether. The arrangement of dots provides a good opportunity for investigation. In most parts of the UK people play with dominoes with a maximum of six spots, but in some parts of the country people play with dominoes with a maximum of nine spots. There are **28** dominoes in the first set and **45** in the second. Both of these are triangle numbers. Would that always be the case, regardless of what the maximum number of spots was or is it just a coincidence?



Doubt **(5)**

To have a feeling the probability of something happening is less than **50%** or significantly less than **50%**, depending on your point of view – there is no formal definition. E.g. *'I doubt if you could throw three dice and obtain at least two sixes.'*

Earliest **(3)**

The first to happen in a group of events. E.g. *'The earliest iron-hulled, propeller-driven ship was the SS Great Britain.'*

East **(3)**

See major topic COMPASS POINT.

Edge **(4)**

A line from one corner or vertex of a shape to another. See the major topic THREE DIMENSIONAL SHAPES.

Eighth **(4)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.

b) One eighth as a fraction: $^{1}/_{8}$. One whole divided by eight.

Eleven **(1)**
See the major topic CARDINAL and ORDINAL NUMBERS.

Eleventh **(1)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.

b) One eleventh as a fraction: $^{1}/_{11}$. One whole divided by eleven.

Enter key **(5)**
The key on a calculator or computer keyboard that signals the end of an entry.

Equal chance **(6)**
When things have the same probability of happening. E.g. *'There is an equal chance of obtaining a head or a tail when a coin is tossed', 'There is an equal chance of obtaining any of the numbers on a normal dice when it is thrown'.*

Equal groups of **(2)**
An introduction to the idea of division by dividing a number of objects into equal sized groups.

Equal parts **(2)**
Parts of the same size.

Equal to **(1)**
When one part is the same size as the other. This may be as simple as **2 x 3** equals **6** or more complicated such as equivalent fractions: $^{4}/_{5} = {}^{36}/_{45}$

Equally likely **(6)**
When things have the same probability of happening. E.g. *'There is an equal chance of obtaining a head or a tail when a coin is tossed', 'There is an equal chance of obtaining any of the numbers on a normal dice when it is thrown'.*

Equals **(1)**
See *'Equal to'*.

Equals sign (=) **(1)**
The sign used to indicate equality.

Equation **(3)**
A mathematical sentence in which symbols on the left and symbols on the right are separated by an equals sign. Sometimes it is written to indicate a sum and an answer such as 5 x 4 = 20 and sometimes to indicate a relationship with an unknown that needs to be found, a process called 'solving the equation', such as **2x + 5 = 17**.

Equilateral triangle **(4)**
A triangle with three equal sides and three equal angles. See the major topic TWO DIMENSIONAL SHAPES

Equivalent **(5)**
Equivalent fractions are fractions that look different but have the same value such as ½ and $^{2}/_{4}$.
See the major topic FRACTIONS.

Estimate **(R)**
A guess based on experience.

Even **(R)**
One of the numbers **…-8, -6, -4, -2, 0, 2, 4, 6, 8, …,** although in the early stages children will only handle positive even numbers and zero.

Even chance **(6)**
See *'Equal chance'*.

Every other **(R)**
The process of taking one and missing one repeatedly. E.g. *'Starting at **1**, every other number is odd'*.

Exactly **(2)**
An indication that there is no error in a calculation or measurement. E.g. *'The number of people in the crowd was exactly **387**.'*

Exchange **(1)**
a) Used for the process of swapping one in the tens column for ten units.
b) Used when swapping money in one currency for money in another.

Face **(R)**
One of the surfaces of a three dimensional shape.

Factor **(4)**
A number that will divide exactly into another. E.g. *'The factors of **12** are **1, 2, 3, 4, 6**, and **12**.'*

Factorise **(6)**
The process of finding the factors of a number.

Fair **(5)**
a) An experiment in which the outcomes are fairly generated, for example when you throw a fair dice or spin a fair spinner.
b) A fair survey is one in which the data is not biased towards one group or particular idea.

Fast **(1)**
Quick; covers a large distance in a short time.

Faster **(1)**
See the major topic COMPARATIVE and SUPERLATIVE.

Fastest **(1)**
See the major topic COMPARATIVE and SUPERLATIVE.

February **(2)**
See the major topic TIME.

Feet **(6)**
Plural of *'foot'*.

Fifth **(4)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.
b) One fifth as a fraction: $^{1}/_{5}$. One whole divided by five.

Fifty-fifty chance **(6)**
Describes an event in which there are two possible outcomes, both of which have a **50%** chance of happening.

Figures **(2)**
Another word for *'digits'*.

First, second, third etc **(R)**
See the major topic on CARDINAL and ORDINAL NUMBERS.

Fold **(2)**

Often used when demonstrating that a shape has symmetrical symmetry or when making three dimensional shapes.

Foot **(6)**

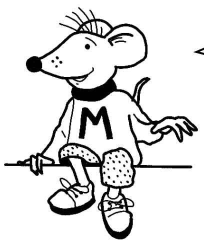
An imperial measure equal to **30.48 cm**. See the major topic IMPERIAL UNITS.

For every **(4)**

Used when describing patterns. E.g. *' For every square there are four circles'*.

Formula **(5)**

Any expression that describes how to find the answer to a particular problem. Initially written in words: *'To find the fifth square number, multiply five by itself.'* And later in symbols: *'The area* **A** *of a rectangle is given by the length* **l** *multiplied by the width* **w***. In other words* **A = lw***.'*



To find how much cheese a Maths Rat needs, multiply its height in centimetres by its mass in grams, square your answer, add in the first square number after **34 532**, take the cube root of the answer, divide by the rat's detection coefficient and that's your answer in grams.

I.e. $C = \frac{\sqrt[3]{(hm)^2 + N}}{D}$

Alternatively, a very large piece will do nicely, thank you very much!

Fortnight **(2)**

A period of two weeks. On its own it normally starts on a Sunday and finishes on a Saturday, but can be from any day of the week depending on the context.

Four digit number **(4)**

A number with four digits, normally thousands, hundreds, tens and units.

Fourth **(R)**

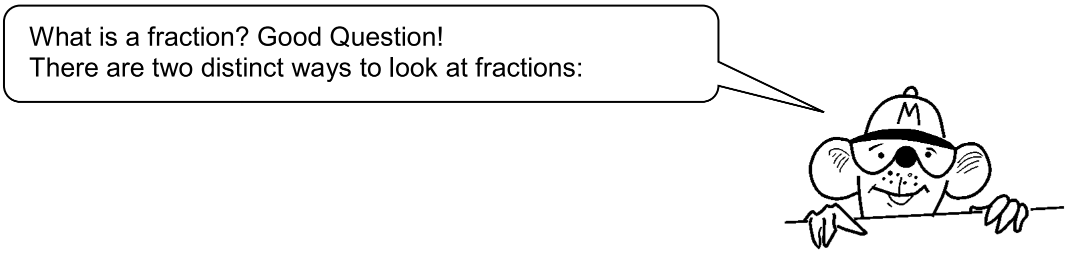
See the major topic CARDINAL and ORDINAL NUMBERS.

FRACTIONS

Many people believe that now we use mainly a decimal system in everyday life, it is no longer necessary to teach fractions. Nothing could be further from the truth. We often come across fractions in everyday life (in sale price reductions, for example); there is a close relationship between percentages, decimals and fractions of which children should be aware and fractions are still used a great deal for interest rates. In addition to this, however, there is a more subtle use. As we shall soon see, a fraction may be regarded as a division sum and fractions are therefore an easy way to give an answer to a division problem when it is not an easy matter or is indeed completely impossible to give a numeric answer. The most obvious example of this is when dealing with algebra.

The manipulation of fractions involves many concepts and the teaching of these should not be rushed. Teachers have spent many years trying to teach the manipulation of fractions (by which we mean addition, subtraction, multiplication and division) by what has been, to all intents and purposes, a series of tricks. We are pleased to see that the Numeracy Strategy Document has at last recognized this fact and has recommended that before year seven, children confine their learning to understanding the nature of fractions, finding fractions of given amounts (e.g. $\frac{2}{3}$ of **600**) and similar ideas.

Under this topic heading we shall be going a little further into the processes involved and delving into work of higher year groups to illustrate how important the work of the lower year groups is in developing an understanding of the processes that will be required in later mathematical life.



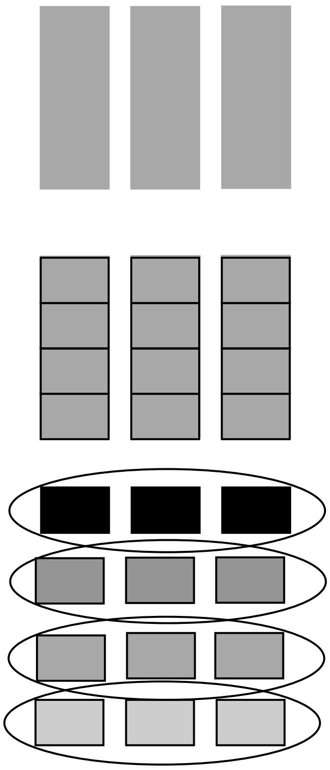
The first is that of starting with a cake, dividing it into a number of equally sized pieces and taking some of these pieces. For example, $\frac{3}{4}$ is thought of as dividing a cake into four pieces and taking three of them. This is the simpler method and is that taught from an early age. It turns out, however, that there is a much more useful way of viewing fractions and that is to think of a fraction as a division sum. $\frac{3}{4}$ is then thought of as three cakes divided by four or, in the abstract, simply three divided by four. This, of course gives the same answer as illustrated below:

Take three cakes

Divide each into four pieces

Separate the pieces

Each colour gives
$\frac{3}{4}$ of the cake.
Imagine each colour is
a person. Voila!



This is more useful because it enables us to answer questions of three different types:

Type 1: E.g. What is **7** divided by **16** ? Why, $^{7}/_{16}$, of course. We see from this it is not always necessary to give an answer as a decimal.
E.g. What is **a ÷ b** ? Answer $^{a}/_{b}$.

Type 2: E.g. Write $^{7}/_{15}$ as a decimal. As we know a fraction is a divide sum, we simply divide **7** by **15** on our calculator.

Type 3: E.g. Find ¾ of **£6.40**. To answer this we realize that finding ¾ of a quantity means finding one quarter of it by dividing by **4** and then multiplying by **3**. **£6.40 ÷ 4 = £1.60. £1.60 x 3 = £4.80**.

Terminology: The upper number in a fraction is called the 'numerator' and the lower number is the 'denominator'.

Equivalent fractions. Equivalent fractions are the single most important concept to understand when learning about fractions and no real progress can be made until they are thoroughly mastered. It is certainly possible to teach children the tricks mentioned earlier, but tricks are soon forgotten unless regularly practised and understanding will be lacking.

Firstly, what are equivalent fractions? Two or more fractions are said to be equivalent if they have the same value, even though they look different. E.g. $^{2}/_{3}$, $^{4}/_{6}$, $^{300}/_{450}$ and $^{4000}/_{6000}$ are all equivalent because they are equal to $^{2}/_{3}$.

It is possible to change a fraction into an equivalent fraction in two ways:

The first is called <u>cancelling</u> and is carried out by dividing both the numerator and the denominator by the same number. E.g. $^{24}/_{30}$ become $^{4}/_{5}$ by dividing both **24** and **30** by **6**.

The second is called <u>lecnacing</u> and is carried out by multiplying the numerator and the denominator by the same number. E.g. $^{3}/_{7}$ becomes $^{12}/_{28}$ by multiplying both **3** and **7** by **4**.

Thus a series of equivalent fractions may easily be constructed. For example, begin with the fraction $^{3}/_{5}$ and lecnac by **2, 3, 4** etc in turn:

$^{3}/_{5}$, $^{6}/_{10}$, $^{9}/_{15}$, $^{12}/_{20}$, ... $^{60}/_{100}$,... $^{300}/_{500}$ etc

It can easily be seen that the sequence could have been constructed by starting on the right and cancelling.

An interesting teaching point is to get the children to think of fractions as spies. The fraction in its lowest terms (i.e. fully cancelled) is the 'naked' spy whose identity is easily determined. As the fraction is lecnaced by higher and higher numbers, he/she acquires more and more disguise until he is almost unrecognizable. Although his identity is now more difficult to determine, he is still the same fraction underneath!

To fully appreciate the importance of equivalent fractions let us look at some examples.

E.g. Calculate $^{3}/_{5} + ^{5}/_{6}$.

$^{3}/_{5} + ^{5}/_{6} = ^{18}/_{30} + ^{25}/_{30} = ^{43}/_{30} = 1^{13}/_{30}$

First we find a number that the two denominators (**5** and **6**) will divide into. This is obviously **30**.
Next we lecnac $^{3}/_{5}$ by **6** to obtain $^{18}/_{30}$ (equivalent fractions) and $^{5}/_{6}$ by **5** to obtain $^{25}/_{30}$ (equivalent fractions). We add to make $^{43}/_{30}$.

At this point we realize we have an improper fraction (one in which the numerator is greater than the denominator) so we take $^{30}/_{30}$ (= $^{1}/_{1}$ = **1** equivalent fraction) from $^{43}/_{30}$ giving the mixed number $1^{13}/_{30}$.
We have used equivalent fractions three times in this simple calculation. Sometimes the fraction part of the mixed number will cancel forcing us to use equivalent fractions again.

E.g. Calculate $^3/_5$ **x** $^{15}/_{20}$.

Multiply the numerators together and the denominators together to obtain $^{45}/_{60}$. Cancel by **15** to get $^3/_4$. Again we have used equivalent fractions.

This obvious method can easily produce very large numbers in the numerator and denominator so in practice we normally do some cancelling before multiplying. This need not concern us here except to say that this involves an even greater use of equivalent fractions.

E.g. Write $3^4/_{15}$ as an improper fraction.

Recognize that **3** is $^3/_1$ and this may be lecnaced to $^{45}/_{15}$ (equivalent fractions).

Then add the $^4/_{15}$ to obtain $^{49}/_{15}$.

In fact, almost every operation involving fractions also involves equivalent fractions, so it is very important to make sure that children really understand the concept and how to change any given fraction into a set of equivalent fractions.

Frequency table **(3)**

A table that shows the frequency with which things occur. E.g. *'This is a frequency table of the number of deliveries made by a lorry driver each day in one week:*

Monday	***23***
Tuesday	***18***
Wednesday	***18***
Thursday	***26***
Friday	***21***
Saturday	***12*** *'*

Friday **(2)**

See the major topic TIME.

Further **(2)**

See major topic COMPARATIVE and SUPERLATIVE.

Furthest **(2)**

See major topic COMPARATIVE and SUPERLATIVE.

Gallon **(5)**

See the major topic on IMPERIAL UNITS.

Geo strips **(2)**

Flexible rods providing a visual means for children to investigate the relationships between geometric shapes. Using them, they can explore the angles, area, and perimeters of shapes.

Good chance **(5)**

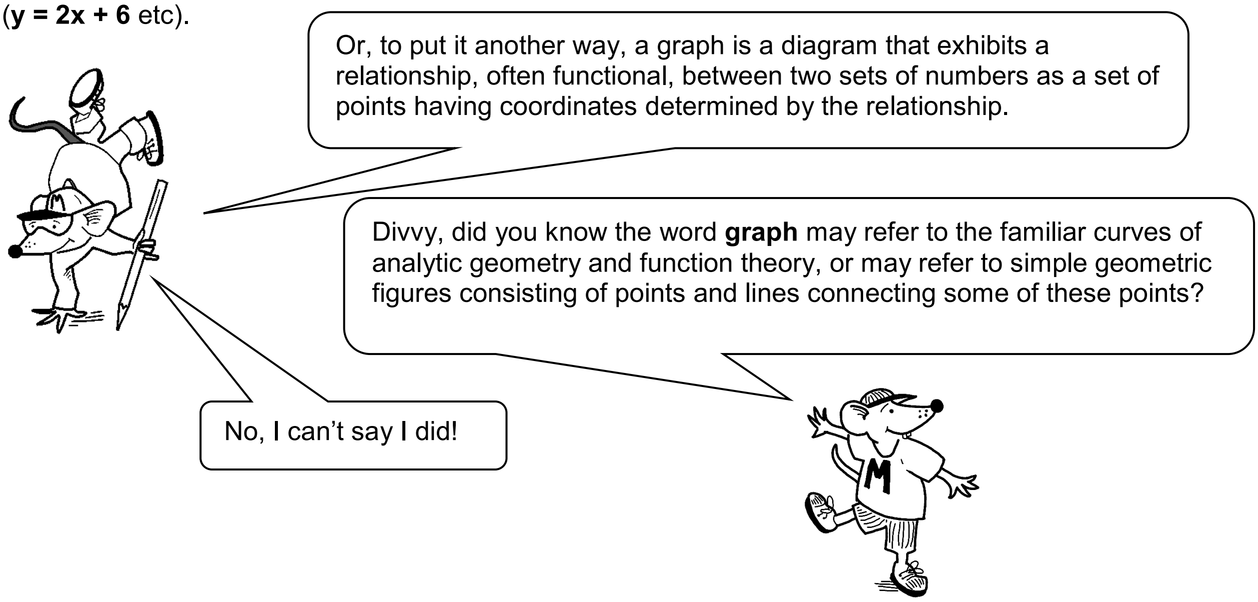
Having a high probability.

Gram **(2)**

One thousandth of a kilogram. See the major topic METRIC SYSTEM for more details.

Graph **(2)**

A diagram set on two axes placed at right angles to each other illustrating either data (favourite chocolate bars, monthly sales etc) or the relationship between two variables connected by an equation (**y = 2x + 6** etc).



Greater **(R)**

See major topic COMPARATIVE and SUPERLATIVE.

Greater than > **(4)**

See *'more'* for examples of uses. This sign means *'greater than'* and for a true statement to be made, the value on the left must be more than (not equal to) the value on the right.

E.g. **5 > 3,** **4 x 6.5 > 30 ÷ 5**, are correct uses.

E.g. **6 x 5 > 2 x 15** is an incorrect use.

As an aide memoir, both the *'greater than'* sign ('**>**') and the 'less than' sign ('**<**') always point to the smaller value.

Greater than or equal to (≥) **(5)**

As above, but includes *'equal to'*. In this case **6 x 5 ≥ 2 x 15** is true.

Greatest **(R)**

See major topic COMPARATIVE and SUPERLATIVE.

Greatest value **(3)**

The maximum of a set of values.

Greenwich Mean Time **(6)**

If the Earth were to orbit the Sun in a perfect circle, we would see the Sun due south at noon every day. Because the real orbit is actually an ellipse, most of the time the Sun is a little either side of south at noon. The word 'mean' in Greenwich Mean Time is used to indicate that the mean (average) of the Sun's position is taken when calculating time so that we do not have to make minor adjustments every day.

In this context, the word *'Greenwich'* means the time at Greenwich (on the Greenwich Meridian, in fact) and this is used as a standard throughout the world from which all other times are calculated (e.g. the time in Iran is **G.M.T. + 3hrs 30 mins**). G.M.T. is also known as Universal Time and Zulu Time.

British Summer Time is one hour ahead of G.M.T. The clocks go forward at **1 a.m. G.M.T.** on the last Sunday in March and back at **1 a.m. G.M.T.** on the last Sunday in October. If you cannot remember which way to set your clocks simply remember *'Spring forward, fall back'* (fall = autumn).

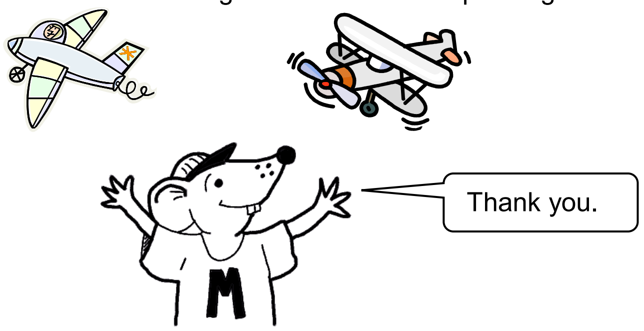
Grid **(3)**
Any rectangular arrangement of squares used in writing tables, playing snakes and ladders, plotting co-ordinates, writing magic squares etc.

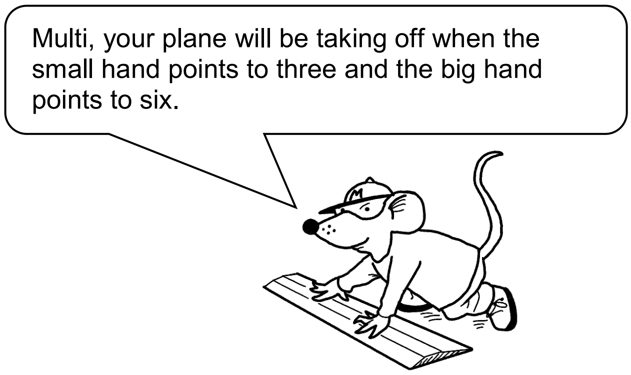
Group in pairs, threes etc **(2)**
An introduction to multiplication and division, showing that six groups of three are eighteen, for example, or that eighteen can be divided into six groups of three.

Half **(1)**
Choosing or calculating a fraction of a set or number in such a way that the part left over is the same as the part chosen.

Half litre **(2)**
Given a litre is **1000 mm^3**, a half litre is **500mm^3**.

Half past **(1)**
When the big hand on a clock is pointing to six.





Half turn **(1)**
Two right angles or **180°**.

Half way between **(1)**
In the middle of two points or numbers (e.g. **7** is half way between **1** and **13**).

Half-kilogram **(2)**
Given a kilogram is **1000 g**, a half kilogram is **500 g**.

Halve **(1)**
An instruction to find half of something.

Heavier **(R)**
See major topic COMPARATIVE and SUPERLATIVE.

Heaviest **(R)**
See major topic COMPARATIVE and SUPERLATIVE.

Heavy **(R)**
Being pulled down by the Earth's gravity with a large force. This is in direct proportion to the mass of the object, so objects with large masses are said to be *'heavy'*. This is, of course, a relative term – a teacher is heavy compared to a young pupil, but very light compared to the weight of a lorry.

Height **(R)**
A term with two meanings:

a) the distance from the bottom of an object to the top (i.e. how tall it is).

b) The distance above sea level, regardless of the size of the object (e.g. the mountaineer was at a height of **2500 metres**).

Hemi-sphere **(3)**
Half a sphere.

Heptagon **(4)**
A polygon with seven sides. See the major topic TWO DIMENSIONAL SHAPES

Hexagon **(2)**
A polygon with six sides. See the major topic TWO DIMENSIONAL SHAPES

Hexagonal **(3)**
In the shape of a hexagon.

High **(R)**
See *'Height'*.

Higher **(2)**
When one object is taller than another or placed at a higher point relative to sea level.

Highest **(R)**
The tallest object or the object placed at the greatest height above sea level.

Holds **(R)**
The capacity of a container.

Horizontal **(3)**
Parallel to the Earth's surface locally.

Hour **(R)**
See the major topic TIME.

Hundred square **(2)**
There are two versions of this:

a) A square of ten rows and ten columns on which the numbers **1** to **100** written, normally starting at the top and working from left to right.

b) The same, but starting at **0** and finishing at **99**.

Each type has its advantages.

Hundred thousand **(4)**
See the major topic on the DECIMAL SYSTEM.

Hundreds **(2)**
See the major topic on the DECIMAL SYSTEM.

Hundreds boundary **(3)**
Used to discuss what happens when adding or subtracting a number to another number takes us into the next hundred. E.g. Adding **23** to **488** involves crossing the **500** boundary.

Identical **(6)**
When two things are exactly the same. This could be two- or three-dimensional shapes or the average height of boys and the average height of girls in a class etc.

IMPERIAL UNITS

A system of units that should have felt the kiss of death years ago, but refuses to go away despite the fact it is no longer taught as the main system of units in schools today.
There are some imperial units still in use and these are given below with their approximate metric equivalents:

Mile	**1.6** kilometres
Pint	Just over half a litre
Gallon	About **4.5** litres
Yard	Just less than a metre
Foot	About **30** cm
Inch	About **2.5** cm
Pound	Just less than half a kilogram
Ounce	About b grams

Here they are in reverse:

Kilometre	**0.6** miles
Litre	**1.75** pints
Litre	**0.2** gallons
Metre	Just over a yard
Cm	Just under half an inch
Kilogram	About **2.2** pounds
Gram	About one thirtieth of an ounce

Impossible (5)

When teaching probability it is important to recognize that some events are actually impossible. Children often have difficulty understanding the difference between impossible and very unlikely. Many unlikely events such as the Sun not rising tomorrow, a bridge being built over the Atlantic Ocean and men giving birth (you never know with the miracles of modern medicine), are seen by children as impossible.

Because of this it is often a good idea to stick to simple 'impossible' events such as throwing a seven with a normal **1 – 6** dice.

<u>Impossible</u> events have a probability of zero whilst <u>unlikely</u> events have a probability slightly higher than zero.

Improper fraction (5)

A ridiculous name for a fraction in which the numerator is greater than the denominator (as if it were improperly dressed in some way!).

In every (4)

Used in work on fractions. If one in every four girls enjoys roller blading, this can be translated into *'one quarter of girls enjoy roller blading'.*

Similarly with probability: If one in every six cars coming off a production line has a fault, then the probability of any particular car having a fault is one in six or one sixth.

Inch (6)

A member of the system of units known as the Imperial system. An inch is **2.54** cm long. See major topic IMPERIAL UNITS.

Increase (4)

To make larger. Can be used for numbers (*'Increase **25** by **10**', 'Increase **40** by **10%**'*) or for shapes (*'Increase this shape in size by **50%***).

INTEGERS

Integers are whole numbers and may be negative, zero or positive. Examples of integers are **⁻100, ⁻1, 0, 3, 350**. The name 'minus' is often used to describe negative numbers especially when referring to temperature, although this can be confusing (See minus).

Positive numbers are thought of as being 'above' zero, negative numbers 'below' zero and zero itself as a sort of neutral fence sitting between them.

Teaching children to use operations with negative numbers can be quite challenging, but it is quite usual to expect older primary children to be able to carry out some simple operations so they may begin to understand the processes. As far as possible examples should be taken from the real world:

E.g. The temperature is **⁻5°C**. What will the temperature be if it rises **12°C**?

E.g. I have **£15.00** in the bank. If I write a cheque for **£20.00**, how much money will I have in the bank (assuming the bank agrees to process the cheque, of course)?

The second example would result in a new balance of **⁻£5**, but we normally refer to this as **£5** overdrawn or 'in the red' and it should be pointed out to children that sometimes mathematical language differs from 'real world' language.

[As a historical note, the reason the phrases 'in the red' and 'in the black' are used is that before computers were used by banks, the typewriters they used had ribbons with two colours, black and red. The positive balances were typed in black and the overdrawn balances were typed in red.]

Number lines with integers can also be used to indicate position. Two such axes are drawn at right angles (see co-ordinates) and points may be plotted by referring to a pair of co-ordinates. Later, of course, the spaces between the integers are filled in with decimal numbers so that many more points may be plotted.

International Date Line (6)

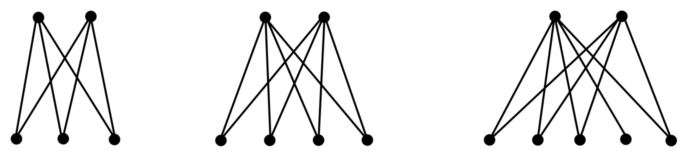
An imaginary line approximately opposite the Greenwich Meridian (**0°** longitude) which separates one day from another.

Imagine it is **6 p.m**. on Wednesday in London. As we move east the hour of the day increases every time we pass through a time zone. **7 pm., 8 p.m.** and so on until we get to midnight on Wednesday evening. By this time we will be one quarter of the way around the world. We continue: **1 a.m., 2 a.m. … 6 a.m.** Now we are half way around the world – but what day is it? Pretty obviously it is now Thursday.
Go back to London at **6 p.m.** on Wednesday. This time go west: **5 p.m., 4 p.m., ….** By the time it is 6 a.m. we will be half way around the world again, but this time it is still Wednesday!

Wednesday meets Thursday on the opposite side of the world to London. The line at which this happens is known as the International Date Line. Any good atlas shows it clearly. It is not a straight line going from the North Pole to the South Pole. It wiggles a little to bypass islands and countries, otherwise some islands would have one day on their eastern sides and a different day on their western sides, even though it would be the same time of day.

Intersecting (6)

Two lines that cross each other are called *'intersecting*'. This idea occurs in the intersection of axes on a graph, diagonals of polygons as in *'The diagonals of a rhombus intersect at right angles,'* and in some interesting situations to investigate such as the number of points of intersection from two given points in a straight line to any number of other points in a parallel straight line:



3 Intersections 6 Intersections 10 Intersections

Inverse **(4)**
Opposite. Used initially to name the idea that subtraction is the opposite of addition and division is the opposite of multiplication etc, but is later extended to such things as square rooting is the opposite of squaring and the solving of algebraic equations.

Irregular **(4)**
Normally used to refer to a polygon that does not have all its sides the same length and all its angles equal or a polyhedron whose faces are not all regular polygons.

Isosceles triangle **(4)**
A triangle with two equal sides and two equal angles. See the major topic TWO DIMENSIONAL SHAPES.

January **(2)**
See the major topic TIME.

Journey **(1)**
Travelling from one place to another. Used in mathematics to reinforce the idea of position (perhaps by the use of co-ordinates) and directions (left, right, north, south etc).

July **(2)**
See the major topic TIME.

June **(2)**
See the major topic TIME.

Key **(5)**
a) A calculator key
b) A key on a map showing the scale of the map.

Kilogram **(2)**
The fundamental measure of mass in the metric system. See the major topic METRIC SYSTEM for more details.

Kilometre **(3)**
One thousand metres. See the major topic METRIC SYSTEM for more details.

Kite **(6)**
A quadrilateral with two pairs of adjacent equal sides. See the major topic TWO DIMENSIONAL SHAPES.

Label **(2)**
Refers to the label given to the axes on a graph. Every graph should have a title and its axes labelled.

Larger **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

Largest **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

Last but one **(R)**
Penultimate.

Layer **(3)**
Used in calculating volume as in '*The volume of one layer of the cuboid is* **60 cm^3**'.

Leap year **(4)**
A year which has **366** days, the extra one being provided by **February 29th**. See the major topic TIME.

Least **(R)**
Smallest number or amount.

Least common **(2)**
The number or object that occurs fewest times.

Least popular **(2)**
The item that is chosen by the smallest number of people.

Least value **(3)**
The item that gives the worst deal for the customer.

Lecnac **(5)**
The operation of changing a fraction into a more complex equivalent fraction by multiplying the numerator and denominator by the same number. See the major topic FRACTIONS.

Length **(R)**
The distance from one end of an object to the far end.

Less than < **(4)**
This sign means 'less than' and for a true statement to be made, the value on the left must be less than (not equal to) the value on the right.

E.g. **3 < 5,** **30 ÷ 5 <4 x 6.5**, are correct uses.

E.g. **2 x 15 < 6 x 5** is an incorrect use.

As an aide memoir, both the *'greater than'* sign ('**>**') and the 'less than' sign ('**<**') always point to the smaller value.

Less than or equal to (≤) **(5)**
As above, but includes *'equal to'*. In this case **2 x 15 ≤ 6 x 5** is true.

Less/least expensive **(3)**
Cheaper/cheapest.

Light **(R)**
As in the sense of *'not heavy'*.

Lighter **(R)**
See major topic COMPARATIVE and SUPERLATIVE.

Lightest **(R)**
See major topic COMPARATIVE and SUPERLATIVE.

Likelihood **(5)**
A word used to express the probability of something happening. E.g. *'The likelihood of Rain in Birmingham tomorrow is about **20%**.'*

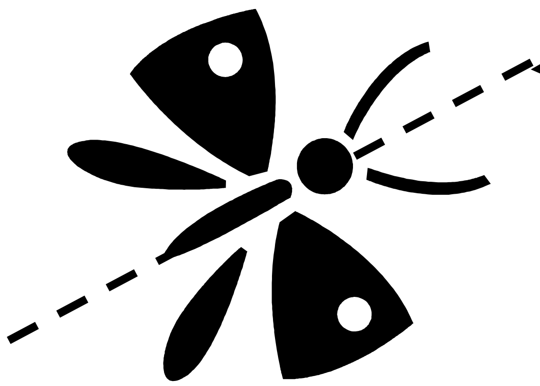
Likely **(5)**
A word used to indicate that something has a probability of happening greater than **50%**, i.e. there is more probability of it happening than not happening.

Line graph **(5)**
A graph in which plotted points are joined with a line. The points between the plotted points must be meaningful. E.g. points in a graph of temperatures in a living room plotted every ten minutes can normally be joined because the points between do exist in real time and each has a corresponding temperature.

On the other hand, twelve points plotted on a graph to represent total sales in each month of a given year should not be joined because the points between are meaningless (what does a point between June and July mean, for example. Despite this, people often do join them up.

Line of symmetry **(2)**

A line passing through the middle of a shape with reflective symmetry so that the half on one side is a reflection of the other half in the line. Often called the *'mirror line'* or *'axis of symmetry'*.



Line of Symmetry or
Axis of Symmetry or
Mirror Line

Line symmetry **(4)**

If a shape has reflective symmetry, i.e. one half of the shape is a reflection of the other half, it is said to have *'line symmetry'*, the line referring to the mirror line through the middle (See *'Line of Symmetry'* above).

Litre **(2)**

The volume of a cube **10 cm x 10 cm x 10 cm**. See the major topic METRIC SYSTEM for more details.

Long **(R)**

A relative term like *'heavy'*. An object can be long compared to a smaller object but not at all long compared to a much bigger one.

Longer **(R)**

See the major topic COMPARATIVE and SUPERLATIVE.

Longest **(R)**

See the major topic COMPARATIVE and SUPERLATIVE.

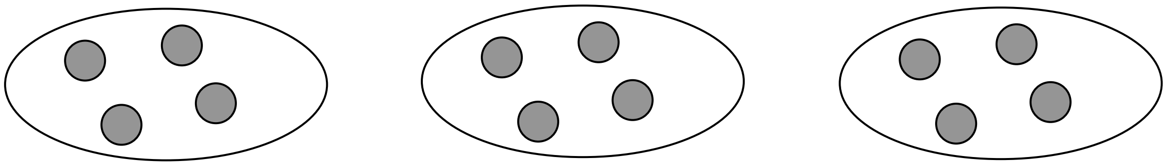
Loss **(6)**

This can be given as an amount of money, *'Harry bought a car for* ***£500*** *and sold it for* ***£450****. He made* ***£50*** *loss'*, or as a percentage of the original price. In the example given, Harry made **£50** loss on an original price of **£500**, i.e. **10%.**

As a teaching point, profit and loss are almost always calculated as a percentage or fraction of the original price.

Lots of **(2)**

Working in groups of objects introduces the concept of multiplication: *'Three groups of four are twelve.'*



Lower **(2)**

See the major topic COMPARATIVE and SUPERLATIVE.

Map **(3)**

A representation on paper drawn to scale of an area of land. Used as an introduction to scales and the idea that a short distance on a map can represent a much longer distance in real life. May also be used to reinforce co-ordinates as these may be drawn over a map and used for treasure maps, for example.

March **(2)**

See the major topic TIME.

MASS and WEIGHT

There is a great deal of confusion between the terms mass and weight. The term mass is normally used correctly but the term weight is often used to mean mass as well as weight.

Mass is the amount of substance in an object and is measured in grams, kilograms or tonnes. Provided nothing is taken from or added to an object, its mass will remain constant no matter where in the universe it is taken. The gravity on the Moon, for instance, is about one-sixth that on Earth, but an object with a mass of **6 Kg** on the Earth will still have a mass of **6 Kg** on the Moon because the amount of matter it contains has not changed.

Weight, on the other hand, is the force by which an object is pulled towards the centre of a planet or moon it happens to be sitting on. This is measured in newtons. Here on Earth, a **1 kg** mass is pulled down with a force of approximately ten newtons, a **2 Kg** mass with a force of approximately twenty newtons and so on. On the Moon, however, the weight of objects is about one sixth that on Earth because the Moon's gravity is weaker. A child with a mass of **36 Kg** will therefore weigh about **360** newtons on Earth, but only **60** newtons on the Moon.

Two stories illustrate this difference quite well:

Nellie the elephant was invited to the ball, but when she came to try on her party dress she discovered she had been eating too many cream cakes and the dress, of course, would not fit. She had heard that astronauts are weightless in space so she hitched a ride on the Space Shuttle but found to her horror that although she no longer had any weight, she still had plenty of mass!

A boy was asked in an examination, 'What is the difference between mass and weight?'. He wrote, 'Mass is when you buy a sack of potatoes. Weight is when you have to carry them home.'

The above describes the technical situation and formal definitions. In practice, however, the situation is quite confused. People ask how much you weigh when they should be asking what your mass is. This starts at a very young age and is well ingrained before children are old enough to understand the difference. The problem is compounded by the fact that we measure the mass of an object by weighing it! This is a very convenient way to find the mass of an object, but is by no means the only method. How do astronauts weigh objects and chemicals in space when they are in a weightless environment? One method they use is to put the object whose mass is required into a small box which is fixed to a steel wire that is tensioned rather like a guitar string. The box and string are set vibrating. A more massive object in the box will vibrate more slowly than a less massive one. A computer then measures the number of vibrations per second and from this it is able to calculate the mass of the object. No gravity required!

It would be wonderful if we could teach children the difference between mass and weight from the beginning of their school education, but there are two difficulties that prevent this. Children first need to understand the 'conservation of mass' - the mass of an object remains the same provided you do not add anything or take anything away. A piece of clay can be constantly reshaped, but it always has the same mass. This is obvious to adults, but is, in fact, a concept that needs to be discovered by play and experiment. Secondly, children do not have an understanding of 'force' and the fact that it is the Earth's gravity that stops us floating away and gives us 'weight'. In fact, many adults think it is the atmosphere that stops us floating away and hold us to the Earth's surface. Until children have understood the concept of the conservation of mass and that it is the Earth's gravity that gives us weight, it is impossible for them to appreciate the difference between mass and weight.

For further discussion about the units used for mass and weight, see the major topic 'Metric System'.

Match **(R)**

The result of comparing different patterns and noticing that two are the same.

Maximum **(5)**

The highest value of a variable. E.g. *'The maximum temperature today will be* ***23^{0}C****.'*
'What is the maximum amount of liquid this glass can hold?'

May **(2)**

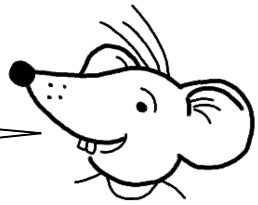
See the major topic TIME.

Mean **(6)**

There are three types of average – mean, median and mode. The mean is the answer when all the numbers are added together and the total is divided by the number of items.

E.g. The mean of **5, 8, 3, 12, 6** is **(5 + 8 + 3 + 12 + 6) ÷ 5 = 34 ÷ 5 = 6.8**

The term *'average'* is used in everyday language to indicate *'mean'* unless it is clear that the median or mode is required.



Measure **(R)**

The process of measuring is more complicated than most people imagine. To measure properly you need a unit with which to measure and a starting point. Children often see the need for the unit, but do not appreciate the need for a starting point. This is true whether they are using a ruler, protractor, weighing scale or measuring cylinder. If you watch children using a ruler (especially the type with an extra bit of wood or plastic at the end to protect the scale) they often begin at the end of the ruler, not at the first mark. When using a protractor they often make the same mistake and when using a weighing scale they forget to set it to zero before they put anything in the pan. It is important to establish the proper principles of measuring before asking them to measure to the nearest millimetre, gram etc.

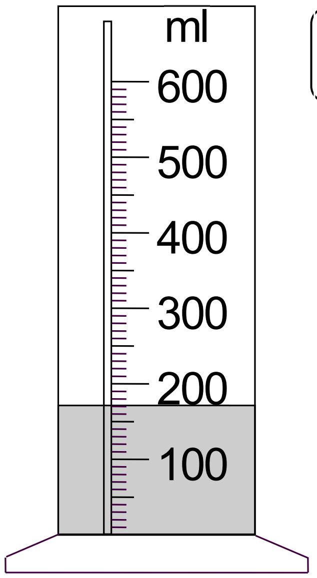
Once they have learnt these principles, the next thing to concentrate on is accuracy of measurement. Children are too often happy with any result, whether it approximates to the true measurement or not. They must therefore be taught that accuracy and careful measurement are essential. This all comes with practice, but too often not enough practice is given.

Measurement **(4)**

The answer to the measuring process!

Measuring cylinder **(4)**

A cylinder with markings up the side, normally in millilitres, used to measure the volume of liquids.



For example, this measuring cylinder shows **170 ml**.

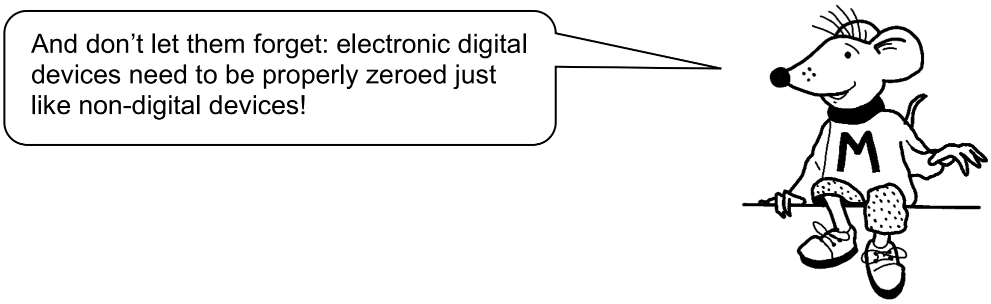
Measuring scale **(2)**

Every measuring instrument needs a measuring scale, whether it is a ruler, measuring cylinder or weighing scale. In other words, the instrument needs to be *'calibrated'*. It is important that children are given a lot of practice with traditional measuring instruments with scales before being allowed to use modern digital types with an electronic scale.

There are two problems with these:

the first is that there is no scale to see – children can easily get the impression that the measurements are produced by 'magic'. After all, many of them still believe in Father Christmas and the Tooth Fairy!

The other is that because they are digital, children think they are extremely accurate in their readings. While they do tend to be quite accurate, they do vary in their readings slightly and this can be pointed out to children by using two or more electronic devices to make the same measurement.



Median **(6)**

Given a set of numbers, the median is the middle number when all the numbers are placed in numerical order. If there are an even number of numbers in the set, the median is the mean of the two middle ones when placed in order.

E.g. Set of numbers: **4, 3, 7, 2, 8** Put in order: **2, 3, 4, 7, 8** The median is therefore **4**
E.g. Set of numbers: **18, 25, 34, 15, 25, 19** Put in order: **15, 18, 19, 25, 25, 34** The median is therefore the mean of **19** and **25**, i.e. **(19 + 25)/2 = 22** .

Memory **(6)**

A place in a calculator where a number may be stored while another part of a calculation takes place. There are keys for moving a number from the display to the memory and from the memory to the display as well as adding and subtracting the content of the memory directly.

Mental calculation **(2)**

A calculation done in one's head. It is normally regarded as permissible to jot down essential numbers or facts on paper as long as the calculation is performed mentally.

Method **(3)**

A way of achieving an end result. For example, there are several methods of adding two two-digit numbers together.

Metre **(1)**

The fundamental measure of length in the metric system. See the major topic METRIC SYSTEM for more details.

Metre stick **(1)**

A piece of wood or plastic that is one metre long. It is often subdivided into centimetres or centimetres and millimetres.

Metric unit **(4)**

One of the units such as metres and grams that are used in the metric system. See the major topic METRIC SYSTEM.

METRIC SYSTEM

The system of units used in most countries of the world (with one or two notable exceptions such as the U.S.A., but even here the metric system is used for most scientific calculations).
A system of units is defined from three fundamental units: time, length and mass. In the metric system the units that correspond to these are second, metre and kilogram respectively. (There are others to define electrical units etc, but these need not concern us here.)

Time: At primary school level, time is always measured in seconds in the metric system. (Minutes, hours, days etc, whilst very useful units in everyday life, are strictly speaking outside the metric system)

Length: The basic unit is the metre. This is divided into millimetres and multiplied up to kilometers.
1000 mm = 1 m **1000 m = 1 Km**
As the millimetre is quite a small unit for children, we also use the centimetre.
100 cm = 1 m **10 mm = 1 cm**

Area: It follows from the above that the basic unit of area must be the square metre (the area of a square **1m x 1m**). This is normally written '**m^2**', but as this is a difficult concept for young children, it is often useful to allow them to write '**sq.m**' instead, changing them over to '**m^2**' when you feel they are ready. Similarly a square millimetre, square centimetre and square kilometre may be written as '**sq mm**', '**sq cm'** and '**sq km**' until children are ready for '**mm^2**', '**cm^2**', and '**km^2**' respectively. It is more important in the early years for the children to understand the concepts involved than to be able to use some fancy notation they do not begin to comprehend.

Volume: Similarly, the units of volume are the cubic metre, cubic millimetre, cubic centimetre and cubic kilometre which should each be written **m^3, mm^3, cm^3, Km^3**, but in the early stages could be written **cu.m, cu.mm, cu.cm** and **cu.Km** respectively.

However, with volume there is a complication. Because the cubic millimetre and cubic centimetre are very small units of volume and the cubic metre is quite a large volume, we need something in between for everyday use. For this we use the litre. A litre is defined as the volume of a cube **10 cm x 10 cm x 10cm**. Of course it does not always come in this shape. Orange juice cartons are often a litre in capacity but they are rarely cubic in shape. The symbol for the litre is simply the letter l, but this can cause confusion as it looks too much like the number one and so, although strictly speaking it is against the rules, it is sometimes better to write the full word. Some people like to use a capital letter L instead.

This definition means that there are **1000** litres in **1** cubic metre and **1000** cubic centimetres in **1** litre. Because 'milli' means 'one thousandth', a millilitre is therefore the same as a cubic centimetre. We tend to use millilitres for liquids and cubic centimetres for solids although they are really interchangeable (What happens when **500** millilitres of liquid water changes to ice?)

It is interesting and necessary to note that, although there are **10** millimetres in a centimetres, there are **100** square millimetres in a square centimetre.
Similarly, there are: **100 cm** in **1 m**, but **10 000 cm^2** in **1 square metre** and **1 000 000 cm^3** in **1 cubic metre** etc.

Mass:

The basic unit of mass is the kilogram which is obviously **1000** grams. **1000** kilograms make a tonne.
A kilogram is defined as the mass of one litre of water which turns out to be very useful as it follows that:
One cubic metre of water (which is **1000** litres) has a mass of **1000** Kg (tonne).
One cubic centimetre of water (which is 1 ml) has a mass of **1** g.

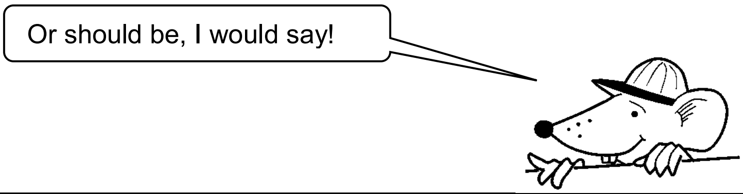
Abbreviations: You will notice that some abbreviations for the units begin with lower case letters whilst others begin with upper case letters.
The convention is that the fundamental units and subdivisions of them use lower case letters and multiples use upper case letters.
m, m^2, m^3, l and **g** are all basic units and so use lower case letters.
mm, cm, m (and their squares and cubes) are subdivisions of units so also use lowercase letters.
Km and **Kg** are multiples of the basic units and so begin with capital letters.

Middle (R)

The one between two others. This may refer to geometrical position such as a building that is in the middle of two other buildings. It may also refer to the middle of three or more values.

Midnight (1)

12.00 p.m. The dividing line between days. Children should realize that each day has a beginning and an end. Unfortunately this occurs when children are asleep.



Mile (3)

An imperial unit approximately equal to **1.6 Km**. See the major topic on IMPERIAL UNITS.

Millennium (4)

One thousand years. Plural *'millennia*'. See major topic TIME.

Millilitre (2)

One thousandth of a litre. See the major topic METRIC SYSTEM for more details.

Millimetre (4)

One thousandth of a metre. See the major topic METRIC SYSTEM for more details.

Million (4)

1 000 000. One thousand thousands. $\mathbf{10^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10}$.

Minimum (5)

The smallest of a set of values. This could refer to discrete data such as *'The minimum pocket money pupils should bring on the school trip is **£10**'* or to continuous data such as *'What was the minimum temperature reached in the playground this afternoon?'*

Minus (1)

The most confusing word in mathematics since it has two completely different meanings, but we mix the meanings up and even combine them willy nilly.

The first meaning is *'negative'*, i.e. to indicate a number whose value is less than zero. Here it is used as an adjective.
The second meaning is *'subtract'* or *'take away'*. Here it is used as a verb – an operation.
In the early stages everything goes swimmingly because the two meanings are kept well apart:
What is **17** minus **8** ? (An operation or verb)
The temperature is **4°C**. It falls **10°C**. What temperature is it now? (Ans. **Minus 6°C**) (An adjective)

The problems arise at secondary level when we mix the two meanings in the same sentence:
Find $^{-}5 - {}^{-}12$ Here we notice that before the number **12** are two minuses and it is not long before you hear teachers saying 'Two minuses make a plus'. They simply skip over the fact that the first 'minus' is a subtraction (verb) and the second 'minus' is a negative sign (adjective) and combine them without further ado to give a 'plus'. But is this a 'plus' meaning 'add' (verb) or a 'plus' meaning 'positive' (adjective).
If it is a verb we have just combined a verb with an adjective to give a verb.
If it is an adjective we have just combined a verb with an adjective to give an adjective.
This must rate as one of the greatest loads of codswallop flourishing in the education system.

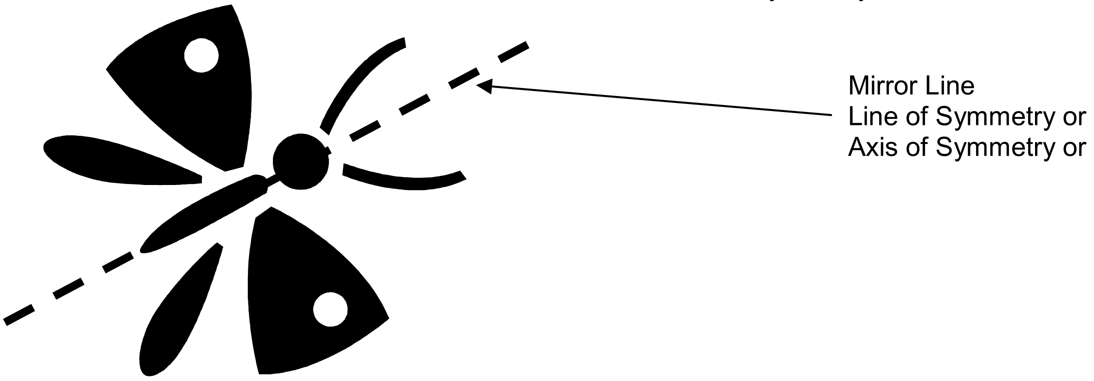
Not only that, but children then extend the idea of 'two minuses make a plus' to situations where it does not apply such as: $^{-}5 + {}^{-}12 = 17$ (i.e. **positive 17**).
Unfortunately, this mess cannot be sorted out in a short article such as this; it really needs the co-operation of all teachers of mathematics, probably the world over!
We mention it here to warn you to be careful when using the word *'minus'*. Despite what it may say in the Numeracy Strategy Document, it is better to stick to 'negative' and *'subtract'* (or 'take away' for younger children) and to avoid the use of the word 'minus' wherever possible.

Minute (2)

See the major topic TIME.

Mirror line (2)

A line passing through the middle of a shape with reflective symmetry so that the half on one side is a reflection of the other half in the line. Often called the 'line of symmetry'.

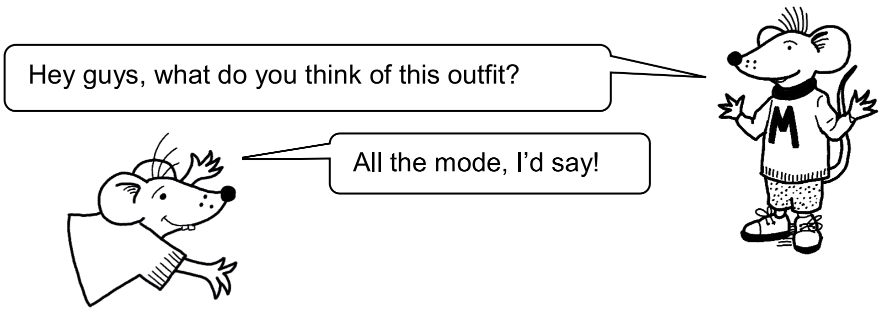


Mixed number (5)

A number consisting of a whole number and a fraction, e.g. **2¼ 6⅝**. For further information see the major topic FRACTIONS.

Mode (5)

The most common of a given set of values. E.g. the mode of **7, 3, 12, 7, 9, 5, 8, 8, 7** is **7** because it occurs more often than any other number. It is possible to have more than one mode if two or more numbers occur the greatest number of times. E.g. The numbers **3, 3, 3, 4, 4, 5, 7, 8, 8, 8, 9, 10, 10, 11, 11, 11** have three modes: **3, 8** and **11**. This is one form of average and is generally used in situations where we need to find which is the most popular, e.g. the most popular dress or shoe size.
Also means 'popular' in everyday language as in 'It's all the mode these days'.



Monday (R)

See the major topic TIME.

Money (R)

A difficult concept for children to grasp since it has two aspects – the actual notes and coins that we use in shops and the concept of a 'value' given to an object (*'these sweets cost **20p**'*). When we use money we are really matching the value of the coinage to the value of the goods we are buying. The value of the money we have is not directly related to the number of coins/notes we have as each has a different value.

The only way for children to understand and use money is to give them lots of practice in the real world and in play shops etc.

Months of the year (2)

See the major topic TIME.

More (R)

Greater than. There are many uses for this word as in *'which is more, **45** or **34**? **20%** or $^1/_6$? ¾ or $^2/_3$? **7 x 16** or **8 x 15**? etc'. 'What is **8** more than **45.2**?'*

More/most expensive **(3)**
Comparison of the cost of two or more items. See COMPARATIVE AND SUPERLATIVE.

Morning **(R)**
The period of time between midnight and noon. a.m.

It is important for children to know that the day is divided into parts – morning, afternoon, evening etc. This should be constantly reinforced by good use of language with children from an early age.

Most **(R)**
Greatest quantity, number or amount.

Most common **(2)**
The number or object that occurs the greatest number of times.

Most popular **(2)**
The item that is chosen by the greatest number of people.

Movement **(R)**
An introduction to translations, rotations etc. These may be performed in P.E. lessons and translated to paper as mathematical ideas later.

Multiple of **(2)**
The numbers in the times table. E.g. The multiples of **6** are **6, 12, 18, 24, …**

x	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

← Multiples of 1
← Multiples of 2
← Multiples of 3
etc.

Multiplied by **(2)**
Added together a certain number of times. E.g. *'Six multiplied by three is eighteen'*.

Multiply **(2)**
The operation of repeated addition. **4 x 6** means add six lots of four together. This can be tedious with larger numbers so it is very important that children learn their tables as soon as they are able. The use of calculators is a brilliant innovation in many respects, but teachers should make sure that children do have many opportunities to practise multiplication tables as well as many other mental calculations.

Narrow **(R)**
Not very wide.

NE **(4)**
See COMPASS POINT.

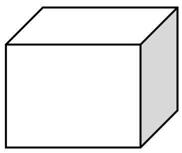
Near double **(1)**
This describes the situation where one number is almost, but perhaps not quite the double of another. E.g. **19** is a near double of **10**. This becomes very useful later with sums such as *'calculate **55 + 56**' Doubling **55** gives **110**, so **55 + 56** must be one more, i.e. **111**.*

Nearest **(2)**
See the major topic COMPARATIVE and SUPERLATIVE.

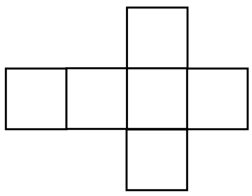
Negative **(4)**
See the major topic INTEGERS.

Net **(4)**
Used to describe the shape we should draw and cut out from a piece of paper so that when it is folded it makes a three-dimensional shape.

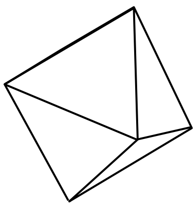
A cube



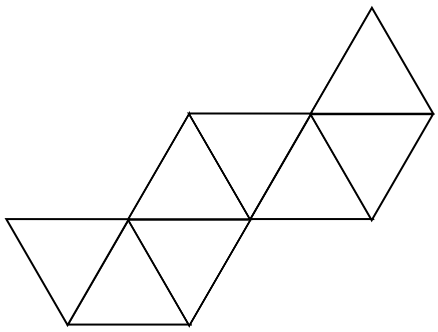
The net of a cube



An octahedron



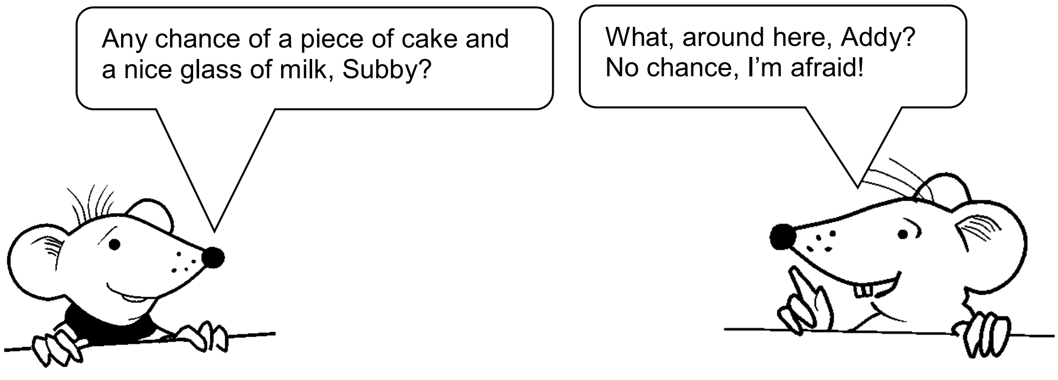
One net of an octahedron



Newer **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

Newest **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

No chance **(5)**
Describes the likelihood of event happening when, in fact, the probability of it happening is zero.



Noitcarf numbers.

You will not find Noitcarf Numbers in the Maths Curriculum (or any other sane document, come to that), but they provide such a wonderful April Fool's trick for year six mathematically able pupils that it would be a shame to miss them out.

First, give the children a little of the background to the numbers – Henri Noitcarf was born in Paris in **1767** and died in **1852**, aged **85**. Among his more notable achievements was the invention of Noitcarf Numbers …… (embellish at will).

Secondly give the rules for Noitcarf numbers. Each Noitcarf Number consists of two parts which are written in square brackets separated by a comma. Square brackets are used so that Noitcarf Numbers are not mixed up with co-ordinates. Either part of a Noitcarf Number may be zero, negative or include a decimal, but these additions make life rather difficult, so stick to positive whole numbers, (unless, of course, you have a class of geniuses)

Examples of Noitcarf Numbers are therefore **[2 , 5] [12 , 17]** and **[150 , 250]**.
The rules for the four operations are as follows. Take two Noitcarf Numbers **[a , b]** and **[c , d]**.

Addition and subtraction are similar:

Addition: **[a , b] + [c , d] = [ad + bc , bd]**
E.g. **[3 , 4] + [2 , 5] = [3 x 5 + 4 x 2 , 4 x 5] = [15 + 8 , 20] = [23 , 20]**

Subtraction: **[a , b] – [c , d] = [ad – bc , bd]**
E.g. **[4 , 5] – [2 , 3] = [4 x 3 – 5 x 2 , 5 x 3] = [12 – 10 , 15] = [2 , 15]**

Multiplication and division are similar:

Multiplication **[a , b] x [c , d] = [ac , bd]**
E.g. **[6 , 9] x [3 , 5] = [18 , 45]**

Division **[a , b] ÷ [c , d] = [ad , bc]**
E.g. **[10 , 12] ÷ [4 , 7] = [70 , 48]**

Two Noitcarf Numbers are equal if one can be changed into the other by multiplying both parts by the same number. E.g. **[4 , 5] = [12 , 15]** because **[4 x 3 , 5 x 3] = [12 , 15]**

Thirdly, having explained the rules and illustrated with examples, give the children some of their own to do and explain that these are used by design engineers when designing cars, bridges, structures and manufacturing machines.

How much better if you have a friend, unknown to the children, who can be a visiting 'professor' from your local university.

Hopefully, it will be some while before one of your children realizes that Noitcarf is fraction spelt backwards! Have fun!

None (R)

An introduction to the concept of zero. This could be the number of toys in a bag after all have been removed, the height of a bar on a bar chart or the number of integers between **21** and **22**.

Noon (4)

12.00 a.m. The moment half way between **11.59 a.m**. and **12.01 p.m**. See *'12-hour clock'.*

North (3)

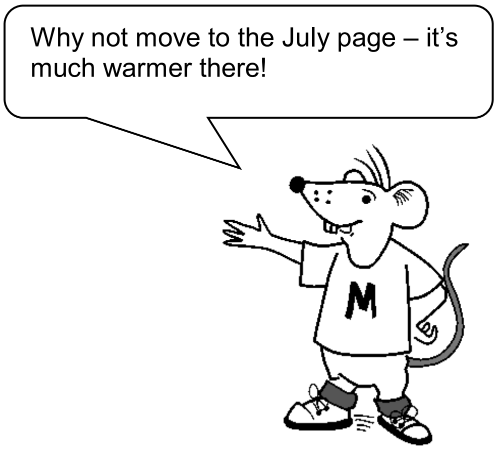
See the major topic COMPASS POINT.

North-east (4)

See the major topic COMPASS POINT.

North-west (4)
See the major topic COMPASS POINT.

November (2)
See the major topic TIME.



Number bonds (2)
The addition of pairs of numbers. The phrase *'number bonds up to ten'* means the combination of numbers that give answers equal to or less than ten. E.g. **3 + 2, 6 + 4, 1 + 5 …**

Number grid (2)
Any grid (normally rectangular) with numbers placed in some logical pattern, e.g. numbers from one to a hundred in order or a table square.

Number line/ track (R)
A line with equally spaced marks on which numbers have been placed. Initially, this will just be positive whole numbers, but later will include negative numbers, fractions and decimals.

Number pairs (2)
Any two numbers that are to be used together in some way. They may, for example, be numbers that are to be added as 'number bonds' or a pair of co-ordinates as in **(3, 8)**.

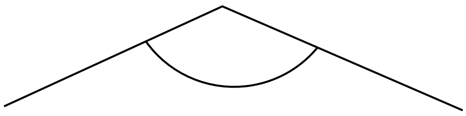
Number sentence (1)
A sentence using numbers and symbols such as **4 + 8 = 12, 3 x 4 + 8 x 9 = 84**.

Numeral (4)
A loosely defined word meaning either a single digit or any number, depending on whom you speak to.

Numerator (5)
The upper number in a fraction.

NW (4)
See COMPASS POINT.

Obtuse (5)
An angle greater than $\mathbf{90^0}$ and less than $\mathbf{180^0}$.



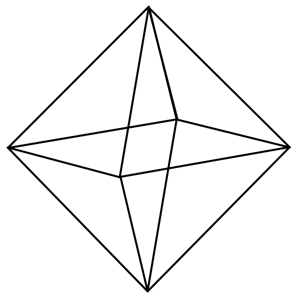
Octagon (2)
A polygon with eight sides. See the major topic TWO DIMENSIONAL SHAPES.

Octagonal (3)
In the shape of an octagon.

Octahedron **(5)**

A three-dimensional shape with eight faces.

A regular octahedron has faces which are all equilateral triangles:



October **(2)**

See the major topic TIME.

Odd **(R)**

An odd number, i.e. **1, 3, 5, 7, 9, 11, 13, …** So called because if you try to make two equal towers from an odd number of bricks, there will always be an odd one left over.

Older **(R)**

See the major topic COMPARATIVE and SUPERLATIVE.

Oldest **(R)**

See the major topic COMPARATIVE and SUPERLATIVE.

Once **(1)**

a) Describes the fact that something has only happened the one time.
b) Part of the times tables as in 'Once seven is seven'.

One **(R)**

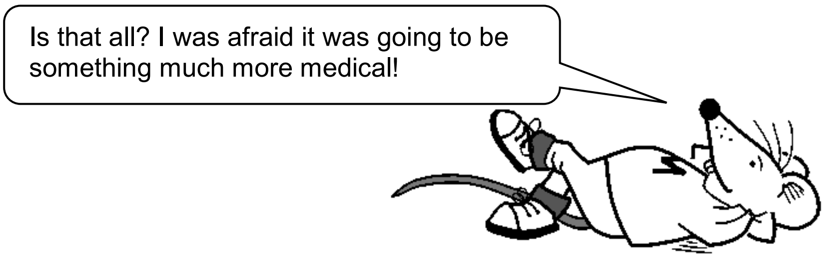
The first positive whole number. Positive whole numbers are often called Natural Numbers, because these are believed to have been the first numbers used in mathematics.

Open **(4)**

See *'Closed'*.

Operation **(1)**

A process performed on shapes or numbers.



Shape operations are such things as *'reflect', 'rotate'* and *'translate'*.

Number operations divide into two groups: Unary operations involving just one number such finding the square or square root of a number. Binary operations involving two numbers such as addition, subtraction, multiplication and division.

Operation key **(6)**

One of the keys that performs an operation on a calculator. On a simple calculator they will be **+, -, x** and **÷** and sometimes √ and $\mathbf{x^2}$. On scientific calculators these will be extended to **sin, cos, log** etc.

Opposite **(R)**
On the other side of.

Origin **(4)**
The point where the x-axis and the y-axis meet. The co-ordinates of the origin are **(0, 0)**. In the early years only the first quadrant (top right hand corner) is used. Later, all four are used. See *'Co-ordinates'*.

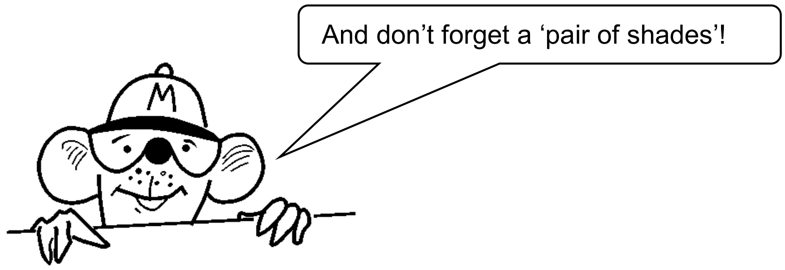
Ounce **(6)**
An imperial unit approximately equal to thirty grams. See the major topic IMPERIAL UNITS.

Outcome **(5)**
What happens in an experiment in probability. The actual outcome is what really happened in an experiment. The expected outcome is what you would expect to happen in an experiment and they are rarely the same. E.g. The expected outcome when you toss a normal dice sixty times is ten ones, ten twos, ten threes etc, but you would be very suspicious if you actually achieved that! The reason for using the expected outcome is so that we can forecast or predict in real situations with some sort of accuracy.

For example, if we discovered from tests on a small number of patients that a new drug cured about one third of the patients on whom it was tried, we could then estimate the number of people who would be cured if we tried it on the population at large.

P.M. **(3)**
See *'12-hour clock'*

Pair **(R)**
Two matching items such as gloves or shoes. Items described as a *'pair'* are not often identical (although they may be in the case of decorated plant pots, for example). Often one is a reflection of the other as with shoes and gloves. Some things are called a *'pair'*, even though they are not, such as a *'pair of trousers'*. These were originally two separate legs which were only later sewn together. Often things match in some other way such as a married couple.



Parallel **(5)**
Straight lines which are the same distance apart throughout their length. Sometimes they are described as lines that never meet, but this definition only applies to lines in two dimensions such as those drawn on a piece of paper. It is possible to have lines in three dimensions that never meet but are not parallel (try it with two rulers).

Parallelogram **(6)**
A quadrilateral with two pairs of equal opposite sides. See the major topic TWO DIMENSIONAL SHAPES.

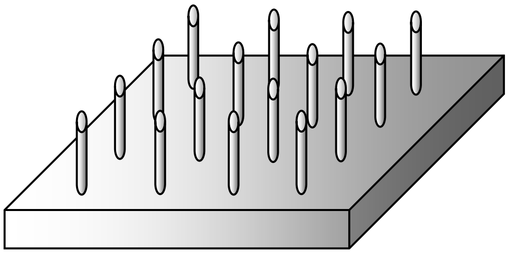
Part **(2)**
Related to fractions. A part is a fraction, so a fourth part of something is the same as a quarter.

Partition **(1)**
The splitting of a number into its component parts, I.e. units, tens, hundreds etc.
E.g. *'Partition **367** into hundreds, tens and units – this gives **3** hundreds, **6** tens and **7** units.'*

This idea is used when we place beads on an abacus to represent a number.

Pegs, peg board (R)

A board (normally square, but not necessarily) with equally spaced pegs in both directions. It can be made from plastic or from panel pins knocked into a piece of plywood or any other suitable materials. It is usually used to investigate properties of polygons which are made on the board using elastic bands.
Ask children to make shapes that follow a particular pattern such as having a right angle (can this be done with the sides adjacent to the right angle going parallel to the edges or diagonally across the board), having an area of four squares as defined by the pegs, having two parallel sides and so on. You can ask them to make a shape according to a given rule and then reflect it in a diagonal or rotate it a quarter turn without moving the board.



A variation is to ask the children to construct any shapes they wish on their boards and you, as teacher, quickly move around the classroom, telling each child which shapes fit a rule that you have previously determined and which only you know. They can have as many goes as they like until someone guesses the rule. The ultimate dirty trick for the last go is to have in mind the rule that the elastic band must go <u>under</u> the board and up the other side!
Naughty, but great fun!

Pence (R)

Plural of *'penny'*.

Penny (R)

The smallest coin currently in circulation in the U.K. See *'Money'*.

Pentagon (2)

A polygon with five sides. See the major topic TWO DIMENSIONAL SHAPES.

Pentagonal (3)

In the shape of a pentagon.

Per cent % (5)

One part in a hundred.

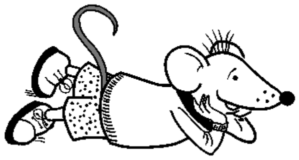
Percentage % (5)

Expressed as hundredths. **23%** means **23** parts in a hundred. All percentages may be written as fractions, **34%** is $^{34}/_{100}$, for example, but some have simpler equivalents (**25%** is ¼, **80%** is $^{4}/_{5}$ etc).

Perimeter (4)

The distance around a two dimensional shape. A circle's perimeter is called the *'circumference'.*

A good teaching point is to get the children to imagine an ant walking around the shape. The distance it walks is called the *'perimeter'*.

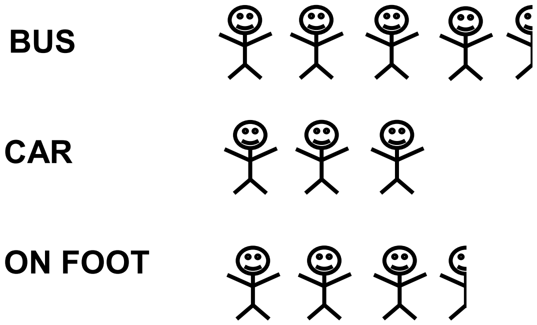


Perpendicular **(5)**
At right angles to something else.

E.g. *'The telegraph poles are perpendicular to the pavement', 'The gymnast kept his arms perpendicular to his body throughout the roll'.*

Pictogram **(2)**
A type of graph in which drawings are used to represent numbers.

E.g. In this pictogram showing the number of people travelling to work by bus, by car and on foot, each stick figure represents 100 people.



Pint **(4)**
A unit used to measure liquid, equal to approximately half a litre.

Place **(2)**
See the major topic DECIMAL SYSTEM.

Place value **(2)**
See the major topic DECIMAL SYSTEM.

Plan **(3)**
Similar to a map, but generally used for smaller area such as individual streets or buildings. A plan is always seen from above and is sometimes referred to as a 'bird's eye view'.

Plane **(6)**
A flat surface. Two-dimensional shapes are drawn in a plane.

Plot **(4)**
Putting points on a grid: *'Plot the point **(6,7)** on the grid'*.

Plus **(1)**
Add.

Point **(1)**
The sharp bit.

Polygon **(4)**
A closed two dimensional shape whose edges are straight. See the major topic TWO DIMENSIONAL SHAPES.

Polyhedron **(4)**
A three dimensional shape whose faces are polygons. See the major topic THREE DIMENSIONAL SHAPES.

Poor chance **(5)**
Indicating a low probability of happening: *'The horse called "Stewball" had a poor chance of winning the race.'*

Positive **(4)**
See the major topic INTEGERS.

Possible **(5)**
An event that has a chance of happening, no matter how low the probability, as long as it is not zero.

Pound (Mass) **(6)**
An imperial unit used to measure mass. Approximately **500g**. See the major topic IMPERIAL UNITS.

Pound sign (£) **(2)**
Used to represent the currency of the U.K. Others children should be familiar with are the Euro symbol and the dollar sign.

Predict **(2)**
The task of telling the outcome of an experiment based on some previous experience.

Prime factor **(6)**
A prime number that divides exactly into another number. E.g. *'What are the prime factors of **20**'*. First write down the factors of **20** (i.e. all the whole numbers that will divide into it): **1, 2, 4, 5, 10, 20**. Of these **2** and **5** are prime numbers and therefore prime factors of **20**. (Reminder: 1 is not a prime number).
We can write any number as the product of its prime factors. E.g. **20 = 2 x 2 x 5** or $\mathbf{2^2 \times 5}$.

E.g. The prime factors of **420** are **2, 3, 5** and **7**. We can write **420 = 2 x 2 x 3 x 5 x 7** or $\mathbf{2^2 \times 3 \times 5 \times 7}$.
E.g. The prime factors of **216** are **2** and **3**. We can write **216 = 2 x 2 x 2 x 3 x 3 x 3** or $\mathbf{2^3 \times 3^3}$.

Prime number **(6)**
'A whole number which cannot be divided by any other whole number other than **1** and itself'. An alternative definition is 'A whole number with exactly two factors', which explains why 1 is not a prime number.
The first few prime numbers are **2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31 …**

Some interesting facts about prime numbers:
Apart from **2** and **3**, all prime numbers are one more or one less than a multiple of 6. Another way of expressing this is to write all the whole numbers in rows with six in a row, thus:

1	**2**	**3**	**4**	**5**	**6**
7	**8**	**9**	**10**	**11**	**12**
13	**14**	**15**	**16**	**17**	**18**
19	**20**	**21**	**22**	**23**	**24**
25	**26**	**27**	**28**	**29**	**30**
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

The prime numbers (except **2** and **3**) are all in the first and fifth columns. As the sixth column is the multiples of six, the primes must be one more or one less than a multiple of six. It is easy to see why they are not in the other columns – columns **2, 4** and **6** are the even numbers, column **3** is the multiples of three. Make sure your children understand that this does not mean that all numbers in columns **1** and **5** are prime numbers e.g. **5** and **25** are not prime.

The largest known prime number before computers started to work on the problem was $\mathbf{2^{127} - 1}$, which is: **170 141 183 460 469 231 731 687 303 715 884 105 727** discovered by Lucas in **1876**!

There are an infinite number of prime numbers.

The very large prime numbers that you see calculated today are all of the same type, e.g. $2^9 - 1$. These are known as Mersenne Primes. If you are interested in finding the largest currently know prime number try searching the internet.

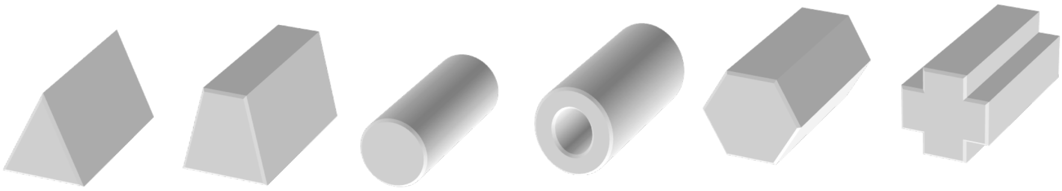
Goldbach's Conjecture: All even numbers (except **2**) can be written as the sum of two prime numbers (which may be the same prime number repeated).

E.g. **4 = 2 + 2,** **6 = 3 + 3,** **8 = 3 + 5,** **10 = 3 + 7,** **12 = 5 + 7**

Great fun to try with your children. This is called a 'conjecture' because, although it always works as far as computers have tried it (which is a very long way indeed), no-one has yet proved that it always works.

Prism **(3)**

A three dimensional shape that has the same cross section throughout its length. One of the most common is the triangular prism which is the same shape as the traditional tent. Many glass prisms used in binoculars etc are triangular prisms.



Various types of prism.

Probability **(5)**

Used to indicate the likelihood that something will happen. In simple cases it is defined as 'The number of favourable outcomes divided by the number of possible outcomes.' In this case 'favourable outcomes' means the things we are after or are considering.

For example, if we ask the question, 'What is the probability of throwing a normal dice and obtaining a number less than five?', the number of favourable outcomes (i.e. the ones we are looking for) is **4 (1, 2, 3** and **4**) and the number of possible outcomes is **6 (1, 2, 3, .. 6)**. The probability of obtaining a number less than five is therefore $^4/_6$ which may be cancelled to $^2/_3$ if we wish.

We can see from this that the smallest value a probability can take is **0**, since the number of favourable outcomes can never be less than **0**. A probability of **0** means 'impossible' – can never happen.

The highest value a probability can take is **1**, since the number of favourable outcomes could be equal to the number of possibilities, but can never exceed it. For example, if the question were, 'What is the probability of throwing a normal dice and obtaining a number less than seven' the number of favourable outcomes would be **6** and the number of possibilities would be **6,** giving a probability of $^6/_6$, i.e. **1**.
A probability of **1** means that something is certain to happen.

In summary, whether we write probabilities as fractions or decimals, all probabilities must be between 0 and **1**.

In more complex cases such as predicting whether it will rain or not tomorrow in Edinburgh, the Metrological Office using a combination of computer calculations and experience based on statements such as *'in the last fifty times the weather was in this particular state, it rained on eight occasions, therefore the probability of rain tomorrow is approximately* $^8/_{50}$*'*.

Probable **(5)**

A word used to indicate that an event is likely to happen. There is no strict definition of how probable something needs to be to be probable. No dictionaries give a strict definition, but in practice more than **50%** probability would seem reasonable to be useful.

Product (3)

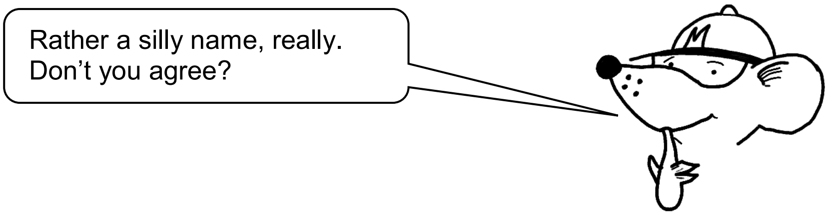
The answer when two or more numbers are multiplied. E.g. *'The product of **4** and **7** is **28**'*.

Profit (6)

This can be given as an amount of money, *'Jane bought a car for **£500** and sold it for **£550**. She made **£50** profit'*, or as a percentage of the original price. In the example given, Jane made **£50** profit on an original price of **£500**, i.e. **10%**.

Proper fraction (5)

A fraction in which the numerator is smaller than the denominator.



Property (4)

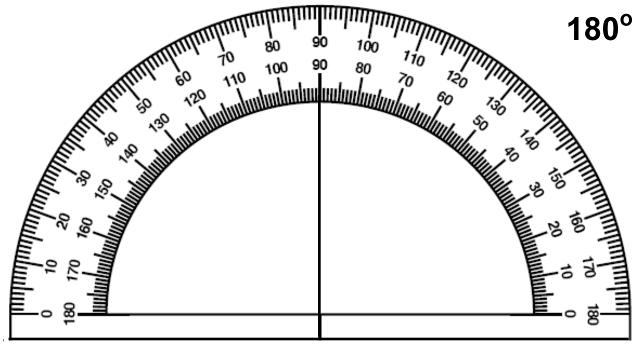
A characteristic of an object or number that may be used to distinguish it from others or group it with similar objects/numbers.
E.g. *'These shapes have four sides', 'These numbers are multiples of **7**', 'The number **5** is a factor of **20**'*

Proportion (4)

Parts in relation to a whole. E.g. *'To make concrete cement and ballast should be mixed in the proportions **1** to **6**', 'There is a greater proportion of people who cycle to school than walk'.*

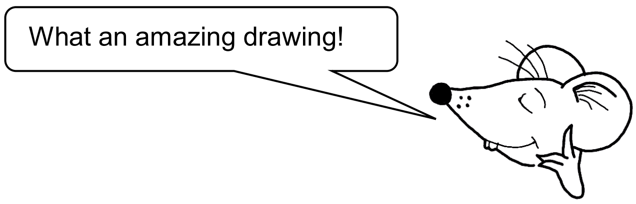
Protractor (5)

A tool for measuring angles. Two versions are available – the **180^0** and the **360^0** types.



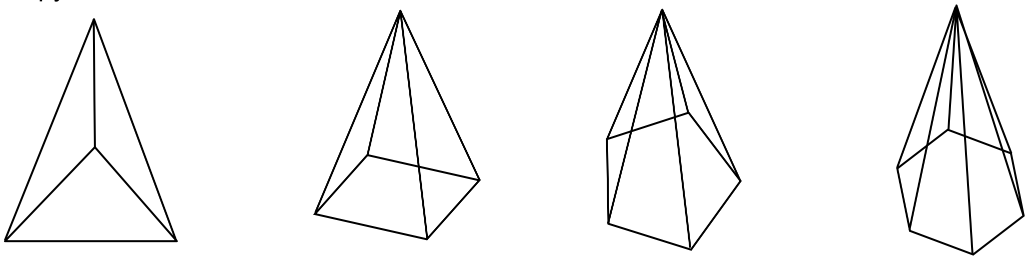
180^o Protractor

The protractor normally has two scales running in opposite directions so that angles may be measured clockwise or anti-clockwise.



Pyramid (R)

A three-dimensional shape sitting on a base with triangular faces rising to a point. In buildings such as the pyramids of Egypt, the base is square and there are four triangular faces, but there are many other types of pyramids:



Tetrahedron | Square-based Pyramid | Pentagonal-based Pyramid | Hexagonal-based Pyramid

Quadrant (5)
One of the four areas of the co-ordinate grid. The top right area is known as the first quadrant, the top left the second quadrant and so on anti-clockwise. See *'Co-ordinates'* for diagram.

Quadrilateral (3)
A two dimensional shape with four straight sides. See the major topic TWO DIMENSIONAL SHAPES.

Quarter past (2)
This should be associated with a quarter turn of the big hand, reinforcing several ideas: a complete rotation of the big hand represents one hour, a quarter turn is a right angle, the hands move clockwise and that the quarter hour is independent of the position of the small (hour) hand.

Quarter to (2)
As above, but with the difference that *'quarter to'* is represented by three-quarters of a full turn.

Quarter turn (2)
A turn of one right angle ($\mathbf{90^0}$).

Questionnaire (4)
A group of questions designed to collect data that may be used to give the answer to an important question through finding averages, drawing graphs etc. The most important thing about a questionnaire is that it should have a specific purpose. In other words, the collected data should be able to help the pupils answer specific questions into research they are conducting, so they should have a clear idea of what it is they are trying to find out.

Obviously, in the early years, this will be something simple such as finding the favourite chocolate bar of the class, as we are mainly interested in teaching the children how to process the data, but later it should develop into something more worthwhile such as supporting a project to develop the school play facilities or how the local parks are used throughout the four seasons of the year. In order to design the questionnaire, the children should know what data needs to be collected to answer their questions and what graphs and statistics they will need. This should then lead to a questionnaire that is purposeful in that it collects the necessary data. In other words, the questions are generally the last items to be written – a good plan of what is required is the first item to be constructed.

Quicker (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Quickest (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Quotient (4)
The answer when one number is divided by another. E.g. *'The quotient of **12** and **4** is **3**'*.

Radius (4)
The line or distance from the centre of a circle to any point on the circumference.

Random (6)
A number chosen without any bias in its choosing. This can be achieved for all practical purposes with a physical device such as a dice or spinner. Surprisingly, it is very difficult to achieve this with software and random number generating programs on computers often have a slight bias towards certain numbers, although this is hard to detect.

Range (5)
The difference between the largest and the smallest of a set of numbers. E.g. *'The range of these numbers **3, 13, 32, 5, 15, 6, 19** is **32 – 3 = 29**'*. It is not correct in mathematics to say that the range is from **3** to **32**, although this is often done in other subjects as in *'The temperature range was from 10^0C to 22^0C.'*

Record (1)
The making of a permanent statement of the results of calculations, experiments etc. This may be in the form of a written statement, graph, audio/video tape etc.

Rectangle **(R)**

A quadrilateral with two pairs of parallel sides and four right angles.
See the major topic TWO DIMENSIONAL SHAPES.

Rectangular **(2)**

In the shape of a rectangle.

Recurring **(6)**

Decimal numbers come in three types:

a) those that finish after a certain number of decimal places such as **5.873524363363**

b) those that extend to the right for ever with a repeating pattern such as **98.89898989898989…**

c) those that extend to the right for ever but do not repeat such as **π = 3.14159265358979323846…** and **√2 = 1. 41421356237309504880…**

Type b) are called recurring decimals. There are two ways of obtaining them. The first is to simply make them up. Choose a number of digits and simply repeat them. The second is to perform certain division sums. Bearing in mind that fractions can be thought of as division sums (see the major topic on FRACTIONS), this translates into changing a fraction into a decimal, choosing the numerator and denominator carefully.

E.g. dividing by **3, 7, 9, 11** etc and their multiples such as **6, 21** and **45** will generally give recurring decimals provided that the number into which you are dividing is not a multiple of the divisor.

So, $^{1}/_{3}$ **= 1 ÷ 3 = 0.333333…** $^{2}/_{3}$ **= 2 ÷ 3 = 0.666666…** $^{2}/_{7}$ **= 2 ÷ 7 = 0.285714285714285714…**

To begin with children will only come across simple recurring decimals such **0.333333…** and **0.666666…,** but quite quickly those who love to play with numbers can start to explore all sorts of patterns.

E.g. Divide each of the numbers **1, 2, 3, 4, 5** and **6** by **7** in turn and look for patterns.

Try changing recurring decimals back to fractions. This can be done (we do not have space to explain why this works here) by taking one set of the recurring digits and making them the numerator of a fraction. The denominator is them made up from the same number of nines.

E.g. Change **0.333333…** to a fraction. We see only one digit is repeated (**3**) and so all we need to do is put this as a numerator with one nine as a denominator: $^{3}/_{9}$. This can, of course, be cancelled to $^{1}/_{3}$, giving the fraction that is usually associated with **0.333333…** (There are others, of course, such as $^{2}/_{6}$, $^{5}/_{15}$ and so on, but these are simply fractions that are equivalent to $^{1}/_{3}$.)

E.g. Change **0.153153153…** to a fraction. We notice that this time there are three recurring digits (**153**) and so we put these as the numerator with three nines as the denominator: $^{153}/_{999}$. After a little thought, we notice that this fraction will cancel by nine (the digits **153** add to **9** and so **153** is divisible by **9**). Cancelling gives $^{17}/_{111}$ which is a fraction in its lowest terms. Dividing **17** by **111** on a calculator confirms this fraction is indeed **0.153153153…**

Recurring decimals can sometimes need some hard thought on the part of the children. For example, swimming three lengths of a pool that is **33**$^{1}/_{3}$ metres long gives a distance of **100m**. But **33**$^{1}/_{3}$ is **33.333333…,** so three lengths must be **99.999999…**m. Is the swimming test complete? (This, of course, proves that **99.999999…** is the same as **100**, but children need to think about this quite a bit before accepting it).

One last thing. There is an abbreviation for recurring decimals. There is no need to write the recurring digits out several times. Simply put a dot over the first and last of the recurring digits (or just the recurring digit if there is just one). So **0.247424742474…** can be written:

$$0.\dot{2}47\dot{4}$$

Some recurring decimals have non-recurring digits immediately after the decimal point followed by the recurring digits. E.g. $^{67}/_{90}$ gives **0.744444…** and $^{8007}/_{11100}$ gives **0.72135135135…** which can be written

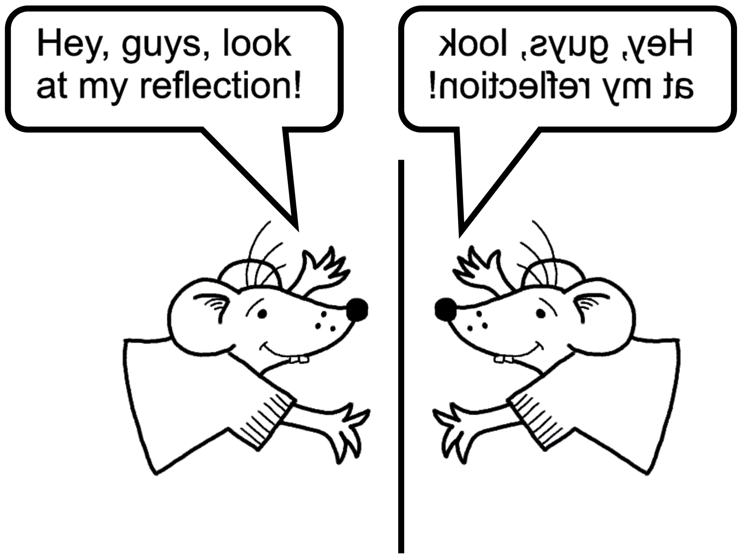
$0.7\dot{4}$ and $0.72\dot{1}3\dot{5}$ respectively.

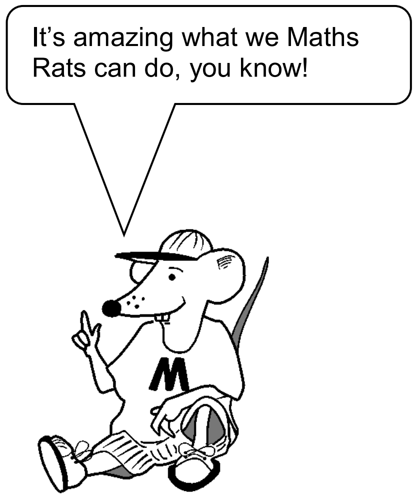
Reduced to **(5)**

A term used when dealing with equivalent fractions to express the fact that the fraction has been cancelled to something simpler. E.g. *'$^{50}/_{60}$ can be reduced to $^{5}/_{6}$.'* E.g. *'$^{7}/_{11}$ is a fraction that has been reduced to its lowest terms.'*

Reflection **(2)**

What you see when you look in a mirror. This idea is then extended to 'mathematical' mirrors. The difference between a normal mirror and a mathematical one is that with a normal mirror you can only stand in front of it to see a reflection. With a mathematical mirror, you can stand either side and see a reflection. This idea is used to describe shapes that have reflective symmetry in that the left side can be reflected to the right side and the right side can be reflected to the left side. If, therefore, we are given only one side of a shape that we know has reflective symmetry, we can draw the other half, no matter which side it is on.



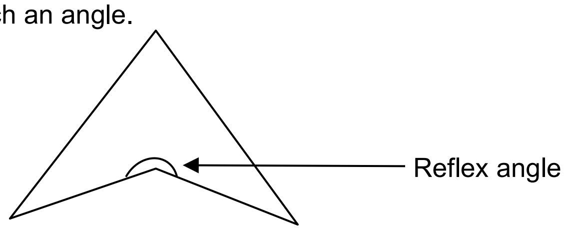


Reflective symmetry **(5)**

The property of a shape by which one half is a reflection of the other in a line passing through the middle of the shape, this line being the *'mirror line'* or *'line of symmetry'*.

Reflex **(6)**

Used to describe an angle that is greater than **180^0** and less than **360^0**. Some shapes such as the arrow head contain such an angle.



Regular **(4)**

Used to describe a two dimensional shape with all the sides equal and all the angles equal (See the major topic TWO DIMENSIONAL SHAPES) or a three dimensional shape with all faces identical (See the major topic THREE DIMENSIONAL SHAPES).

Remainder **(3)**

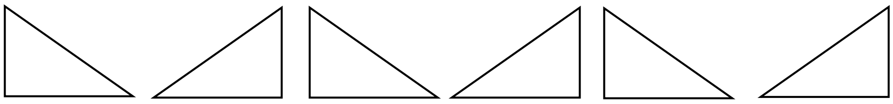
The number left over when a division sum is calculated without using decimals or fractions.
E.g. *'**58 ÷ 11** is **5** remainder **3**'*.

Repeated addition **(2)**

The idea that multiplication is repeated addition is very important in a child's understanding of this concept. Tables are really an expression of this fact: Once four is four, two fours are eight etc, illustrates the fact that one lot of four is being added on each time. Of course, things are not so simple when we multiply two fractions or decimals together. (Can we use repeated addition for **5.673 x 8.522** ?)

Repeating pattern **(R)**

A repeating pattern can be very simple such as the repeating of coloured squares (red, blue, green, red, blue, green…) or it can be more complex perhaps involving reflected or rotated shapes.



This gives children an introduction to more complex problems on reflections and rotations they will meet later in life.

Represents **(2)**

When one item represents another. A **£1** note, for instance, represents **100** pennies. A step on a block graph could represent five people or things or in place value the third digit to the left of the decimal point represents hundreds.

Rhombus **(6)**

A quadrilateral with four equal sides. See the major topic TWO DIMENSIONAL SHAPES.

Right **(R)**

Correct. Children should enjoy learning and it is essential that they are not criticized too much for mistakes they make, which are a natural part of the learning process ('to err is human'). Children love to be told that they have something correct, but feel bad when their answers are wrong, so try to avoid using this word if possible. The most important thing to do if a mistake is made is to use a less critical phrase such as 'not quite correct' and then make an effort to see where they have gone wrong and help the child to understand his/her mistake. Too many children say *'I'm not very good at maths'* when they are only seven or eight years old. This is quite an indictment on the skills (or lack of) of some teachers. This is not to say that children should not sometimes be reprimanded for lack of effort or concentration, which is a different matter.

Right angle **(2)**

A quarter turn or $\mathbf{90^0}$.

Right-angled **(3)**

Containing a right angle (as in right-angled triangle).

Risk **(5)**

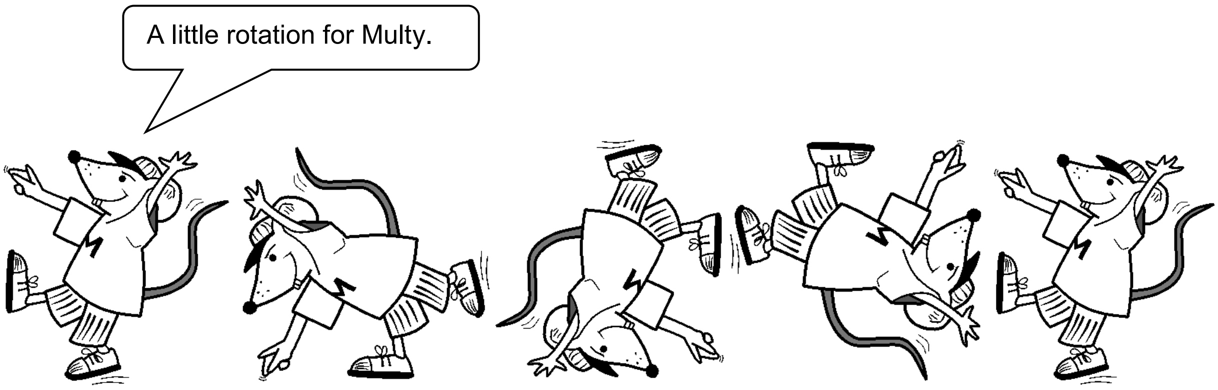
Used to assess the probability of something happening as in, *'If I stay late at school this afternoon, there is a high risk I will miss my bus.'*

Roll **(R)**

Used to describe the property that some objects will roll whilst others will not.

Rotation **(5)**

Used to describe a turning motion. Every rotation has a centre (which may be on the shape or off the shape being rotated) and a direction (clockwise or anti-clockwise). In addition, it is important to indicate the angle of the rotation, either in degrees or in terms of a whole turn (half-turn, one right angle, etc).



Roughly **(1)**

Used to mean *'approximately'*.

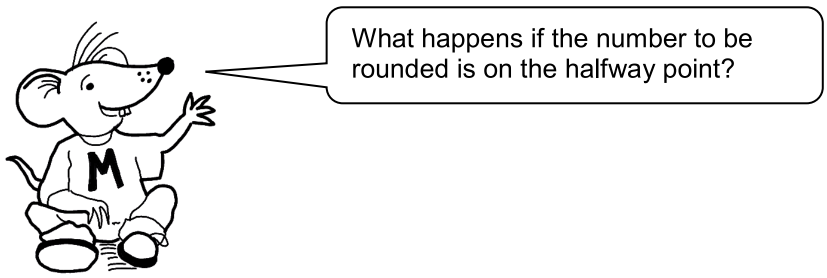
Round **(2)**

Used to approximate a number.
The principle here is to look for the halfway point between the appropriate limits.

Example 1: *'Round sixteen to the nearest ten.'* In this example, the nearest ten could be **10** or **20**. Halfway is **15** and sixteen is greater than **15**, so we round to **20**. If the question had asked us to round **13**, we would have rounded down because **13** is closer to **10** than **20**.

Example **2**: *'Round **5 438** to the nearest thousand.'* Here the possibilities are **5 000** and **6 000**. Halfway is **5 500**, so **5 438** is rounded to **5 000** as it below the halfway point.

Example 3: *'Round **23.6** to the nearest unit (whole one)'.* The possibilities are **23** and **24**. Halfway is **23.5** and **23.6** is greater than this so we round up to **24**.



If the number to be rounded is on the halfway point, we always round up.
Example **4**: *'Round **45** to the nearest **10**'.* The possibilities are **40** and **50**. The halfway point is **45**. The number we are asked to round is equal to the halfway point, so we round up. Therefore **45** rounded to the nearest **10** is **50**.

The reason we do this is that it is only rarely that the number to be rounded is exactly on the halfway point. More often it is a tiny bit above because there are figures in the less significant digit places.

Example **5**: *'Round **67.500023** to the nearest unit (whole one).* The possibilities are **67** and **68**. The halfway point is **67.5**, but the extra digits (**0.000023**) push the number to the higher side of the halfway point, so we need to round up to **68**. Even a single **1** in the fiftieth decimal digit would be enough to tip us into the higher side of the halfway point.

Round (R)
Used to describe the circular nature of an object: *'Footballs are round.'*

Round to the nearest hundred (4)
Giving a number to the nearest hundred: *'Round **475** to the nearest hundred.'* See ROUND.

Round to the nearest ten (2)
Giving a number to the nearest ten: *'Round **87** to the nearest ten.'* See ROUND.

Rounding (5)
The process of giving a number to a pre-defined accuracy. For examples see ROUND.

Route (2)
A way from place A to place B on a simple map. Normally given as a series of instructions or a line drawn on a map.

It's a good idea for children to have some understanding of how the Global Positioning Satellite System is used to track vehicles and help drivers find the route to their destination.

Row (2)
Rows and columns as used in an array such as a table square. Columns run from top to bottom like the columns in the old Greek or Roman buildings; rows run from left to right as do the seats in a cinema.

Ruler (1)
Rulers used by young children will show only centimetres, but millimetres will be included as soon as they are able to manage these. However, in the same way that small hands need big bricks, young minds need big units and it is a mistake to introduce millimetres too early. What is important is to practise the process of measuring which is never as simple as it seems. See *'Measure'* for a discussion of this point.

Saturday (2)
See the major topic TIME.

Scalene triangle (5)
A triangle with no special properties i.e. all its sides are different lengths. See the major topic TWO DIMENSIONAL SHAPES.

Scales (R)
See *'Weigh'*.

Score (R)
A result obtained in a game such as darts and some card games.

SE (4)
See COMPASS POINT.

Seasons (1)
The important thing about seasons is that they are cyclic like the days of the week and the months of the year. They always come in the same sequence, but there was no first season and there will be no last.

Second **(2)**

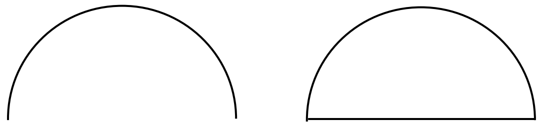
A well defined unit of time. Children begin to understand the second as *'How many seconds does it take to do …'*, but later it is combined with other units such as distance to produce speed. See the major topic TIME for more information.

Second **(R)**

See the major topic CARDINAL and ORDINAL NUMBERS.

Semi-circle **(3)**

A half circle:



September **(2)**

See the major topic TIME.

Sequence **(2)**

a) A group of related shapes displayed in some logical linear way.

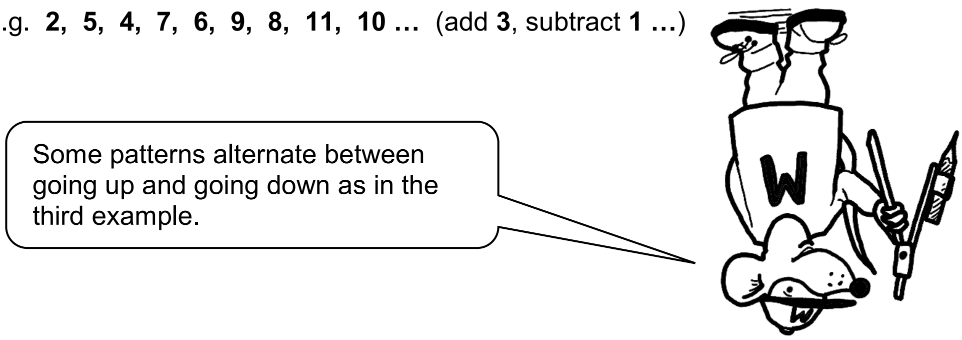
E.g. ■ ■ ■ ■ ● ● ● ● ■ ■ ■ ■ ● ● ● ● ■ ■ ■ ■ ● ● ● ●

b) A set of numbers written in a logical sequence

E.g. **2, 4, 6, 8, 10, 12, 14, …**

E.g. **6, 3, 0, -3, -6, -9, …**

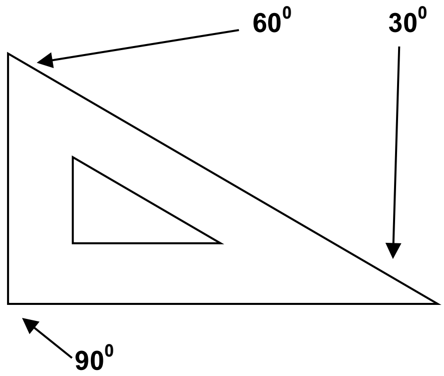
E.g. **2, 5, 4, 7, 6, 9, 8, 11, 10 …** (add **3**, subtract **1 …**)



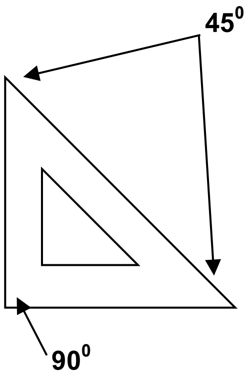
Set **(R)**

A group of items or numbers that are related. See *also 'Venn and Carroll Diagrams'*.

Set square (4)
A triangular piece of plastic shaped to have either a) one right angle and two **45°** angles or b) one right angle, a **30°** angle and a **60°** angle.



60⁰/30⁰ Set Square



45⁰ Set Square

Share equally (2)
Introduction to division.

Shorter (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Shortest (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Side (R)
One of the edges joining two corners on a polygon.

Sign (1)
Initially the equals, add, subtract, multiply and divide signs, but later the negative and square root signs etc.

Sign change (6)
A key on a calculator that changes the sign of the number in the display. If it was positive, it becomes negative and visa versa.

Sixth (4)
a) See the major topic CARDINAL and ORDINAL NUMBERS.
b) One sixth as a fraction: $^1/_6$. One whole divided by six.

Sketch (4)
A reasonable accurate drawing of an object or shape, showing the essential features but not drawn accurately to scale.

Slower (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Slowest (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Smaller (R)
See the major topic COMPARATIVE and SUPERLATIVE.

Smallest **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

Sold **(2)**
Past tense of *'sell'*.

Solid **(R)**
Used to refer to a shape that has no empty space inside – opposite of 'hollow'.

Sort **(4)**
An instruction to classify shapes or numbers by their properties.
E.g. *'Sort these numbers into prime and non-primes', 'Sort these shapes according to how many right angles they have'.*

South **(3)**
See the major topic COMPASS POINT.

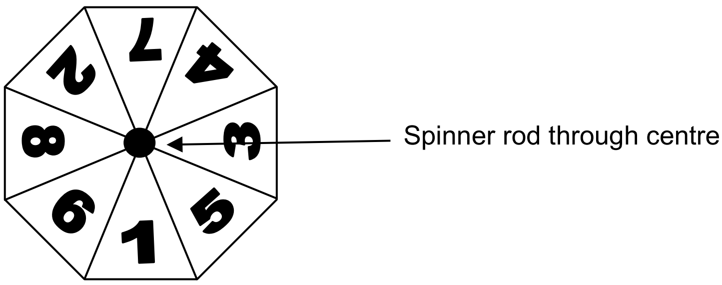
South-east **(4)**
See the major topic COMPASS POINT.

South-west **(4)**
See the major topic COMPASS POINT.

Sphere **(R)**
A ball shape. More technically, a three dimensional shape for which every point on its surface is the same distance from a fixed point (the centre).

Spherical **(4)**
In the shape of a sphere. *'Most planets are spherical in shape.'*

Spinner **(5)**
A device that can be spun to generate a random number. Used in the study of probability.
One type is made from a piece of plastic or card in the shape of a regular hexagon, octagon etc on which numbers are written. It then has a rod through the centre so that it may be spun, rather like a small gyroscope.



Spring **(1)**
One of the four seasons. The main idea for children to understand is that the seasons are cyclic, without beginning or end.

Square **(R)**
a) A quadrilateral with four equal sides and four right angles. See the major topic TWO DIMENSIONAL SHAPES.
b) Non-Daddyo.

Square centimetre (cm^2) **(4)**
The area of a square **1cm x 1cm**. See the major topic METRIC SYSTEM.

Square metre (m^2) **(5)**
The area of a square **1m x 1m**. See the major topic METRIC SYSTEM.

Square millimetre (mm^2) **(5)**
The area of a square **1mm x 1mm**. See the major topic METRIC SYSTEM.

Square number **(5)**
A number that results from multiplying an integer by itself. E.g. **9** is a square number because it results from **3 x 3**. These numbers are called *'square'* because they can be drawn in the shape of a square array:

☺ ☺ ☺
☺ ☺ ☺
☺ ☺ ☺

The first few square numbers are **0, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100 …**

Square-based **(4)**
A three dimensional shape that sits on a square face known as its base. This is normally used to refer to pyramids. *'The Egyptian pyramids are all square-based pyramids'*. See the major topic THREE DIMENSIONAL SHAPES.

Standard unit **(4)**
When children begin measuring they can use any convenient unit such as hand spans or strides. Pretty soon, however, with a little encouragement from their teacher, they feel the need to have a standard unit so that people agree on the length or mass of an object. Standard units such as metre, centimetre and kilogram are normally amongst the first to be introduced.

Stands for **(2)**
A reference to place value. E.g. *'The second digit from the right (or from the decimal point) represents tens.'*

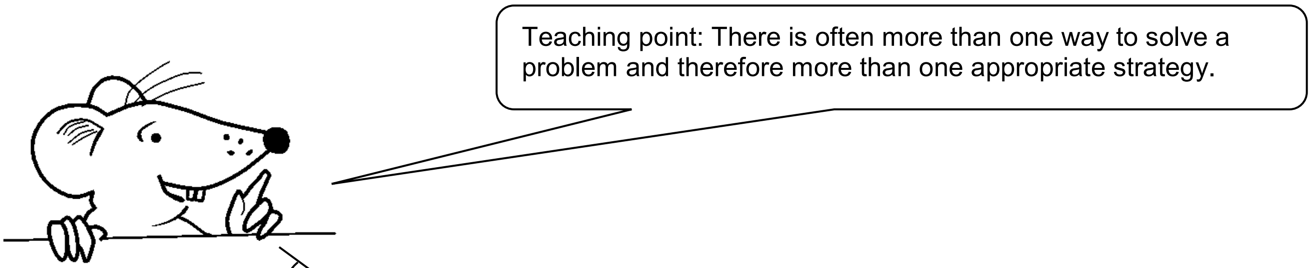
Star **(R)**
Simply refers to a star shape. Later, the reflective and rotational symmetry of star shapes can be discussed.

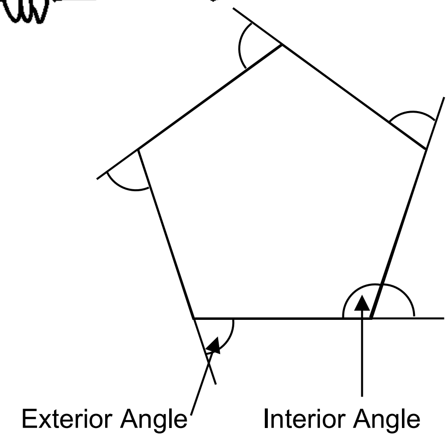
Statistics **(6)**
The study of collecting and analyzing data. Includes collecting data through surveys, graph drawing, and finding averages.

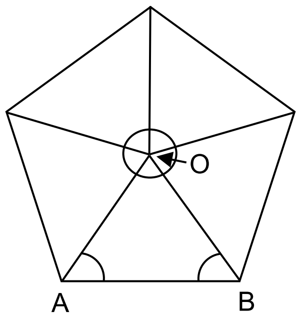
Straight (line) **(R)**
The idea of a straight line. The shortest distance between two points. Polygons are made from straight lines and so on.

Strategy **(5)**

A technique designed to solve a problem.
E.g. *'How would you find the interior angle of a regular pentagon?'*







Strategy 1

a) Notice that there are five equal exterior angles on a regular pentagon.

b) Each exterior angle must therefore be **$360^0 \div 5 = 72^0$** since turning through five of these will produce a complete turn. (Imagine a bus driving around the pentagon and turning **72^o** at every corner (vertex)).

c) Each interior angle must be the difference between **180^0** and the exterior angle,
i.e. **$180^0 - 72^0 = 108^0$**.

The interior angle is therefore **108^0**.
Q.E.D.

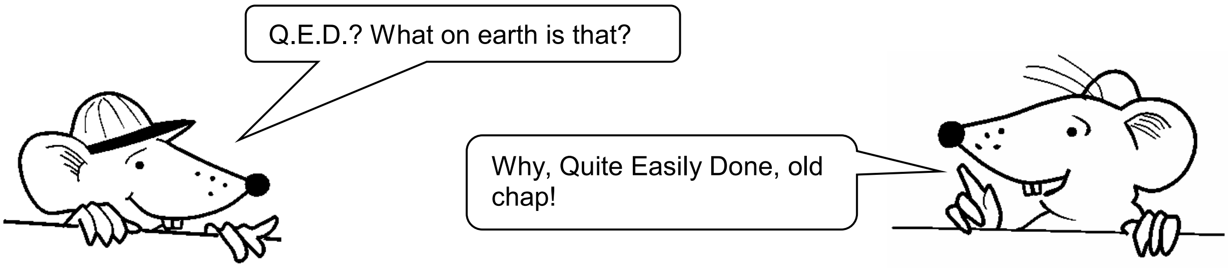
Strategy 2

a) Draw lines from the centre of the shape to the vertices.

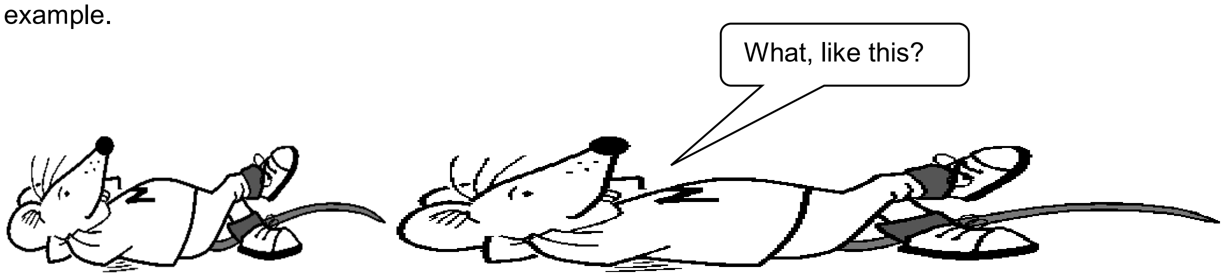
b) Calculate the value of one of the angles at the centre so formed, say, <AOB:
$360^0 \div 5 = 72^0$

c) <OAB + <OBA must therefore be equal to **$180^0 - 72^0 = 108^0$**.

d) But <OAB + <OBA equals one interior angle. The interior angle must therefore be **108^0**.
Q.E.D.



Stretch **(R)**
The process of stretching a shape in one or both directions. Changing a square into a rectangle, for example.



Subtract **(1)**
The process of taking one number from another. There are many ways of subtracting such as counting on; counting back; counting up to the next ten, then between tens and finally to the second number; decomposition.

Sum **(R)**
This term has two meanings:
a) Any operation that involves addition, subtraction, multiplication or division.
b) The stricter definition of the answer to an addition sum. E.g. *'The sum of six and five is eleven.'*

Summer **(1)**
One of the four seasons. The main idea for children to understand is that the seasons are cyclic, without beginning or end.

Sunday **(2)**
See the major topic TIME.

Surface **(2)**
A portion of space having length and breadth but no thickness. One of the faces of a three-dimensional shape. The area of a surface is often required to be found. See AREA.

Survey **(4)**
The collection of data, normally by going out into the field with questionnaires.

SW **(4)**
See COMPASS POINT.

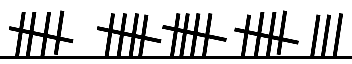
Symbol **(2)**
Any character that represents some concept. For example, road signs represent road works etc, figures represent numbers, flags represent countries. Given that figures (themselves an abstract concept) represent the abstract concept of number, it is surprising that children catch on so quickly when learning to count and to write numbers.

Symmetrical **(R)**
A shape may have reflective or rotational symmetry and is therefore described as *'symmetrical'*.

Taller **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

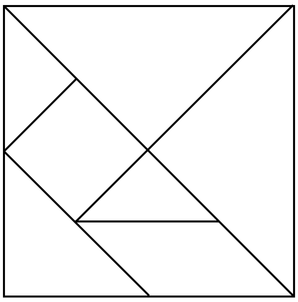
Tallest **(R)**
See the major topic COMPARATIVE and SUPERLATIVE.

Tally **(2)**
A method or recording counting in which a line is drawn for each number counted. These are drawn in groups of five with the first four vertical and the fifth horizontal.

E.g. This tally represents **23**: 

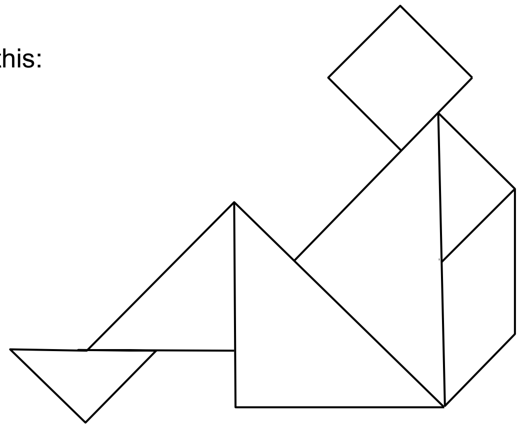
Tangram **(6)**

An ancient Chinese puzzle in which a square is cut into seven parts as follows:



The idea of the puzzle is to rearrange the pieces to make pictures, some of them traditional, some newer.

Like this:



Tape measure **(2)**

One of a number of devices used for measuring. For younger children it should be marked in centimetres and metres only. Later, children can progress to tapes marked in millimetres as well.

Ten less **(R)**

The process of subtracting ten from a number. Initially, this will be just a two digit number, but will include higher numbers later. The important point is that children learn and understand that the first digit in a two digit number is the number of tens in the number, so to reduce a number by ten simply involves subtracting one in this column. Unfortunately, the confidence with which an adult may approach this problem is not matched by the confidence of a young child and many will need to subtract one from the tens column <u>and</u> count ten backwards to see if they are the same before the penny really drops.

Ten more **(R)**

The same process as above in *'Ten Less'*, but adding instead of subtracting.

Ten thousand **(4)**

The value of a **1** placed in the fifth digit counting left from the decimal point. See the major topic DECIMAL SYSTEM.

Tens **(1)**

The value of a **1** placed in the second digit counting left from the decimal point. See the major topic DECIMAL SYSTEM.

Tens boundary **(2)**

Used to discuss what happens when adding or subtracting a number to another number takes us into the next ten. E.g. Adding **8** to **15** involves crossing the **20** boundary.

Tenth **(3)**

a) See the major topic CARDINAL and ORDINAL NUMBERS.

b) One tenth as a fraction: $^{1}/_{10}$. One whole divided by ten.

Tenths boundary **(5)**
Used to discuss what happens when adding or subtracting a number to another number takes us into the next tenth. E.g. Adding **0.06** to **1.38** involves crossing the four tenths (**0.4**) boundary.

Tetrahedron **(4)**
A three dimensional shape with four triangular faces. See the major topic THREE DIMENSIONAL SHAPES.

Third **(R)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.
b) One third as a fraction: $^{1}/_{3}$. One whole divided by three.

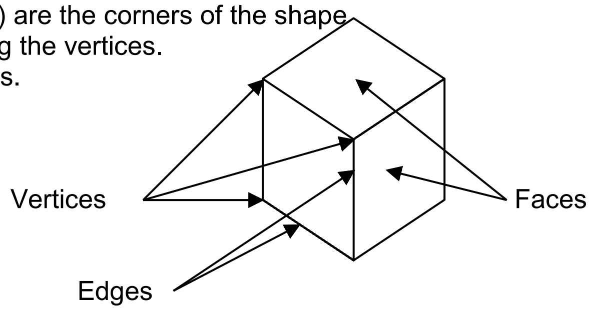
Thousands **(4)**
See the major topic on DECIMAL SYSTEM.

Thousandth **(6)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.
b) One thousandth as a fraction: $^{1}/_{1000}$. One whole divided by a thousand.

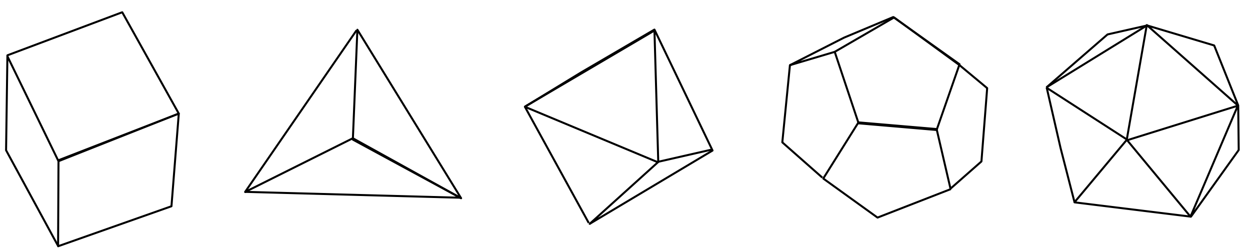
THREE DIMENSIONAL SHAPES
Shapes that have length, width and thickness. In other words, shapes that occupy space and need to be made from a material such as clay or can be made hollow using card or plastic. It is important to have a collection of these shapes in the classroom because it is difficult to visualize some of them without an example in front of you. There are, of course, an infinite number of such shapes but some are more interesting from a mathematical point of view than others:

Most of the interesting shapes are made up from straight lines, the sphere, the cone and the cylinder being notable exceptions.

It is important to use the correct terminology with three dimensional shapes:
Vertices (singular 'vertex') are the corners of the shape
Edges are the lines joining the vertices.
Faces are the flat surfaces.

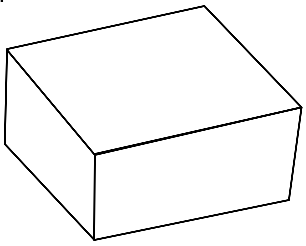


Three dimensional shapes are referred to as 'polyhedra' (singular 'polyhedron') if all the edges are straight lines.
Regular polyhedra are polyhedra whose faces are all identical. There are only five regular polyhedra, shown below. All other polyhedra are known as irregular.



Cube	Regular Tetrahedron	Regular Octahedron	Regular Dodecahedron	Regular Icosahedron
6 faces	**4 faces**	**8 faces**	**12 faces**	**20 faces**

A ‘stretched’ cube is called a cuboid:

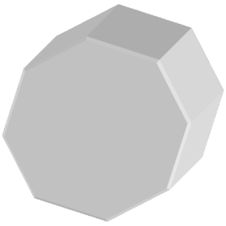


Another interesting group of three dimensional shapes is the pyramids. A pyramid is normally referred to by the shape of its base. So the pyramids found in Egypt are all ‘Square based pyramids’
A pyramid with a triangular base is called a tetrahedron which is the exception to the naming system.
Other pyramids are:

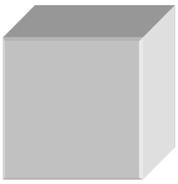
Pentagonal based pyramid	Five sides base
Hexagonal based pyramid	Six sided base
Heptagonal based pyramid	Seven sided base
Octagonal based pyramid	Eight sided base
Nonagonal based pyramid	Nine sided base
Decagonal based pyramid	Ten sided base
Dodecagonal based pyramid	Twelve sided base.

In practice, children rarely come across pyramids with a base of more than eight sides.

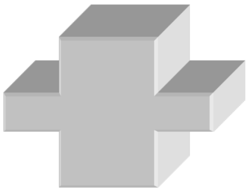
Prisms are an important class of three dimensional shapes. A prism is a shape that has the same cross section throughout its whole length. In other words, if you sawed it across its length you would always get the same shape at the same size no matter where you sawed it. Here are some prism:



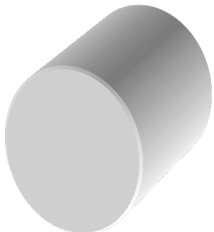
Octagonal Prism



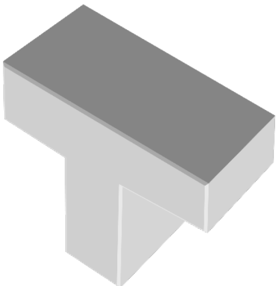
Cuboid



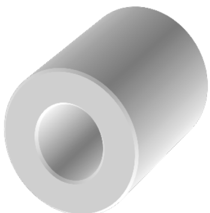
Cross girder



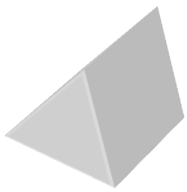
Cylinder



Tee girder

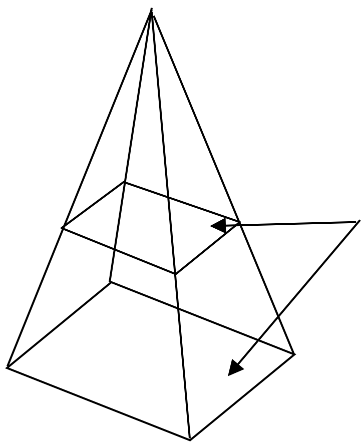


Hollow Cylinder



Triangular Prism

Note that pyramids and cones are not prisms because, although they have the same cross sectional shape throughout their length (or height), this changes in size as we move along the axis of the pyramid or cone.



Thursday (2)

See the major topic TIME.

TIME (R)

There are many aspects to the subject of time which children must learn as they progress through school.

Firstly, there are the ways we divide up time and the labels we use to discuss it. We refer to the following:

Millennia: a millennium is a thousand years and on our calendar normally starts at a complete multiple of **1000** plus **1** year, **1-1000** being the first millennium, **1001-2000** the second millennium, **2001-3000** the third millennium and so on. Notice that although the millennia begin on years **1, 1001, 2001** etc, we celebrated the new millennium in the year **2000** because celebration is more to do with round numbers than it is with technical accuracy!

Centuries: a century is a hundred years and on our calendar normally starts at a complete multiple of **100** plus **1** year, **1-100** being the first century, ….. **1901-2000** the twentieth century, **2001-2100** the twenty-first century and so on.

Years: a year is the time it takes the Earth to orbit once about the Sun. This time is just under **365¼** days. As we like days to begin at midnight, we deal with the extra quarter days by introducing leap days every four years on February **29th**. Unfortunately, because the orbital period is slightly under **365¼** days, this means we have too many leap years. The solution is that every fourth year in the calendar is a leap year unless it is divisible by **100**. However, every **400th** year **is** a leap year.

The following are therefore leap years: **1600, … 1980 ….1996, 2000, 2004, … 2020,… 2400** etc
The following are not leap years: **1700, 1800, 1900, 2100, 2200, 2300, 2500** etc
It is interesting to note that not all calendars in the world begin at midnight on January **1st**. A calendar commonly used in the east begins its year at the precise moment of the Spring Equinox on or about **21st** March!

Months: Children need to learn the names and order of the months of the year as well as the number of days in each. It is also a good idea for them to learn how to spell them:
January **31** February **28/29** March **31** April **30** May **31** June **30** July **31** August **31** September **30** October **31** November **30** December **31**

It helps children realize the significance of months if they use a calendar and put on it any significant days in their lives – Christmas Day, birthdays of themselves and their friends, beginning and end of school terms etc.

Weeks: There are, of course, fifty two weeks in a year, each with seven days. This gives **364** days in all. Hence we have a surplus of one day each year (two in leap years). That is why a fixed day (your birthday, for example) moves forward one day of the week each year (two days where there is February **29th** in between). If your birthday was on a Wednesday in **2002**, it would have been on a Thursday in **2003**.

Days, Hours, Minutes, Seconds: Children need to know there are **24** hours in a day, **60** minutes in an hour and **60** seconds in a minute. As they grow older it is also useful to know that there are **3600** seconds in an hour and **84 600** seconds in a day.

As a matter of interest a million seconds is **11** days, **13** hours, **46** minutes and **40** seconds and A billion seconds is approximately **31** years and **251** days, depending on leap years. So someone born at midnight on **1st** January **2000** will pass the one billion second mark at **1** hr **46** min and **40** seconds past midnight on **1st** June **2031**.

Secondly, children need to know in year six the difference between Greenwich Mean Time and British Summer Time. Greenwich Mean Time can be thought of as 'Sun time'. It is the time at which the Sun is due south at midday. Because the Earth does not orbit the Sun in a perfect circle and because we divide the Earth's surface into time zones in which quite a large part of the Earth has the same time regardless of its geographical location within that time zone, the Sun is not often exactly south at midday, but it is a good approximation that suffices for everyday use. (If you live in Eastern England and travel to the west coast of Ireland, for example, you will notice how much later, according to your watch, the sun sets in the evening). It's also interesting to note that despite its great size, there is only one time zone in China. Greenwich Mean Time (**G.M.T.**) is also known as Universal Time (**U.T.**), particularly by astronomers, and Zulu Time (**Z.T.**).

British Summer Time is simply Greenwich Mean Time with one hour added on. The clocks go forward at **1 a.m. G.M.T**. on the last Sunday in March and back at **1 a.m. G.M.T.** on the last Sunday in October. If you cannot remember which way to set your clocks simply remember 'Spring forward, fall back' (fall = autumn). We do this so that in the summer everyone goes about their daily business one hour earlier and arrives home one earlier than in winter so that they may enjoy the longer summer evenings at home instead of in the office/school etc.

Thirdly, there are the ways we record the passage of time. We can do this over longer periods of time by marking dates in a diary, calculating the time between two dates and placing historical events on a time line.

Over shorter periods we can record the time in seconds and minutes using stop watches/clocks or timers connected to computers. There is even a set of plastic shapes that rock back and forth for a given time (say, ten seconds). As we use time so much in our modern society, children should be given every opportunity to record the time taken to perform certain tasks: travelling from home to school, counting to one hundred, saying the eight times tables and so on. This also gives sets of data that may be used for drawing graphs, finding averages etc.

Fourthly, children should be familiar with timetables. These can be as simple or as complicated as one wishes. Children can begin by making their own timetable of the things they do in a day and progress to but and train timetables.

Fifthly, there is the use that is made of time when it is combined with other units. The most obvious example of this is that of calculating speed, which is time combined with distance. There are numerous experiments children can perform in which they time how long it takes them to run **100** metres and calculate their average speed. The same experiments can be conducted for cyclists, motorists, snails – the world is your oyster!

There also many other units with which time can be combined such as litres in calculating how much water flows along a stream/pipe or into a bath per second, how many grapes can be eaten in a minute, how many degrees the temperature of a kettle of water rises per minute, how many kilograms of sand can be shoveled into empty buckets per minute, how many milliliters of orange juice can be sucked through a straw per second (time over a ten second period and divide by ten).

Timer **(2)**
A device for measuring time. This may be a clock, watch, stopwatch, water timer, sand timer or any other suitable device.

Times as big as, as long as, as wide as etc **(2)**
Indicates number of times one thing is as big/long/wide etc as another. E.g. *'The classroom is six times as long as that table'.*

Timetable **(4)**
A chart showing times of trains, buses etc or lessons in school.

Title **(2)**
Every graph or chart should have a title and children should be encouraged to provide one at every opportunity. They should be learning that, although the purpose of the graph or chart is clear to them, it may not be clear to others and need explaining.

To every **(5)**
Used when describing patterns. E.g. *' To every square there are four circles'.*

Today **(R)**
See the major topic TIME.

Tomorrow **(R)**
See the major topic TIME.

Tonne **(6)**
One thousand kilograms. See the major topic METRIC SYSTEM for more details.

Total **(R)**
The sum of a set of numbers. Used in various situations such finding the average (mean) and finding a total cost of a shopping list.

Translation **(4)**
A slide in a particular direction. Later this can be executed on a squared board such as translating a shape three squares to the right and one up.

Trapezium **(6)**
A quadrilateral with one pair of parallel sides. See the major topic TWO DIMENSIONAL SHAPES**.**

Triangle **(R)**
A two dimensional shape with three straight sides. See the major topic TWO DIMENSIONAL SHAPES for the different types.

Triangular **(2)**
In the shape of a triangular. E.g. *'That box of chocolates is triangular in shape.'*

Tuesday **(2)**
See the major topic TIME.

Turn **(R)**
A complete rotation, i.e. $\mathbf{360^0}$. May be subdivided as in half-turn, quarter turn etc.

Twentieth **(4)**
a) See the major topic CARDINAL and ORDINAL NUMBERS.
b) One twentieth as a fraction: $^1/_{20}$. One whole divided by twenty.

Twenty-second **(2)**
See the major topic CARDINAL and ORDINAL NUMBERS.

Twenty-first **(2)**
See the major topic CARDINAL and ORDINAL NUMBERS.

Twice **(1)**
Two times.

Two hundred **(2)**
See the major topic on the DECIMAL SYSTEM.

Two, three etc **(R)**
See the major topic on the DECIMAL SYSTEM.

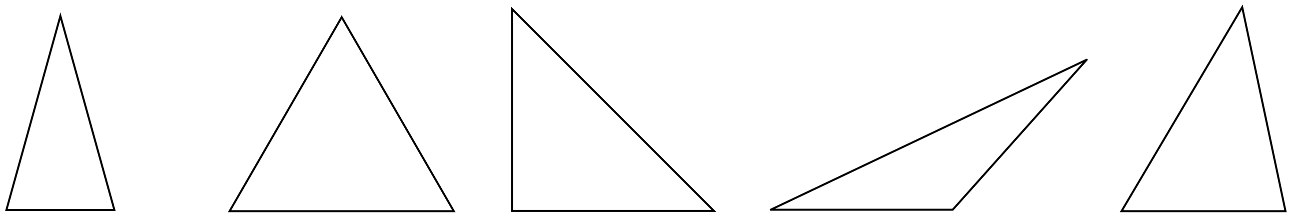
Two-dimensional **(4)**
Having only length and width, but no thickness. Although it is not strictly correct, we sometimes think of the surface of an object such as a sphere or cylinder as two-dimensional as it allows us to illustrate some very interesting geometric possibilities such as two-dimensional creatures living on the surface of a sphere.

TWO DIMENSIONAL SHAPES

Shapes that have length and width but no thickness. In other words, shapes that can be drawn on a piece of paper. There are, of course, an infinite number of such shapes but some are more interesting from a mathematical point of view than others:

Most of the interesting shapes are made up from straight lines, the circle being a notable exception. The main classification we can therefore make is by the number of sides:

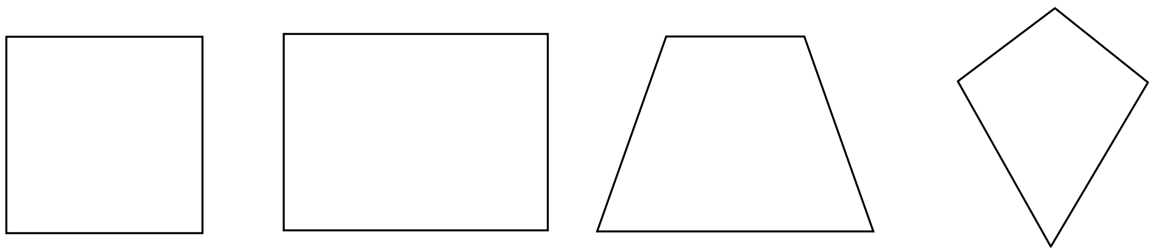
Triangles (3 sides). The basic types of triangle are:



Isosceles:	Equilateral:	Right angled:	Obtuse angled:	Scalene:
Two equal Sides	Three equal Sides	One right angle	One obtuse angle	No sides equal

The scalene triangle is very unusual in that is probably the only shape defined as having no special properties. Normally in mathematics, we define objects by the properties they have, not by the ones they do not have.
With triangles, equal length sides means equal angles, so the isosceles triangle has two equal angles and the equilateral triangle has three equal angles.

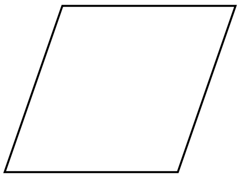
Quadrilaterals (4 sides). The basic types of quadrilaterals are:



Square	Rectangle	Trapezium	Kite
Four equal sides Four right angles	Two pairs of equal sides Four right angles	One pair of parallel sides	Two pairs of adjacent equal sides

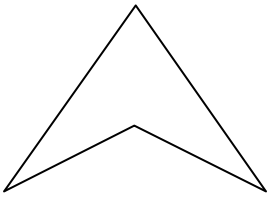
Parallelogram

Two pairs of parallel sides



Rhombus

Four sides of Equal length



Arrow Head

Two pairs of adjacent equal sides
One reflex angle (greater than **180^0**)

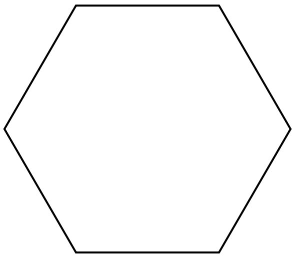
Notice how one set of properties leads to another set. The fact that a parallelogram has two pairs of parallel sides, for example, means it also has two pairs of opposite, equal angles and that its sides are two pairs of equal length.

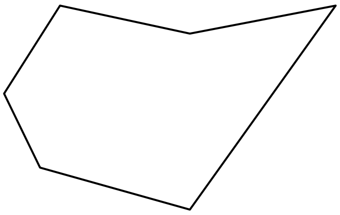
Polygons. From now on, the names of the shapes take on a particular pattern. The word 'polygon' means a two dimensional shape made from straight sides. We use prefixes to indicate the number of sides:

Pentagon	Five sides
Hexagon	Six sides
Heptagon	Seven sides
Octagon	Eight sides
Nonagon	Nine sides
Decagon	Ten sides
Dodecagon	Twelve sides

Triangles and quadrilaterals are also polygons, of course, but we tend to use the individual names such as 'equilateral triangle' and 'square' in everyday use.

With higher number of sides, the shapes can be bent and twisted into all sorts of weird and wonderful shapes. This makes it virtually impossible to name them all, so instead we content ourselves with differentiating between regular and irregular polygons. Regular polygons have all sides the same length and all angles the same value (one does not naturally follow from the other so we must insist on both).





E.g. **Regular Hexagon** **Irregular Hexagon**

Uncertain **(5)**
Used to describe an event that has a low probability of happening. E.g. *'If I throw a normal dice, it is uncertain that I will obtain a six.'*

Unfair **(5)**
See 'Biased'

Unit **(4)**
A unit of measurement. Arises from the idea that units form a system such as the metric or imperial systems and that within each, units are standardised.

Units **(1)**
The units column in place value. The idea that the first digit from the right (or from the decimal point) represents single items. See the major topic PLACE VALUE.

Units boundary **(5)**
In the same way as when we go from, say, **49** to **61**, we cross the tens boundary, we cross the units boundary when we go from, say, **8.9** to **9.1** .

Unlikely **(5)**
Used to describe the idea that some events are not very likely to happen, i.e. they have a low probability of happening. E.g. *'If I toss a coin ten times, it is unlikely that I will obtain ten heads.'*

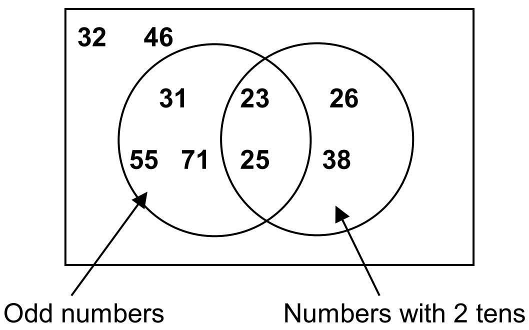
Usually **(1)**
The idea that some things are more likely to happen and therefore have a higher probability than others. E.g. *'My mother usually meets me after school.'*

Value **(3)**
a) The idea that objects have an intrinsic value and may be exchanged for others according to this value. Included in this is the idea that money has value which is not necessarily related to the number of coins/notes we have.

b) The idea that a digit can have a different value depending on its place in a number. See the major topic PLACE VALUE.

Venn and Carroll Diagrams **(3)**
Two types of diagram used for sorting numbers or objects.

Venn Diagram



Carroll Diagram

	Nos. with two tens.	Nos. <u>not</u> with Two tens
Odd Nos.	**23 25**	**31 55 71**
Non-odd Nos.	**26 38**	**32 46**

Here, the numbers **23, 25, 26, 31, 32, 38, 46, 55** and **71** have been sorted in both types of diagram.

Vertex **(3)**
A 'corner' on a two or three dimensional shape; the point at which two or more edges meet. See the major topic THREE DIMENSIONAL SHAPES.

Vertical **(3)**
At right angles to the Earth's surface locally.

Vertices **(3)**
Plural of *'vertex'*.

Vote **(1)**
A way of collecting data. Voting for your favourite chocolate bar so that a block graph may be drawn.

Watch **(R)**
See the major topic TIME.

Wednesday **(2)**
See the major topic TIME.

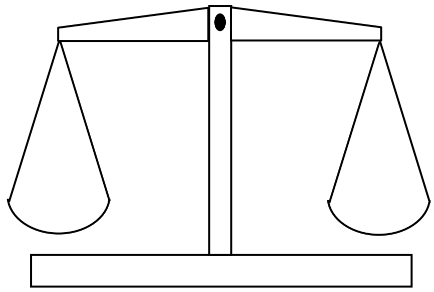
Week **(R)**
See the major topic TIME.

Weekend **(1)**

The two days Saturday and Sunday taken together.

Weigh **(R)**

The process of finding the weight or mass of an object. (If you are not sure of the difference see the major topic MASS and WEIGHT). In the early stages it is enough to show that some objects weight more than others. Objects may be compared by putting each in one pan of a balance:



Later standard weights can be put in one pan to balance an object whose mass is unknown. By making the balance level we can find the mass of the unknown object.
It is interesting to note that this method of finding the mass of an object will work on any planet because the reduction in gravitational force affects each pan equally.

Later, mass may be found by using a weighing scale with a rotating needle such as the type used to measure our own body weights or the older type of Post Office scales. These days many are digital, but whether analogue or digital, they both make use of a spring against which the weight of the object presses. This type would give a different reading of mass because the force pushing against the spring depends on the force of gravity.

Weighs **(R)**

Used to indicate the weight (or mass – see discussion in major topic MASS and WEIGHT) of an object: 'The book weighs **400 g**.'

Weight **(R)**

See the major topic MASS and WEIGHT.

West **(3)**

See the major topic COMPASS POINTS.

Whole turn **(1)**

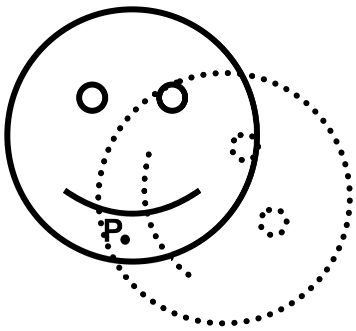
A turn of 360°.

Children can begin to appreciate a whole turn by rotating their bodies about a vertical axis so that they finish facing the same way as they started. They can do this in the classroom or in P.E. lessons.

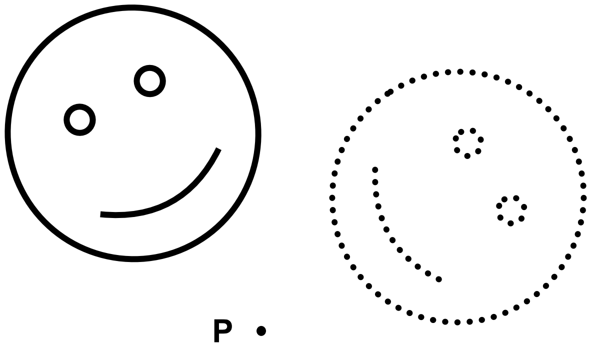
They can be asked to rotate two or three whole turns without stopping, but emphasize precision – you don't want them getting dizzy and falling over! They can also be asked to rotate their heads by a whole turn without moving their bodies to show this particular rotation is not always possible. They can then rotate both two and three dimensional objects a given number of times both clockwise and anti-clockwise.

Later they will come to appreciate that a rotation has a centre – a point that remains in the same place during the rotation. This may be inside the shape or outside as illustrated below:

Left: Shape is being rotated about a point Inside the shape.



Right: Shape is being rotated about a point Outside the shape.



Winter **(1)**

One of the four seasons. The main idea for children to understand is that the seasons are cyclic, without beginning or end.

x-axis **(5)**

The horizontal axis on a graph is normally labelled *'x'* when no other label (such as *'time')* is appropriate or when working with equations of the form **y = 4x – 6**.

Yard **(6)**

An imperial measure just short of a metre. See *'Imperial Units'.*

y-axis **(5)**

The vertical axis on a graph is normally labelled *'y'* when no other label (such as *'frequency'*) is appropriate or when working with equations of the form **y = 4x – 6**.

Year **(1)**

See the major topic TIME.

Yesterday **(R)**

It is important for children to realize that today does not stand in isolation. There are days before it and days after it. Yesterday's tomorrow is tomorrow's yesterday!

Zero **(R)**

A number dividing the negative numbers from the positive numbers and is therefore neither positive nor negative itself. See the major topic INTEGERS for more information.

It is interesting to understand that this number had to be invented to enable us to answer question such as:

*'What is **7** subtract **7** ?'*

*'A farmer had **23** sheep. They all died from a disease. How many did he have left?*

*'How many numbers are there that are both prime numbers and multiples of **3**?*