Mathematics Knowledge Base

Helen Youngman
EDUCATION

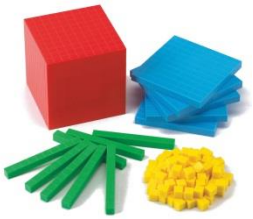
Concrete, Pictorial and Abstract

Objects, pictures, words, numbers and symbols are everywhere. The mastery approach incorporates all of these to help pupils explore and demonstrate mathematical ideas, enrich their learning experience and deepen understanding. Together, these elements help cement knowledge so pupils truly understand what they've learnt.

Pupils are encouraged to physically represent mathematical concepts with resources. Pictures are used to visualise key mathematical concepts and the abstract stage is where children use and apply their mathematical skills to solve problems.

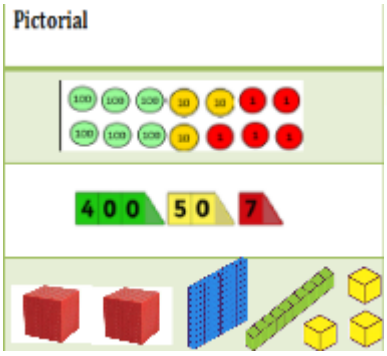
Concrete

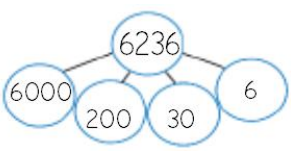
Using concrete objects, equipment and manipulatives to help children understand and explain what they are doing.



Pictorial

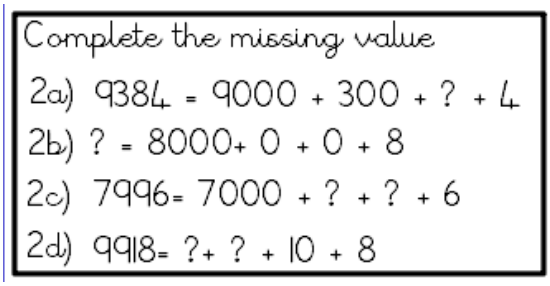
Pictorial representations are pictures, diagrams or drawings that are used to help children reason and solve problems.





Abstract

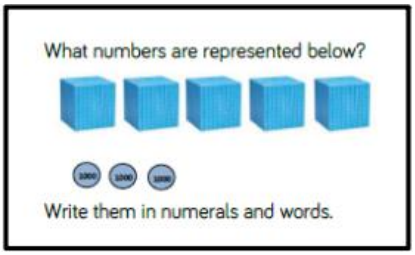
Using numbers and key concepts with confidence.



Fluency, Reasoning and Problem Solving

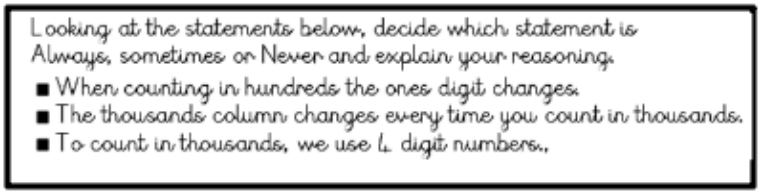
Fluency

Pupils should be able to recall and apply mathematical knowledge both rapidly and accurately. As well as fluency of facts and mental strategies, pupils should be able to move confidently between contexts and representations, recognise relationships and make connections in mathematics.



Reasoning

Pupils should explain and solve a variety of maths problems. They should be able to say not just what the answer is, but how they know it's right.



Problem Solving

Pupils are encouraged to identify, understand and apply relevant mathematical principles and make connections between different ideas. Mathematical concepts are explored in a variety of representations and problem-solving contexts to give pupils a richer and deeper learning experience. Pupils combine different concepts to solve complex problems and apply knowledge to real-life situations.

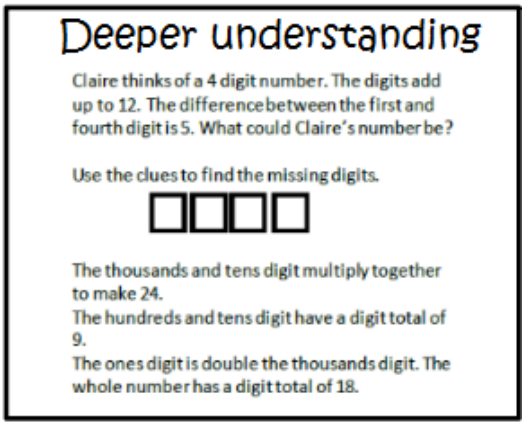
Two different two-digit numbers both round to 40 when rounded to the nearest 10
The sum of the 2 numbers is 79

What could the two numbers be?

Is there more than one possibility?

Deeper understanding

Pupils must be given tasks that give them an opportunity to investigate, explore and apply ideas. This approach enables children to use their skills to solve challenging mathematical problems.



Number and Place Value

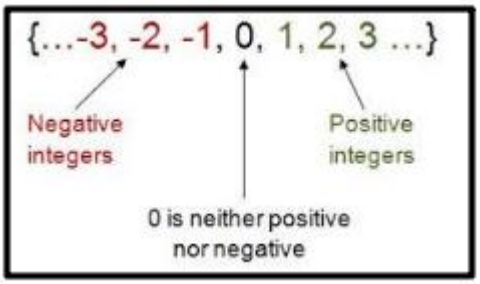
Place holder

Place holder- A place holder is a zero used in any place value column (that contains a value of zero) to clarify the relative positions of the digits in other places.

Thousands	Hundreds	Tens	Ones
2	0	5	3

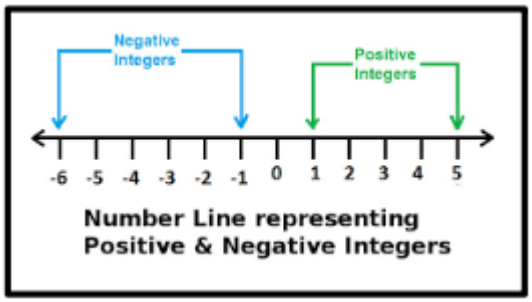
Integer

A whole number that can be positive or negative. 6 is an integer, 0.6 is not.



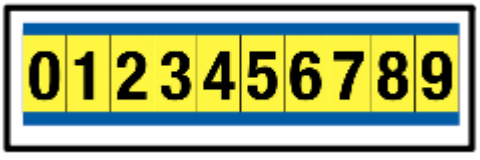
Negative integer

A whole number with a value less than zero. Zero is neither positive nor negative. When the temperature falls below 0° a negative integer is used to record it.



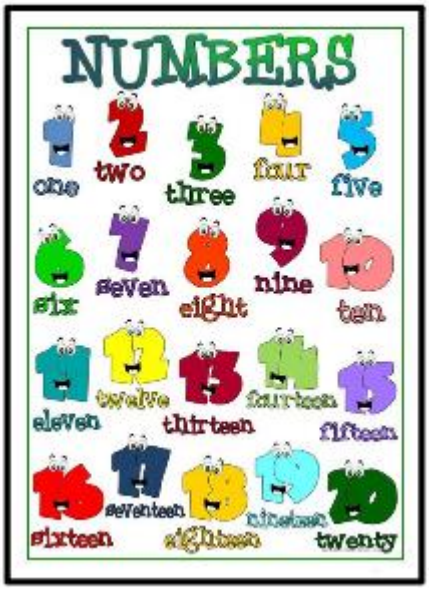
Consecutive

Numbers which follow each other in order, without gaps. I.e 1, 2, 3, 4, 5, 6 are consecutive numbers.



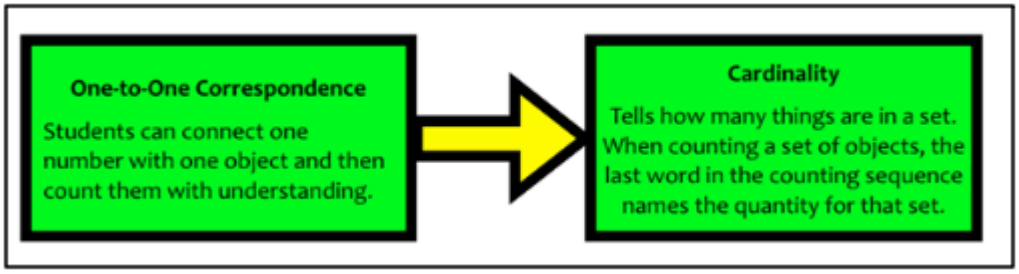
Cardinal Numbers

A number that denotes quantity i.e 1,2,3,4,5 etc



Cardinality

Cardinality is last number said. It is the number of objects counted.

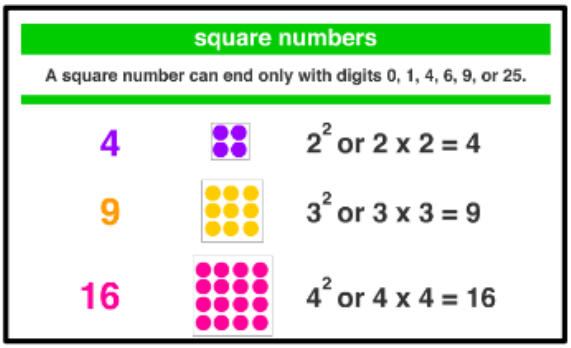


Ordinal Numbers

A number defining the position of something in a series, such as ‘first’, ‘second’, or ‘third’.

Square numbers

The product of two equal factors. 9 is a square number because 9 = 3 × 3



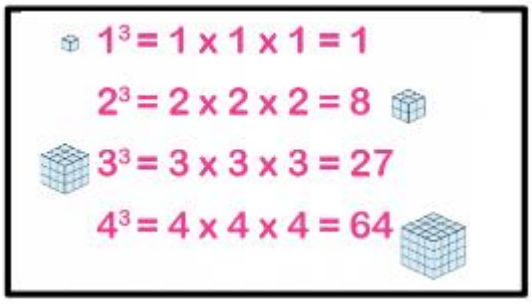
Prime numbers

A whole number with only two factors, one and the number itself.

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
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

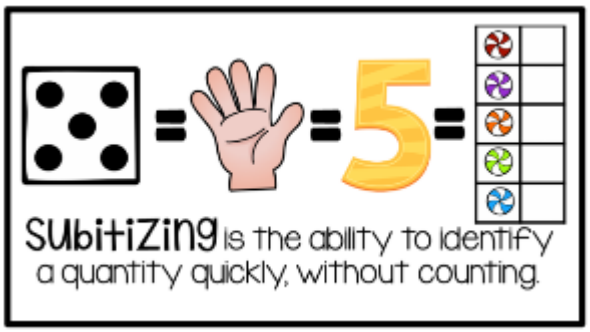
Cube number

The product of three equal factors. Eight is a cube number because 8 = 2 × 2 × 2



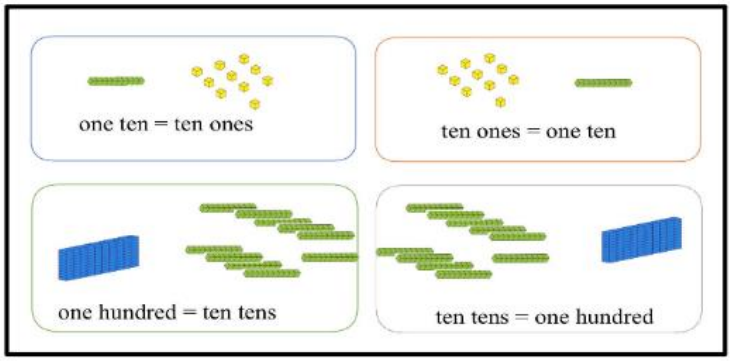
Subitizing

Subitizing is the ability to 'see' a small number of objects and know how many there are without counting. I.e., you do not need to count the numbers on some dice you should instantly recognise the number by the patterns.



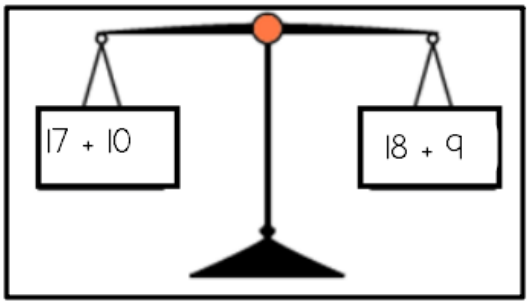
Unitizing

Unitizing is the ability to simultaneously see a given quantity in two or more different ways.



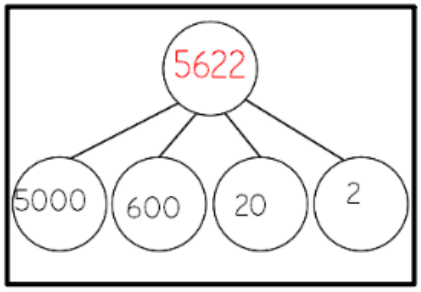
Equivalent Expression

An expression, which can be algebraic, which is equal in value to another expression. I.e to find an equivalent expression to 17 + 10. you could do 18 + 9 is an equivalent expression to 17 + 10.



Partitioning

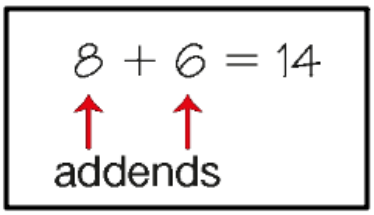
Partitioning is splitting a number into the values of its digits and helps children to understand the values of these digits. For example 5622 can be partitioned into 5000 + 600+ 20 + 2.



Addition and Subtraction

Addend

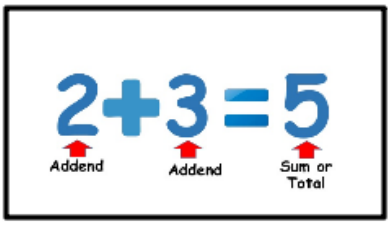
A number which is added to another. All numbers in an addition calculation are called 'Addends'.



Sum

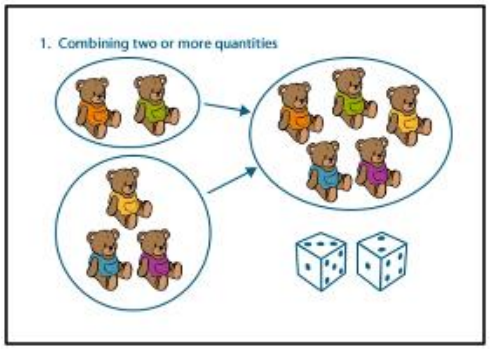
The answer in an addition calculation is called the 'Sum' or 'Total'

Total



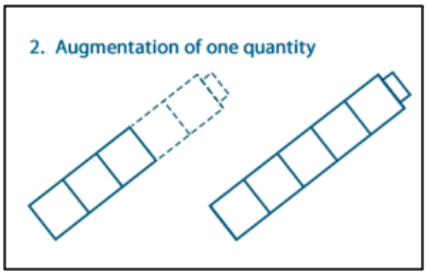
Aggregation

Aggregation is combining of two or more quantities (How much/many altogether? What is the total?)



Augmentation

Augmentation is where one quantity is increased by some amount (increase by).

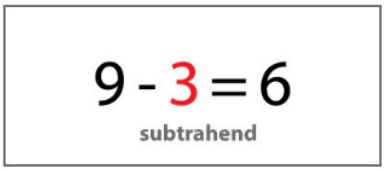


Minuend

The first number in a subtraction calculation. The number from which another number (the Subtrahend) is to be subtracted.

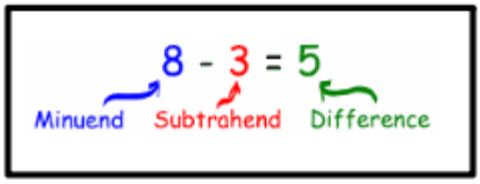
Subtrahend

The number that is to be subtracted. It is the number(s) after the minuend.



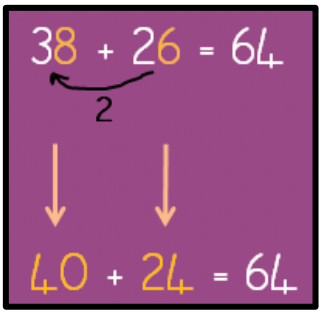
Difference

The answer in a subtraction calculation is called the 'difference'. The result of subtracting one number from another.



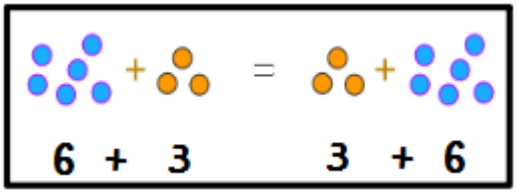
Distributive law

Manipulating numbers to make a calculation easier to solve.



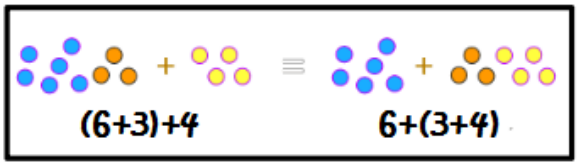
Commutative law

Is the Law that says you can swap numbers around and still get the same answer when you add.



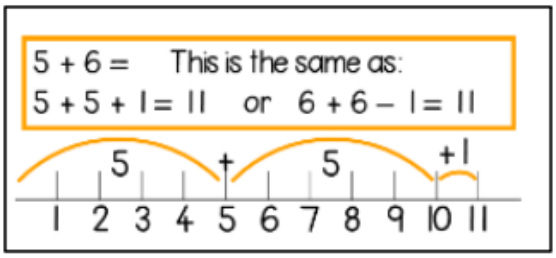
Associative Law

The "Associative Law" say that it doesn't matter how we group the numbers (i.e. which we calculate first) when we add.



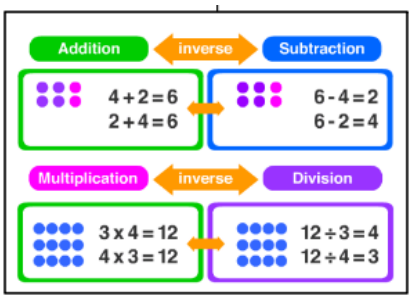
Near double

When two numbers involved in an addition are close in value, such as 5 + 6. The numbers can be treated as exact doubles, followed by compensating. To calculate 5 + 6, I can use the near double strategy. I can double 5 and then add one more.



Inverse operations

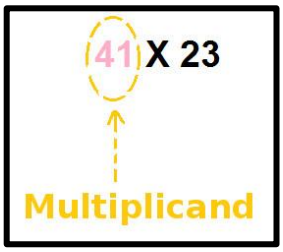
Inverse operations are the opposite operations that 'undo' each other. Addition and subtraction are inverse operations and multiplication, and division are inverse operations.



Multiplication and Division

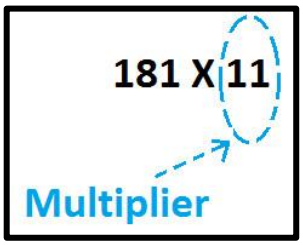
Multiplicand

A Multiplicand is the first number in a multiplication sentence.



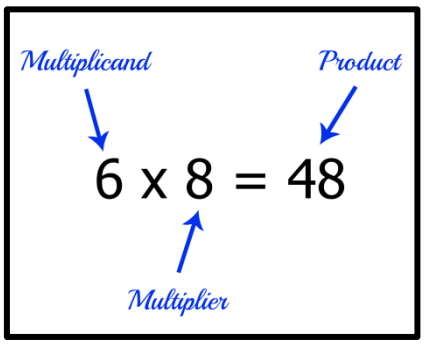
Multiplier

A multiplier is the number(s) after the multiplicand.

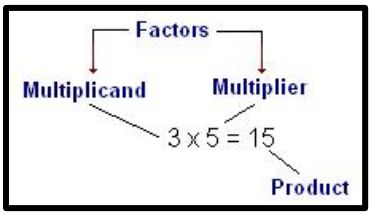


Product

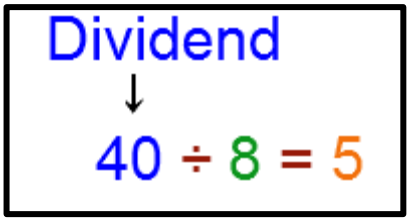
The answer to a multiplication calculation.



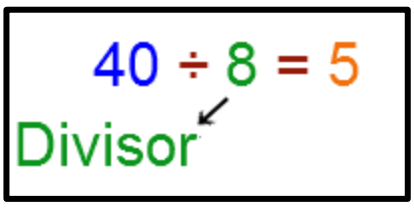
Factor The alternative name for the multiplicand and multiplier because the commutative law applies.



Dividend A dividend is the first number in a division sentence.

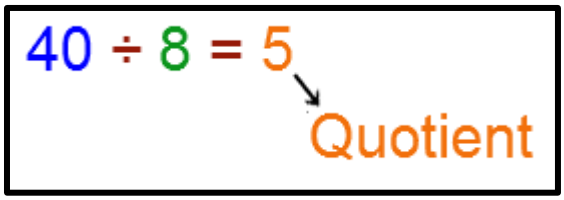


Divisor A divisor is the second number(s) in a division sentence.



Quotient

A quotient is the answer in a division sentence.



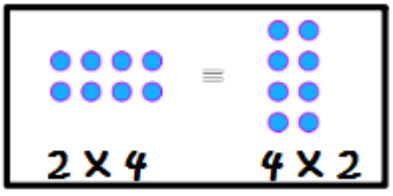
Distributive law

States that we can partition a number before applying the operation without affecting the answer. We can use this law whenever we attempt a multi-digit multiplication because the methods we use rely upon this law.

For example, to calculate 7 × 36 we can calculate 7 × 30 and 7 × 6 and add them together. The 36 has been partitioned into 30 + 6 before the multiplication by 7.

Commutative law

Is the Law that says you can swap numbers around and still get the same answer when you multiply.



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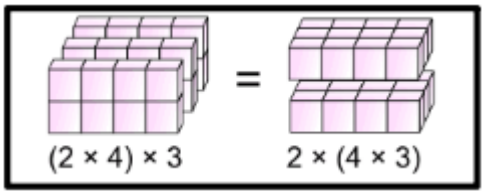
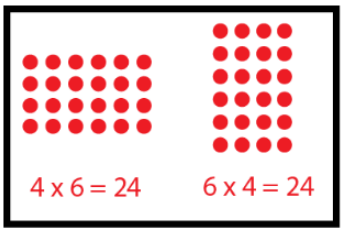


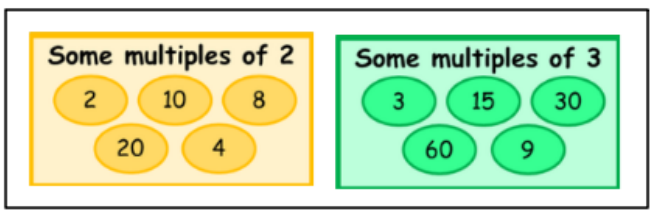
Array

An arrangement of counters or objects in columns and rows, used to represent multiplication and division.



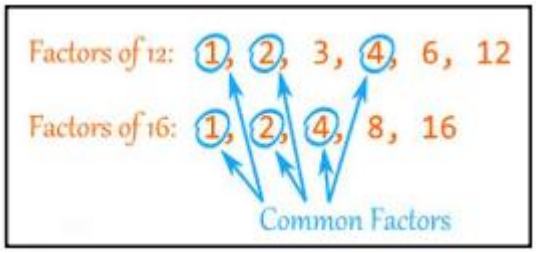
Multiple

The result of multiplying a number by an integer, for example, 12 is a multiple of 3 and 4 because 3 × 4 = 12.



Common Factor

Common factor is a factor of two (or more) given numbers. A common factor of 12 and 9 is 3 because 3 × 4 = 12 and 3 × 3 = 9.



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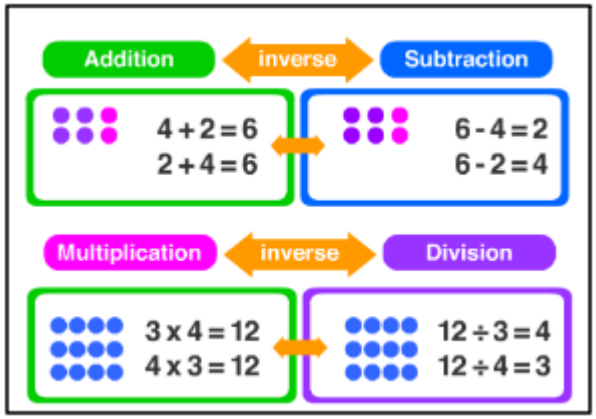


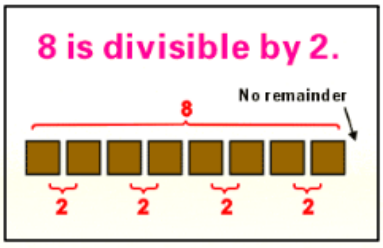
Common multiple

Common multiple is a multiple of two (or more) given numbers. A common multiple of 3 and 6 is 12 because 3 × 4 = 12 and 6 × 2 = 12.

Multiples of 3: 3,6,9,12,15,18,21,24, ...
Multiples of 4: 4,8,12,16,20,24,28, ...
Common Multiples: 12,24, ...

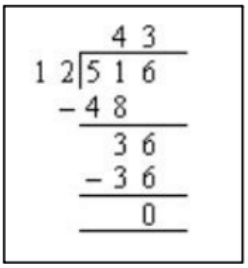
Divisible

Divisible is a number is said to be divisible by another if it can be divided by that number without a remainder. 8 is divisible by 3. When divided by 2 it gives a quotient of 4, with no remainder.



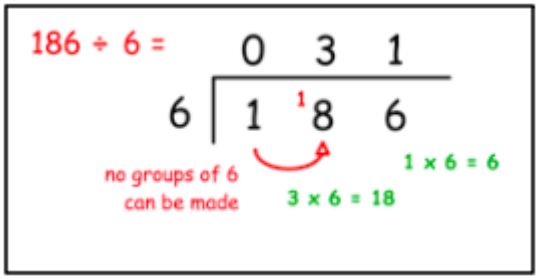
Long division

Long division is the formal written algorithm that can be used to divide by a number with two or more digits.



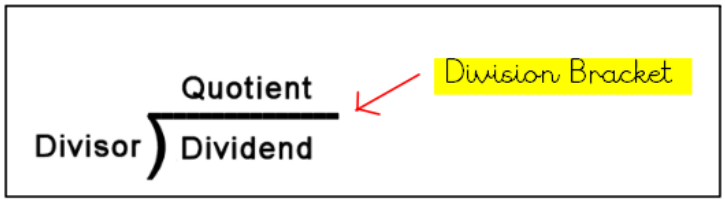
Short division

Short division involves less written work and more mental arithmetic. It still involves division brackets.



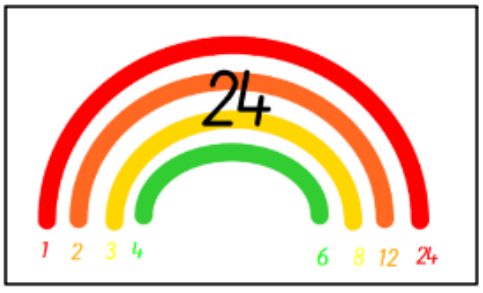
Division Brackets

The symbol used in short and long division (often incorrectly referred to as bus stop)



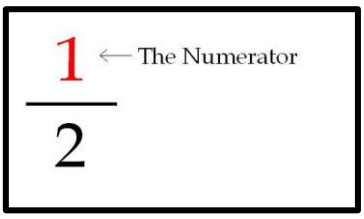
Factorise

To identify factors of a given number. To express a number as factors. I can factorise 12 by looking at its factor pairs. $1 \times 12 = 12$, $2 \times 6 = 12$, $3 \times 4 = 12$. So the factors of 12 are 1, 2, 3, 4, 6 and 12.

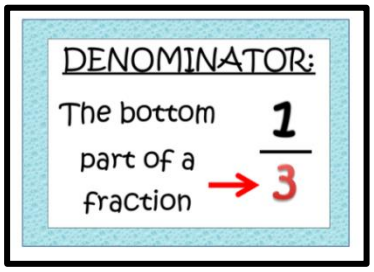


Fractions

Numerator The top number of a fraction that signifies the parts.

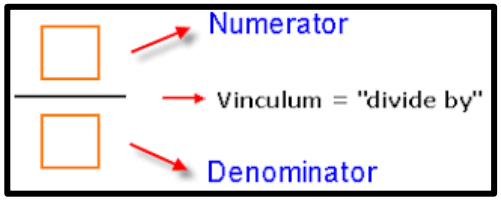


Denominator The bottom number of a fraction that signifies the whole.



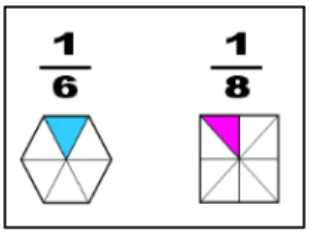
Vinculum

The line that separates the numerator from the denominator and signifies division. It could also be reffered to as the fraction bar.



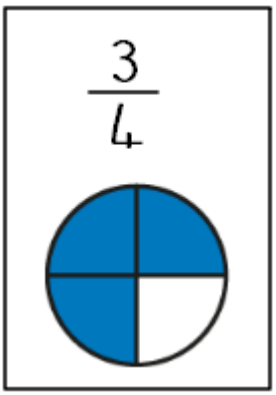
Unit Fraction

A unit fraction is a fraction with a numerator or 1 and a denominator with a whole number.



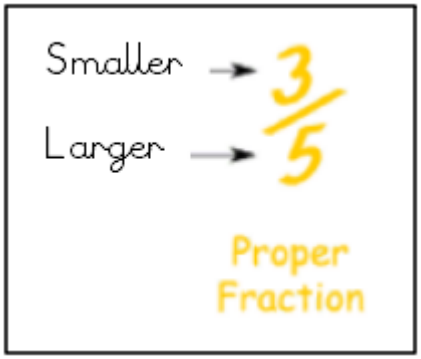
Non- unit Fraction

A fraction with a numerator greater than one. Three quarters is a non-unit fraction.



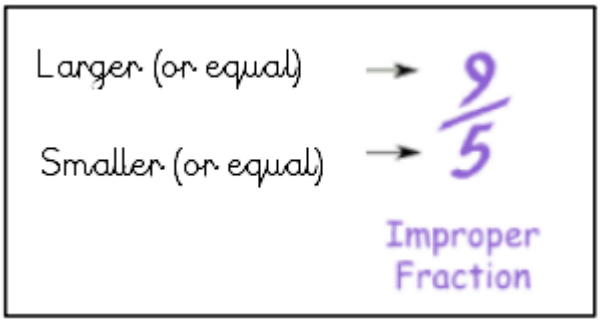
Proper Fraction

A proper fraction is a fraction where the numerator is smaller than the denominator.



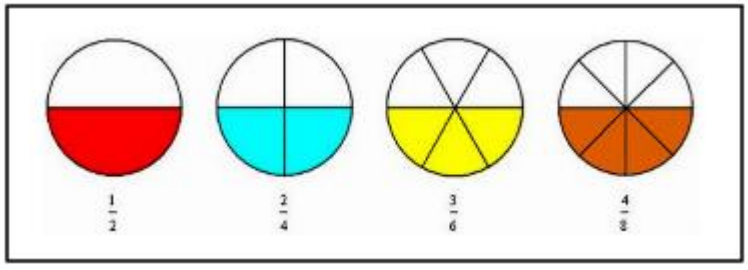
Improper Fraction

A fraction where the numerator is bigger than the denominator. These fractions are therefore greater than one whole.



Equivalent Fraction

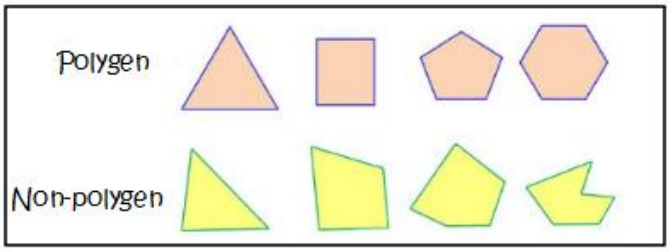
Equivalent fractions are fractions that look different (different numerators or denominators) but show exactly the same amount.



Geometry

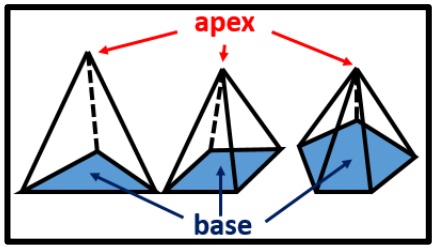
Polygon

A polygon is 2D shape with straight lines and three or more sides.



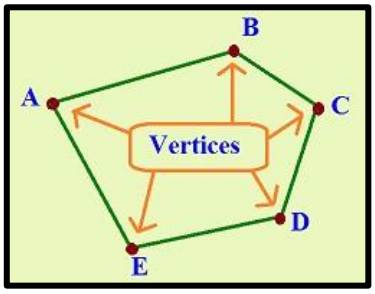
Apex

The vertex which is the highest point from the base.



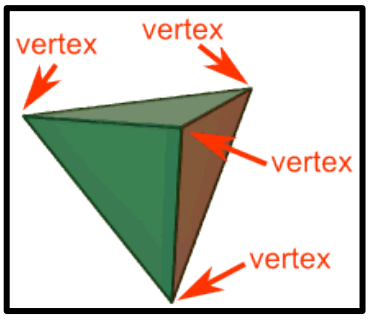
Vertices

Plural of vertex. (See Vertex below)



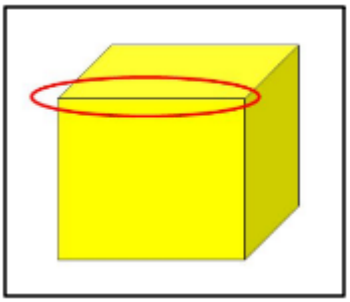
Vertex

The vertex is a corner where two or more lines meet.



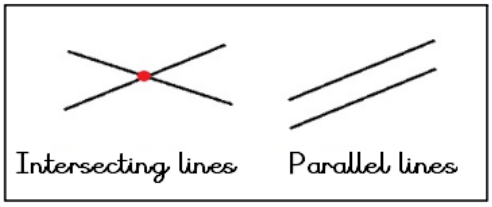
Edge

The line where two faces meet on a 3D shape.



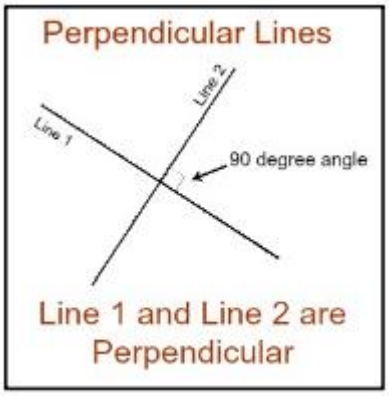
Parallel

Two lines are parallel if they are on the same plane and they do not intersect.



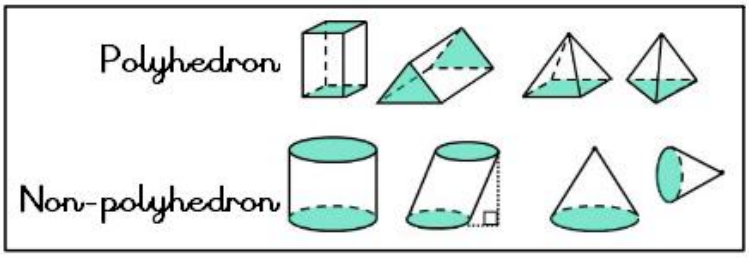
Perpendicular

Perpendicular lines are lines that meet at a right angle.



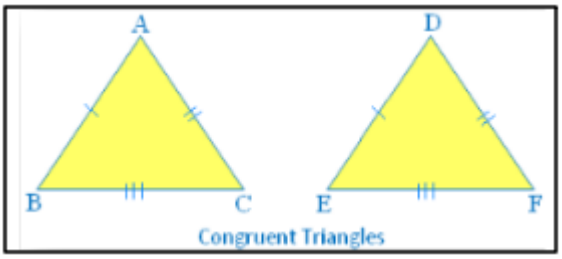
Polyhedron

Polyhedron (plural polyhedra) is a 3-D shape with flat surfaces that are polygons. A cuboid is a polyhedron. A cylinder is not a polyhedron because it has a curved surface.



Congruent

Congruent is used to describe two shapes or figures which are exactly the same size. The two triangles are congruent. If I place one on top of the other, there is no overlap.



Congruent Triangles