mathcentre community project

Arithmetic

When multiplying or dividing positive and negative numbers the sign of the result is given by:

$$\text{positive} \times \text{positive} = \text{positive} \qquad \text{positive} \times \text{negative} = \text{negative}$$
$$\text{negative} \times \text{positive} = \text{negative} \qquad \text{negative} \times \text{negative} = \text{positive}$$

$$\frac{\text{positive}}{\text{positive}} = \text{positive} \qquad \frac{\text{positive}}{\text{negative}} = \text{negative}$$

$$\frac{\text{negative}}{\text{positive}} = \text{negative} \qquad \frac{\text{negative}}{\text{negative}} = \text{positive}$$

The BIDMAS rule reminds us of the order in which operations are carried out. BIDMAS stands for:

Brackets ()	First priority
Indices $\times$	Second priority
Division $\div$	Third priority
Multiplication $\times$	Third priority
Addition $+$	Fourth priority
Subtraction $-$	Fourth priority

Fractions

$$\text{fraction} = \frac{\text{numerator}}{\text{denominator}}$$

Adding and subtracting fractions. To add or subtract two fractions first rewrite each fraction so that they have the same denominator. Then, the numerators are added or subtracted as appropriate and the result is divided by the common denominator: e.g.

$$\frac{4}{5} + \frac{3}{4} = \frac{16}{20} + \frac{15}{20} = \frac{31}{20}$$

Multiplying fractions. To multiply two fractions, multiply their numerators and then multiply their denominators: e.g.

$$\frac{3}{7} \times \frac{5}{11} = \frac{15}{77}$$

Dividing fractions. To divide two fractions, invert the second and then multiply: e.g.

$$\frac{3}{5} \div \frac{2}{3} = \frac{3}{5} \times \frac{3}{2} = \frac{9}{10}$$

Decimals

Decimals are a type of fraction. Usually a fraction is written in the form $\frac{\text{numerator}}{\text{denominator}}$. Decimals are fractions in which the denominator is a power of 10, that is 10, 100, 1000 and so on, but instead of writing them in the usual form only the numerator is written down and a decimal point is used to indicate the size of the denominator.

Decimal fractions:

Look at the following fractions. In every case the denominator is a power of 10:

$$\frac{7}{10}, \qquad \frac{5}{100}, \qquad \frac{3}{1000}$$

In decimal form we would write

$$\frac{7}{10} = 0.7, \qquad \frac{5}{100} = 0.05, \qquad \frac{3}{1000} = 0.003$$

The first position to the right of the decimal point indicates tenths. The second position indicates hundredths, the third indicates thousandths and so on.

A mixed number like $6\frac{3}{10}$ will consist of the whole number part on the left of the decimal point and the fractional part on the right, that is $6\frac{3}{10} = 6.3$.

Multiplying or dividing by powers of 10:

To multiply 36.57 by 10 digits are moved one place to the left,

$$36.57 \times 10 = 365.7$$

To multiply by 100 digits are moved two places to the left. So

$$78.375 \times 100 = 7837.5$$

Similarly

$$0.0095 \times 1000 = 9.5$$

To divide a number by 10 the digits are moved one place to the right. To divide by 100 the digits are moved two places to the right. For example

$$36.7 \div 10 = 3.67, \qquad 5.8 \div 10 = 0.58$$

$$0.0475 \div 100 = 0.000475$$

Converting a fraction to a decimal:

To convert a fraction into a decimal remember that $\frac{a}{b}$ means $a \div b$. Often a calculator can be used to perform the division.

Metric measures (cgs)

Length	Weight/Mass	Capacity
10 mm = 1 cm	1000 mg = 1 g	1 ml = 1000 mm^3
100 cm = 1 m	1000 g = 1 kg	10 ml = 1 cl
1000 m = 1 km	1000 kg = 1 tonne	100 cl = 1 litre
		1000 cm^3 = 1 litre

Imperial measures

Length	Weight/Mass	Capacity
12 inches = 1 foo t(ft)	16 ounces (oz)	20 fluid oz
3 ft = 1 yard (yd)	= 1 pound (lb)	= 1 pint (pt)
1760 yds = 1 mile	14 lb = 1 stone	8 pt = 1 gallon

Time

60 seconds = 1 minute	52 weeks = 1 year
60 minutes = 1 hour	12 months = 1 year
24 hours = 1 day	10 years = 1 decade
7 days = 1 week	100 years = 1 century

Averages

Suppose we have a set of numbers. There are three common types of **average**:

Mean	$\dfrac{\text{Sum of the numbers}}{\text{number of items of data}}$
Median	middle number in an ordered set of data
Mode	number which occurs most often

Spread

The **range** tells us about how widely spread the data values are:

$$\text{Range} = \text{highest value - lowest value}$$

$$\text{Interquartile range} = \text{upper quartile - lower quartile}$$

Probability

0   1
can   will
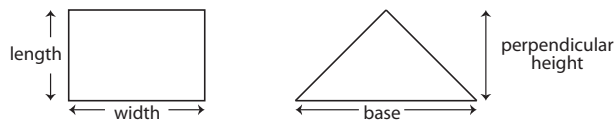never happen   definitely happen

The probability of an event occurring is a number between 0 and 1.
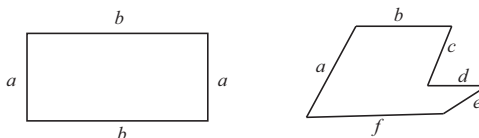
The probability can be calculated from:

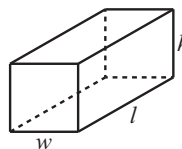$$\frac{\text{number of outcomes for an event}}{\text{total number of outcomes}}$$

Area

Rectangle	Triangle
Area = length x width	Area = $\frac{1}{2}$ x base x height
A = lw	A = $\frac{1}{2}$bh

Perimeter

Rectangular shape	Irregular shape
Perimeter=sum of all lengths	Perimeter=sum of all lengths
P = $a + b + a + b$	P= $a + b + c + d + e + f$

Volume

$$\begin{aligned}\text{Volume} &= \text{length} \times \text{width} \times \text{height (or depth)} \\ &= l \times w \times h\end{aligned}$$
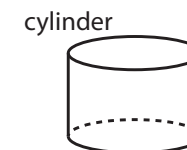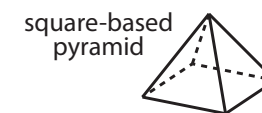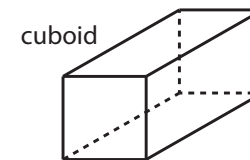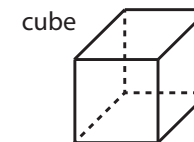
Circles
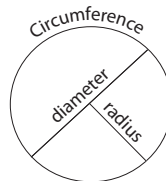
$$\begin{aligned}\text{Circumference} &= 2 \times \pi \times \text{radius} \\ &= 2\pi r\end{aligned}$$

$$\begin{aligned}\text{Area} &= \pi \times \text{radius} \times \text{radius} \\ &= \pi r^2\end{aligned}$$

3D Shapes

cube

cuboid

triangular prism

square-based pyramid

cylinder

3D shape	number of faces	number of edges	number of vertices
cube (square prism)	6	12	8
cuboid (rectangular prism)	6	12	8
cylinder (circular prism)	3	2	0
square-based pyramid	5	8	5
triangular prism	5	9	6