GCSE Mathematics Foundation Tier

Number · Algebra · Ratio, proportion and rates of change · Geometry & measures · Probability · Statistics

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...as BODMAS. Use the correct order of operations; take care when using a calculator.
- Brackets
- Indices (or powers)
- Division and Multiplication
- Addition and Subtraction

Types of number

Integer: a "whole" number
Factors: the divisors of an integer
- Factors of 12 are 1, 2, 3, 4, 6, 12

Multiples: a "times table" for an integer (will continue indefinitely)
- Multiples of 12 are 12, 24, 36, ...

Prime number: an integer which has exactly two factors (1 and the number itself). Note: 1 is not a prime number.

HCF, LCM

Highest Common Factor (HCF)
- Factors of 6 are 1, 2, 3, 6
  Factors of 9 are 1, 3, 9
  HCF of 6 and 9 is 3

Lowest Common Multiple (LCM)
- Multiples of 6 are 6, 12, 18, 24, ...
  Multiples of 9 are 9, 18, 27, 36, ...
  LCM of 6 and 9 is 18

Prime factors

Write a number as a product of its prime factors; use indices for repeated factors.
- $720 = 5 \times 3^2 \times 2^4$

Powers and roots

Special indices for any value a:
$a^0 = 1$
$a^{-n} = \frac{1}{a^n}$

Calculating with fractions

Adding or subtracting fractions: use a common denominator...

Multiplying fractions: multiply numerators and denominators...

Dividing fractions: "flip" the second fraction, then multiply...

Fractions, decimals

Fraction is numerator ÷ denominator

Use place values to change decimals to fractions. Simplify where possible.

Learn the most frequently used ones:

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Surds

Look for the biggest square number factor of the number:
- $\sqrt{180} = \sqrt{36} \times \sqrt{5} = 6\sqrt{5}$

Standard form

Standard form numbers are of the form $a \times 10^n$ where $1 \le a < 10$ and n is an integer.

Standard units

1 tonne = 1000 kilograms
1 kilogram = 1000 grams

1 kilometre = 1000 metres
1 metre = 100 centimetres
= 1000 millimetres
1 centimetre = 10 millimetres

1 day = 24 hours
1 hour = 60 minutes = 3600 seconds
1 minute = 60 seconds

Rounding

Truncate the number, then use a "decider digit" to round up or down.
Decimal places: use the decimal point.
Significant figures: use the first non-zero digit.

Error intervals

Find the range of numbers that will round to a given value.

Algebraic notation

Equations and identities

An equation is true for some particular value of x...
...but an identity is true for every value of x.

Laws of indices

For any value a:
$a^m \times a^n = a^{m+n}$
$\frac{a^m}{a^n} = a^{m-n}$
$(a^m)^n = a^{mn}$

Standard graphs

$y = mx + c$

Equation of straight line $y = mx + c$: m is the gradient, c is the y-intercept.

Parallel lines: gradients are equal.

Expanding brackets

Reverse of expanding is factorising: putting an expression back into brackets.

Quadratics

Solve a quadratic by factorising.

Difference of two squares

$x^2 - y^2 = (x + y)(x - y)$

Simultaneous equations

Multiply to match a term in x or y...
Add or subtract to cancel...
Finally, substitute and solve...

Rearrange a formula

The subject of a formula is the term on its own. Use rules that "balance" the formula to change its subject.

Right angled triangles

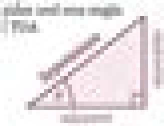
Pythagoras Theorem. Links all three sides. No angles.
$a^2 + b^2 = c^2$

The longest side of any right angled triangle is the hypotenuse; check that your answer is consistent with this.

Special values of sin, cos, tan. Learn (or be able to find without a calculator)...

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
0	0	1	0
30	$\frac{1}{2}$	[illegible]	[illegible]
45	[illegible]	[illegible]	1
60	[illegible]	$\frac{1}{2}$	$\sqrt{3}$
90	1	0	

Trigonometry. Links two sides and one angle. SOH CAH TOA



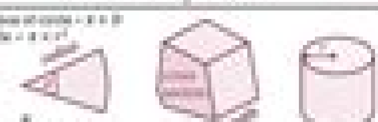
Use "2ndF" or "SHIFT" key to find a missing angle.

Area and volumes

Area of triangle $= \frac{1}{2} \times$ base $\times$ height
Volume of cuboid = length × width × height

Area of trapezium $= \frac{1}{2}(a + b) \times h$

Circumference of circle $= \pi \times D$
Area of circle $= \pi \times r^2$



Volume of cylinder $= \pi r^2 \times$ height
Volume of prism = area of cross section × length

Transformations

Reflection
- Line of reflection

Translation
- Vector

Rotation
- Centre of rotation
- Angle of rotation
- Clockwise or anticlockwise

Enlargement
- Centre of enlargement
- Scale factor

Angle facts

Exact angles in parallel lines: always use correct terminology...
Angles on a straight line total 180°
Angles in a full turn total 360°
Interior angles in a triangle total 180°
Exterior angles always total 360°

Alternate angles · Corresponding angles · ...or $180° \times (n - 2)$

Sequences

Triangular numbers

Square numbers

Cube numbers

nth term of an arithmetic (linear) sequence is $an + d$

Geometric sequence: multiply each term by a constant ratio

Fibonacci sequence: make the next term by adding the previous two...

Probability

$p = 0$ impossible
$p = 0.5$ evens
$p = 1$ certain

Probability rules

Multiply for independent events
Add for mutually exclusive events
Apply these rules to tree diagrams

Parts of a circle

Ratio

Use a ratio for unequal sharing

Ratio and fractions

Percentages

Speed, distance, time

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

Averages

Mode: most frequently occurring
Median: put the data in numerical order, then choose the middle one
$\text{Mean} = \frac{\text{total of items of data}}{\text{number of items of data}}$

Correlation

Positive correlation · Negative correlation

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