

BIDMAS N3

...or 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 N4

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 N4

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 N4

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 N6, N7

Special indices: for any value a :
 $a^0 = 1$
 $a^{-n} = \frac{1}{a^n}$
→ $3^{-4} = \frac{1}{3^4} = \frac{1}{81}$

Calculating with fractions N8

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

→ $\frac{4}{5} - \frac{1}{3} = \frac{12}{15} - \frac{5}{15} = \frac{7}{15}$

Multiplying fractions; multiply numerators and denominators...

→ $\frac{4}{7} \times \frac{2}{3} = \frac{8}{21}$

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

→ $\frac{2}{7} \div \frac{5}{6} = \frac{2}{7} \times \frac{6}{5} = \frac{12}{35}$

Fractions, decimals N10

Fraction is numerator ÷ denominator
→ $\frac{5}{8} = 5 \div 8 = 0.625$

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

→ $0.45 = \frac{45}{100} = \frac{9}{20}$

Learn the most frequently used ones:

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{3}{4}$
0.5	0.25	0.1	0.2	0.75

Surds N8

Look for the biggest square number factor of the number:
→ $\sqrt{80} = \sqrt{16 \times 5} = 4\sqrt{5}$

Standard form N9

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

Standard units N13

1 tonne = 1 000 kilograms
1 kilogram = 1 000 grams

1 kilometre = 1 000 metres
1 metre = 100 centimetres
= 1 000 millimetres
1 centimetre = 10 millimetres

1 day = 24 hours

1 hour = 60 minutes = 3 600 seconds
1 minute = 60 seconds

Rounding N15

Truncate the number, then use a "decider digit" to round up or down.
Decimal places: use the decimal point
→ 162.3681 to 2dp;
162.36 | 81 = 2.37 to 2dp

Significant figures: use the first non-zero digit.
→ 162.3681 to 2sf;
16 | 2.3681 = 160 to 2sf
→ 0.007 039 to 3sf;
0.007 03 | 9 = 0.007 04 to 3sf

Error intervals N15

Find the range of numbers that will round to a given value:
→ $x = 5.83$ (2 decimal places)
 $5.825 \leq x < 5.835$
→ $y = 46$ (2 significant figures)
 $45.5 \leq y < 46.5$

Note use of \leq and $<$, and that the last significant figure of each is 5.

Algebraic notation A1

$ab = a \times b$
 $3y = y + y + y$
 $a^2 = a \times a$
 $a^3 = a \times a \times a$
 $a^2b = a \times a \times b$
 $\frac{a}{b} = a \div b$

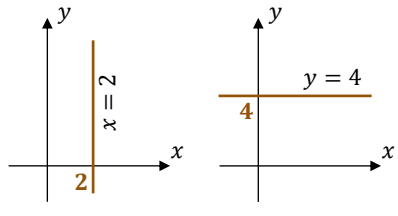
Equations and identities A3

An equation is true for some particular value of x ...
→ $2x + 1 = 7$ is true if $x = 3$
...but an identity is true for every value of x
→ $(x + a)^2 \equiv x^2 + 2ax + a^2$ (note the use of the symbol \equiv)

Laws of indices A4

For any value a :
 $a^x \times a^y = a^{x+y}$
 $\frac{a^x}{a^y} = a^{x-y}$
 $(a^x)^y = a^{xy}$
→ $\left(\frac{2pq^4}{p^3q}\right)^3 = \frac{8p^3q^{12}}{p^9q^3} = \frac{8q^9}{p^6}$ or $8q^9p^{-6}$

Standard graphs A12



Expanding brackets A4

$p(q + r) = pq + pr$
→ $5(x - 2y) = 5x - 10y$
 $(x + a)(x + b) = x^2 + ax + bx + ab$
→ $(2x - 3)(x + 5)$
 $= 2x^2 - 3x + 10x - 15$
 $= 2x^2 + 7x - 15$

Opposite of expanding is factorising - putting an expression into brackets.

Difference of two squares A4

$a^2 - b^2 = (a + b)(a - b)$
→ $x^2 - 25 = (x + 5)(x - 5)$

y = mx + c A9

Equation of straight line $y = mx + c$
 m is the gradient; c is the y intercept:
→ Find the equation of the line that joins (0, 3) to (2, 11)
Find its gradient...
 $\frac{11 - 3}{2 - 0} = \frac{8}{2} = 4$

...and its y intercept...
Passes through (0, 3), so $c = 3$.
Equation is $y = 4x + 3$.

Parallel lines: gradients are equal;
→ $y = 2x + 3$ and $y = 2x - 5$ both have gradient 2, so are parallel.

Rearrange a formula A5

The subject of a formula is the term on its own. Use rules that "balance" the formula to change its subject
→ Make x the subject of $2x + 3y = z$
Here, subtract $3y$ from both sides...
 $2x = z - 3y$
...then divide both sides by 2...
 $x = \frac{z - 3y}{2}$

Simultaneous equations A19

→ Solve $\begin{cases} 2x + 3y = 11 \\ 3x - 5y = 7 \end{cases}$
Multiply to match a term in x or y
 $\begin{cases} 10x + 15y = 55 \\ 9x - 15y = 21 \end{cases}$
Add or subtract to cancel...
 $19x = 76$, so $x = 4$
Finally, substitute and solve...
 $2 \times 4 + 3y = 11$, so $y = 1$

Quadratics A18

Solve a quadratic by factorising.
→ Solve $x^2 - 8x + 15 = 0$
Put into brackets (taking care with any negative numbers)...
 $(x - 3)(x - 5) = 0$
...then either $x - 3 = 0$ or $x - 5 = 0$, so that $x = 3$ or $x = 5$.

Right angled triangles G20, G22

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

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

$\sin \theta = \frac{\text{opp}}{\text{hyp}}$ $\cos \theta = \frac{\text{adj}}{\text{hyp}}$ $\tan \theta = \frac{\text{opp}}{\text{adj}}$

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

Areas and volumes G16, G17, G18, G23

Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

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

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

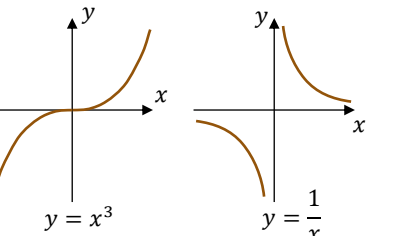
Arc length = $\frac{\theta}{360^\circ} \times \pi \times D$
Area of sector = $\frac{\theta}{360^\circ} \times \pi \times r^2$

Transformations G7, G8

Reflection
• Line of reflection
Translation
• Vector
Rotation
• Centre of rotation
• Angle of rotation
• Clockwise or anticlockwise
Enlargement
• Centre of enlargement
• Scale factor (if SF < 1 the shape will get smaller).

Angle facts G3

Equal 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°
Use this for the interior angles of any polygon...
Exterior angles always total 360°



Sequences A24, A25

Triangular numbers:

1st	2nd	3rd	4th	5th
1	3	6	10	15

Square numbers ($n^2 = n \times n$):

1^2	2^2	3^2	4^2	5^2
1	4	9	16	25

Cube numbers ($n^3 = n \times n \times n$):

1^3	2^3	3^3	4^3	5^3
1	8	27	64	125

n th term of an arithmetic (linear) sequence is $an + d$
→ n th term of 5, 8, 11, 14, ... is $3n + 2$ (always increases by 3; first term is $3 \times 1 + 2 = 5$)
Geometric sequence; multiply each term by a constant ratio
→ 3, 6, 12, 24, ... (ratio is 2)
Fibonacci sequence; make the next term by adding the previous two ...
→ 2, 4, 6, 10, 16, 26, 42, ...

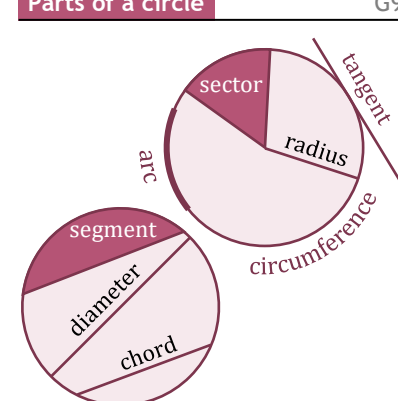
Probability P8, P9

$p = \frac{n(\text{equally likely favourable outcomes})}{n(\text{equally likely possible outcomes})}$
 $p = 0$ impossible
 $0 < p < 0.5$ unlikely
 $p = 0.5$ evens
 $0.5 < p < 1$ likely
 $p = 1$ certain

Probability rules P8, P9

Multiply for independent events
→ P(6 on dice and H on coin)
 $\frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$
Add for mutually exclusive events
→ P(5 or 6 on dice)
 $\frac{1}{6} + \frac{1}{6} = \frac{2}{6}$
Apply these rules to tree diagrams.

Parts of a circle G9



Division using ratio R5

Use a ratio for unequal sharing
→ Divide £480 in the ratio 7 : 5
 $7 + 5 = 12$, then $\text{£}480 \div 12 = \text{£}40$
 $7 \times \text{£}40 = \text{£}280$, $5 \times \text{£}40 = \text{£}200$
(check: $\text{£}280 + \text{£}200 = \text{£}480$ ✓)

Ratio and fractions R8

Link between ratios and fractions
→ Boys to girls in ratio 2 : 3
 $\frac{2}{5}$ are boys, $\frac{3}{5}$ are girls.

Percentages R9

y percent of $x = \frac{y}{100} \times x$
→ Increase £58 by 26%.
 $\frac{26}{100} \times \text{£}58 = \text{£}15.08$
 $\text{£}58 + \text{£}15.08 = \text{£}73.08$
 y as a percentage of $x = \frac{y}{x} \times 100\%$
→ The population of a town increases from 3 500 to 4 620. Find the percentage increase.
 $\frac{1\ 120}{3\ 500} \times 100\% = 35\%$
Note: fraction = $\frac{\text{increase}}{\text{original}}$

Learn the most frequently used ones:

$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{100}$
50%	25%	10%	20%	1%

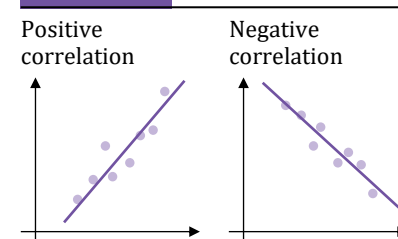
Speed, distance, time R11

Speed = $\frac{\text{distance}}{\text{time}}$
→ A car travels 90 miles in 1 hour, 30 minutes. Find its average speed.
 $90 \text{ miles} \div 1.5 \text{ hours} = 60 \text{ mph}$

Averages S4

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

Correlation S6



Use this for the interior angles of any polygon... G3

