GCSE Mathematics Foundation Tier

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

[illegible]

BIDMAS
...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
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
$a^0 = 1$
$a^{-n} = \frac{1}{a^n}$
◆ [illegible]

Calculating with fractions
Adding or subtracting fractions: use a common denominator...
◆ [illegible]
Multiplying fractions: multiply numerators and denominators...
◆ [illegible]
Dividing fractions: "flip" the second fraction, then multiply...
◆ [illegible]

Fractions, decimals
Fraction is numerator ÷ denominator
◆ [illegible]
Use place values to change decimals to fractions. Simplify where possible.
◆ [illegible]
Learn the most frequently used ones:

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

Surds
Look for the biggest square number factor of the number...
◆ $\sqrt{200} = \sqrt{100} \times \sqrt{2} = 10\sqrt{2}$

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
◆ [illegible]
Significant figures: use the first non-zero digit.
◆ [illegible]

Error intervals
Find the range of numbers that will round to a given value.
◆ [illegible]
Note use of ≤ and <, and that the last significant figure of each is 5.

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

Equations and identities
An equation is true for some particular value of x
◆ [illegible]
...but an identity is true for every value of x.
◆ [illegible]
(note the use of the symbol ≡)

Laws of indices
For any value a
$a^m \times a^n = a^{m+n}$
$\frac{a^m}{a^n} = a^{m-n}$
$(a^m)^n = a^{mn}$
◆ [illegible]

Standard graphs

y = mx + c
Equation of straight line $y = mx + c$: m is the gradient, c is the y-intercept.
◆ [illegible]
Find its gradient...
...and its y-intercept...
[illegible]
Parallel lines: gradients are equal.
◆ [illegible]

Expanding brackets
$a(x + y) = ax + ay$
◆ [illegible]
◆ [illegible]
Reverse of expanding is factorising: putting an expression into brackets.

Quadratics
Solve a quadratic by factorising.
◆ [illegible]
Put into brackets (taking care with any negative numbers)...
...then either ... or ...

Difference of two squares
$a^2 - b^2 = (a + b)(a - b)$
◆ [illegible]

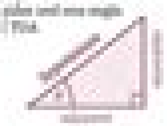
Simultaneous equations
◆ [illegible]
Multiply to match a term in x or y
Add or subtract to cancel...
Finally, substitute and solve...

Rearrange a formula
The subject of a formula is the term on its own. Use rules that "balance" the formula to change its subject.
◆ [illegible]
Next, subtract ... from both sides...
...then divide both sides by 2

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.

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



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

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

θ°	sinθ°	cosθ°	tanθ°
0	0	1	0
30	[illegible]	[illegible]	[illegible]
45	[illegible]	[illegible]	1
60	[illegible]	[illegible]	$\sqrt{3}$
90	1	0	

Area and volume
Area of triangle = ½ × base × height
Volume of cuboid = length × width × height

Area of trapezium = ½(a + b) × h
Circumference of circle = π × d
Area of circle = π × r²

Arc length, Area of sector [illegible]
Volume of cylinder = πr² × 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 [illegible]

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

Alternate angles · Corresponding angles · ...so 180° × (n − 2)

Sequences
Triangular numbers

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

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

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

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

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

nth term of an arithmetic (linear) sequence is an + d
◆ [illegible]
Geometric sequence: multiply each term by a constant ratio
◆ [illegible]
Fibonacci sequence: make the next term by adding the previous two...
◆ 1, 1, 2, 3, 5, 8, 13, 21, ...

Probability
[illegible]

Probability rules
Multiply for independent events
◆ [illegible]
Add for mutually exclusive events
◆ [illegible]
Apply these rules to tree diagrams

Parts of a circle

Dividing using ratio
Use a ratio for unequal sharing.
◆ [illegible]

Ratio and fractions
Link between ratios and fractions
◆ [illegible]

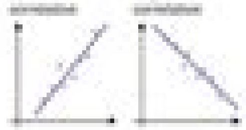
Percentages
[illegible]
◆ Increase £150 by 16%
[illegible]
◆ The population of a town increases from ... Find the percentage increase.
[illegible]
Learn the most frequently used ones:

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

Speed, distance, time
Speed = distance ÷ time
◆ [illegible]

Averages
Mode: most frequently occurring
Median: put the data in numerical order, then choose the middle one
Mean = total of items of data ÷ number of items of data

Correlation
Positive correlation · Negative correlation



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