



GCSE Mathematics Foundation Tier WJEC

● Number ● Algebra ● Geometry & measures ● Statistics

Here is pretty much all the Foundation Tier content we could fit onto an A3 sheet of paper, including all the formulae you are required to know for GCSE. An → points to an illustrative example. NM = Numeracy and GCSE Mathematics; M = GCSE Mathematics only. Pin this to a wall, keep it on your desk, carry it in your bag, make notes on it (sorry, don't take it into the examination)...

BIDMAS NM

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

Directed numbers NM

Use the rules
"two negatives make a positive",
"one of each make a negative"...

Addition and subtraction

$$\rightarrow -5 + (-7) = -12$$

Multiplication or division

$$\rightarrow -5 \times -7 = +35$$

Types of number NM

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.

Prime factors NM

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

Standard form NM

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

Decimal places NM

Truncate the number, then use a "decider digit" to round up or down. Count digits from the decimal point
→ 162.3681 to 2dp;
 $162.36 \mid 81 = 162.37$ to 2dp

Estimation NM

Round each number in a calculation so that it is easier to work out (even though the answer will not be exact)
→ Estimate the value of 38×217

Rounding off gives
 $\frac{40 \times 200}{50} = 8000 \div 50 = 800 \div 5$
Estimated value is 160

Division using ratio NM

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

Ratio and fractions NMA

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

Calculating with fractions NMA

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

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

Multiplying fractions; multiply numerators and denominators...

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

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

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

Fraction of an amount; divide and multiply...

$$\rightarrow \frac{3}{5} \text{ of } 70 = 70 \div 5 \times 3 = 42$$

Improper fractions NMA

[note: an improper fraction is often called a "top heavy" fraction]

→ Change $\frac{25}{7}$ to a mixed number

$$25 \div 7 = 3 \text{ with remainder } 4$$

$$\text{so } \frac{25}{7} = 3\frac{4}{7}$$

→ Change $5\frac{2}{9}$ to an improper fraction

$$5 \times 9 + 2 = 47$$

$$\text{so } 5\frac{2}{9} = \frac{47}{9}$$

Fractions, decimals NMA

Fraction is numerator ÷ denominator

$$\rightarrow \frac{5}{8} = 5 \div 8 = 0.625$$

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

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

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

Percentages NMA

y percent of $x = \frac{y}{100} \times x$

→ Increase £58 by 26%.

$$\frac{26}{100} \times £58 = £15.08$$

$$£58 + £15.08 = £73.08$$

y as a percentage of $x = \frac{y}{x} \times 100\%$

→ The population of a town increases from 3500 to 4620

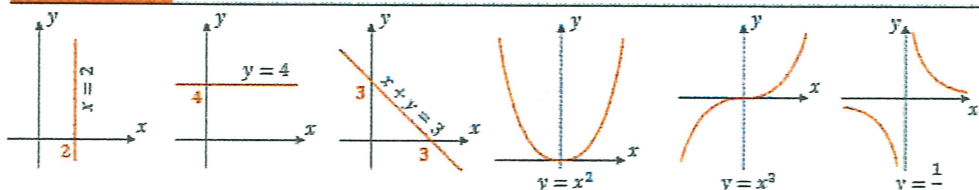
$$\text{Find the percentage increase. } \frac{1120}{3500} \times 100\% = 32\%$$

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%

Standard graphs M



Algebraic notation NMA

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

Expanding brackets M

$$p(q+r) = pq + pr$$
$$5(x-2y) = 5x - 10y$$

Sequences NMA

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 $3 \times 1 + 2 = 5$)

Types of angle NM

Acute [less than 90°]
Right angle [exactly 90°]
Obtuse [between 90° and 180°]
Reflex [between 180° and 360°]



Bearings NM
Always measured clockwise from North
Always use three digits [for example 38° is written 038°]

N	E	S	W
000°	090°	180°	270°
NE	SE	SW	NW
045°	135°	225°	315°

Quadrilaterals G20, G22

	side lengths	angles	symmetry	parallel sides
kite	2 equal pairs	1 equal pair	1 line	none
parallelogram	2 equal pairs	2 equal pairs	no lines; rotational order 2	2 pairs
rectangle	2 equal pairs	all equal 90°	2 lines; rotational order 2	2 pairs
rhombus	all equal	2 equal pairs	2 lines; rotational order 2	2 pairs
square	all equal	all equal 90°	4 lines; rotational order 4	2 pairs
trapezium	-	2 pairs that total 180°	-	1 pair

Areas and volumes NM

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



Circumference of circle = $\pi \times D$
Area of circle = $\pi \times r^2$
Area of trapezium = $\frac{1}{2}(a+b) \times h$

Transformations M

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

Reflection
• Line of reflection
Translation
• Horizontal
• Vertical

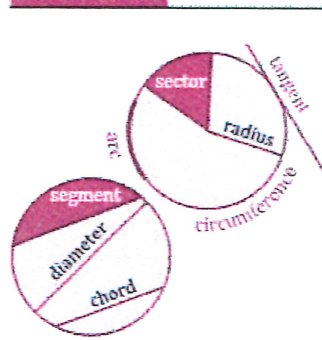
Enlargement
• Centre of enlargement
• Scale factor

Angle facts NM

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 triangles for the interior angles of any polygon...
Exterior angles always total 360°
...or $180^\circ \times (n-2)$



Parts of a circle NM



Standard units NMA

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

Metric - imperial conversions NMA

8 kilometres \approx 5 miles
1 kilogram \approx 2.2 pounds
1 litre \approx 1.75 pints

→ I am driving at 35mph. The speed limit is 50kph. Am I breaking the speed limit?
 $35 \div 5 = 7$
 $7 \times 8 = 56$ kilometres
Yes I am breaking the speed limit

Speed, distance, time NM

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

Currency conversion NMA

→ A camera costs £450 in London. The camera costs \$560 in New York. The exchange rate is £1 = \$1.30. Where is the camera cheaper?
 $450 \times 1.30 = \$585$
Camera is cheaper in New York

Averages NM

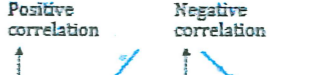
Mode: most frequently occurring
Median: put the data in numerical order, then choose the middle one
Mean = $\frac{\text{total of items of data}}{\text{number of items of data}}$

Measure of spread NM

Range = maximum - minimum

Correlation NM

Positive correlation
Negative correlation



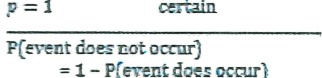
Probability M

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

P(event does not occur) = $1 - P(\text{event does occur})$

Total probability of all the possible outcomes of an experiment is 1

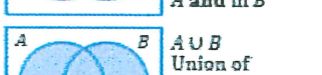
Venn diagrams NMA



$A \cap B$
Intersection of A and B.
Elements in A and in B



$A \cup B$
Union of A and B.
Elements in A or B or both



A'
Complement of A.
Elements which are not in A