

My mathematical journey

What do I need to remember from before?

Place value of numbers up to 10 000 000 (KS2)

Rounding numbers to the nearest 10, 100, 1000, 10 000 and 100 000 (KS2)

Rounding decimals to 1, 2 or 3 decimal places (KS2)

Ordering negative numbers on a number line (KS2)

Multiplying and dividing numbers by 10, 100 and 1000

What will I learn about in this unit?

Writing integers and decimals in expanded form and words

Ordering numbers

Rounding to decimal places and to significant figures

Converting metric units

Finding the midpoint of two numbers

Finding the median of discrete data

Where does this lead?

Addition & subtraction (NP2)

Multiplication & division (NP3)

Percentages, fractions & decimals (NP8)

Estimation (NP9)

Analysing discrete data (SP1)

Using units of measure (all GM units and many SP units)

Standard form (NP12)

Indices & surds (NP15)

Key words & symbols

Word	Explanation	Symbol	How to read it
number	a value or a quantity used to count or measure	<	is less than
digit	a symbol we use to make numbers, such as "0" or "9"	>	is greater than
numeral	a number written with digits, such as "213" or "0.5"	≤	is less than or equal to
integer	a "whole" number (with no decimal part), such as 15 or 510, but <u>not</u> 2.5	≥	is greater than or equal to
base 10	our numeral system, where each column is worth a different power of 10	=	is equal to
decimal	means "base 10" but more often used for non-integers written like this: 2.5 or 38.7	≠	is not equal to
less than	numbers further left on the number line	≈	is approximately equal to
greater than	numbers further right on the number line		
ascending	going up		
descending	going down		

Fingertip facts: what I need to learn by heart

Prefix	micro-	milli-	centi-	kilo-	mega-	giga-
Symbol	μ	m	c	k	M	G
Scale factor	0.00 001	0.00 1	0.01	1000	1 000 000	1 000 000 000
Example (using grams)	1 μ g is one millionth of a gram	1 mg is one thousandth of a gram	1 cg is one hundredth of a gram	1 kg is one thousand grams	1 Mg is one million grams	1 Gg is one billion grams

My mathematical journey

What do I need to remember from before?

- Place value (NP1)
- Vectors on a number line (NP1)
- Adding and subtracting whole numbers with pen and paper and mentally (KS2)
- Using rounding to check answers to calculations (KS2)

What will I learn about in this unit?

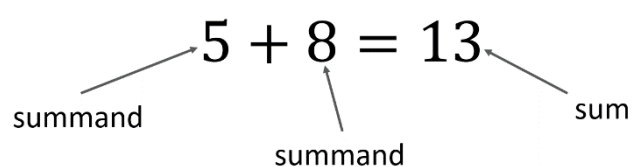
- Addition and subtraction with integers and decimals
- Commutativity & mental methods with integers and decimals
- Number bonds, complements, working with decimals
- Vectors, inverse operations, equality and zero pairs
- Perimeter
- Angle facts
- Mean and range

Where does this lead?

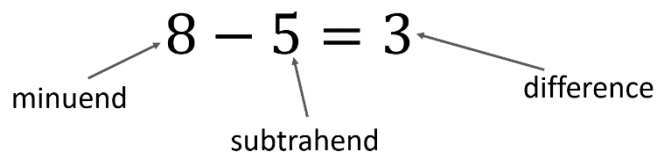
- Order of operations (NP5)
- Directed numbers (NP6)
- Simplifying expressions (A1)
- Adding & subtracting fractions (NP7)
- Solving linear equations (A2)
- Adding & subtracting numbers in standard form (NP12)
- Adding and subtracting surds (NP15)

Key words: what I need to say and write accurately

Word	Explanation
commutative	if you can change the order of the numbers and not change the answer, then the operation is commutative. e.g. $5 + 7 = 12$ and $7 + 5 = 12$, so addition <i>is</i> commutative e.g. $20 - 6 = 14$ and $6 - 20 = -14$, so subtraction <i>is not</i> commutative
complement of a decimal	the number you add to get to 1, e.g. the complement of 0.7 is 0.3
inverse operations	operations that 'undo' each other, such as addition and subtraction
function	a combination of one or more operations
zero pair	a pair of numbers whose sum is 0, e.g. 3 and -3
additive inverse	the numbers in a zero pair are called additive inverses of each other
perimeter	total length of all the sides of a 2D shape
rectilinear shape	a shape with only right angles and straight lines

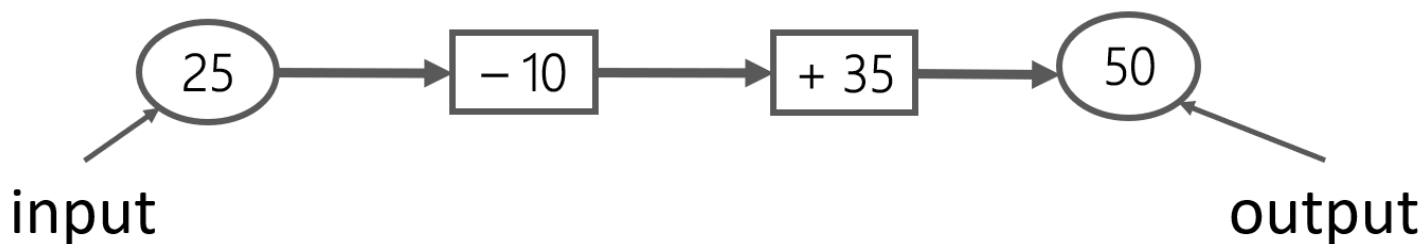


summand + summand = sum



minuend - subtrahend = difference

A function machine:



My mathematical journey

What do I need to remember from before?

Place value (NP1)

Vectors on a number line (NP1)

Multiplying and dividing on paper and mentally (KS2)

Using rounding to check answers to calculations (KS2)

What will I learn about in this unit?

Multiplication and division with integers and decimals

Area models for multiplication

Multiples and factors

Multiplying to stretch

Area and volume

Where does this lead?

Powers, roots and primes (NP4)

Order of operations (NP5)

Directed numbers (NP6)

Fractions (NP7)

Percentages (NP8)

Proportional reasoning (NP10)

Key words: what I need to say and write accurately

Word	Explanation
area	a measure of the space inside a two-dimensional shape
volume	a measure of the space inside a three-dimensional shape
multiple	you find the multiples of a number by multiplying it by an integer. e.g. the first six positive multiples of 7 are 7, 14, 21, 28, 35, 42
factor	a number which divides into another leaving no remainder. e.g. the factors of 12 are 1, 2, 3, 4, 6 and 12 because 1×12 , 2×6 and 3×4 all equal 12

Fingertip facts: what I need to learn by heart

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

My mathematical journey

What do I need to remember from before?

Multiplication and division (NP3)

Multiplying by composing and decomposing (NP3)

Multiples and factors (NP3)

What will I learn about in this unit?

Repeated multiplication

Powers and roots

Prime numbers

Composing and decomposing primes

Where does this lead?

Order of operations (NP5)

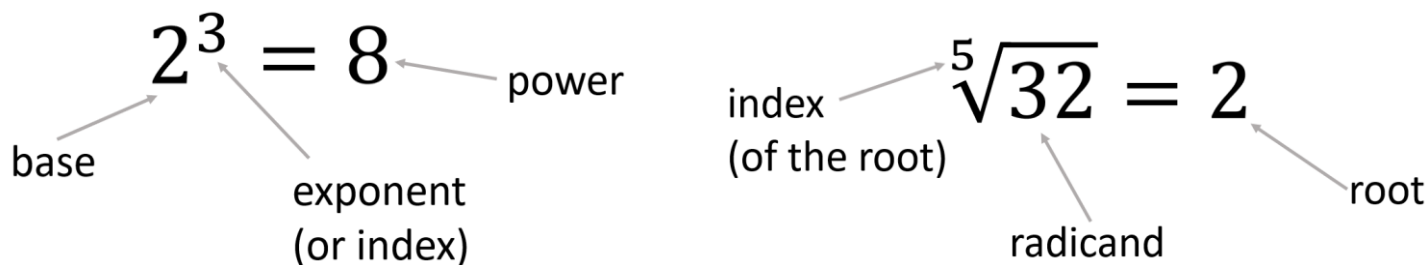
Directed numbers (NP6)

Quadratics (A11)

Index laws (NP15)

Exponential growth (NP16)

Key words and symbols: what I need to say and write accurately



The "radical" or "root" symbol: $\sqrt{\quad}$

Fingertip facts: what I need to learn by heart

The first fifteen square numbers:

Square number	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th	14 th	15 th
Value	1	4	9	16	25	36	49	64	81	100	121	144	169	196	225

The first ten cube numbers:

Cube number	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
Value	1	8	27	64	125	216	343	512	729	1000

The prime numbers less than 100:

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

My mathematical journey

What do I need to remember from before?

Addition and subtraction (NP2)

Multiplication and division (NP3)

Exponents and roots (NP4)

What will I learn about in this unit?

Flexible calculating

The order of operations

Using visible and invisible brackets to break the order of operations

Where does this lead?

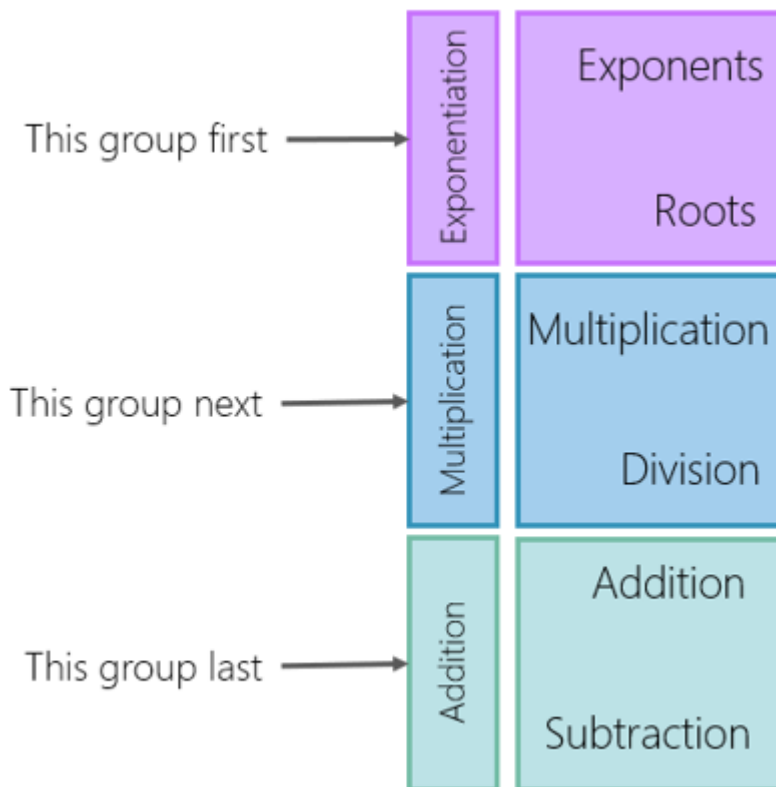
Directed numbers (NP6)

Substitution (A1, A2, A5)

Linear equations (A4)

Fingertip facts: what I need to learn by heart

The order of operations is:



To break the order, use brackets.

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My mathematical journey

What do I need to remember from before?

Addition and subtraction with integers and decimals (NP2)

Multiplication and division with integers and decimals (NP3)

Exponents and roots (NP4)

Order of operations (NP5)

What will I learn about in this unit?

Direction of numbers

Using negative numbers

Calculating with negative numbers

Where does this lead?

Algebraic expressions (A2, A3)

Linear equations (A4)

Formulae (A5)

Quadratic expressions (A11)

My mathematical journey

What do I need to remember
from before?

Directed numbers (NP6)

What will I learn about in this
unit?

Variable unknowns

Algebraic expressions

Substitution

Equations

Where does this lead?

Simplifying expressions (A2)

Multiplying expressions (A3)

Linear equations (A4)

Formulae (A5)

Key words and symbols: what I need to say and write accurately

Word	Explanation
variable	a number that can change its value, represented by a letter such as x or a green tile when we do not know its value
constant	a number that does not change, is fixed
operation	something that takes input numbers and turns them into output numbers, such as addition (including subtraction), multiplication (including division), exponentiation (including roots)
term	the parts of an expression separated by $+$ or $-$. e.g. in the expression $4x - \frac{1}{2}y$, the terms are $4x$ and $\frac{1}{2}y$

My mathematical journey

What do I need to remember from before?

Addition and subtraction (NP2)

Multiplication and division (NP3)

Exponents and roots (NP4)

Order of operations (NP5)

Directed numbers (NP6)

What will I learn about in this unit?

Representing fractions with pictures and numerals

Calculating with fractions

Finding fractions and wholes

Where does this lead?

Percentages, decimals and fractions (NP8)

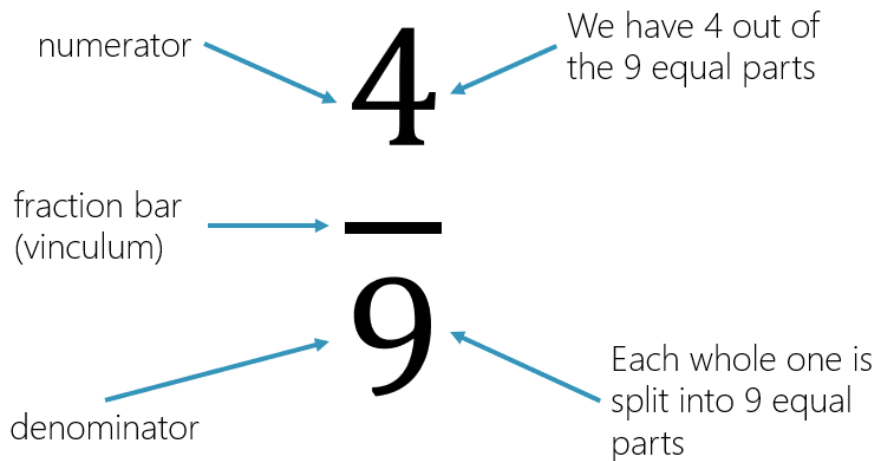
Proportional reasoning (NP10)

Ratio (NP11)

Linear equations (A4)

Algebraic fractions (A17)

Key words and symbols: what I need to say and write accurately



Word	Explanation
proper fraction	a number less than 1, written as a fraction where the numerator is less than the denominator. e.g. $\frac{4}{9}$
improper fraction	a number greater than 1, written as a fraction where the numerator is greater than the denominator. e.g. $\frac{14}{9}$
mixed number	a number greater than 1, written as an integer and a proper fraction. e.g. $1\frac{5}{9}$

My mathematical journey

What do I need to remember from before?

Number lines (NP1, 2, 3, and 6)

Decimals (NP1, 2, and 3)

Fractions (NP7)

Finding a fraction of a number (NP7)

What will I learn about in this unit?

Equivalent fractions, decimals and percentages

Terminating and recurring decimals

Working with percentages

Where does this lead?

Proportional reasoning (NP10)

Contextual graphs (A9)

Percentage change (NP10, NP13)

Recurring decimals to fractions (NP14)

Key words and symbols: what I need to say and write accurately

32% means $\frac{32}{100}$

"percent" means "out of 100"

A **terminating decimal** has a finite (fixed) number of decimal places, e.g. 0.215 e.g. 0.3

A **recurring decimal** has an infinite number of decimal places and its digits have a repeating pattern. The **repetend** is the repeating part. We use dots to show the start and end of the repetend. e.g. 0.333333333 ... = 0.3̄ e.g. 0.804804804 ... = 0.804̄

Fingertip facts: what I need to learn by heart

Tenths and fifths:

Fraction	$\frac{1}{10}$	$\frac{2}{10} = \frac{1}{5}$	$\frac{3}{10}$	$\frac{4}{10} = \frac{2}{5}$	$\frac{5}{10} = \frac{1}{2}$	$\frac{6}{10} = \frac{3}{5}$	$\frac{7}{10}$	$\frac{8}{10} = \frac{4}{5}$	$\frac{9}{10}$	$\frac{10}{10} = 1$
Decimal	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Percentage	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Eighths and quarters:

Fraction	$\frac{1}{8}$	$\frac{2}{8} = \frac{1}{4}$	$\frac{3}{8}$	$\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$	$\frac{5}{8}$	$\frac{6}{8} = \frac{3}{4}$	$\frac{7}{8}$	$\frac{8}{8} = \frac{4}{4} = \frac{2}{2} = 1$
Decimal	0.125	0.25	0.375	0.5	0.625	0.75	0.875	1
Percentage	12.5%	25%	37.5%	50%	62.5%	75%	87.5%	100%

Ninths and thirds:

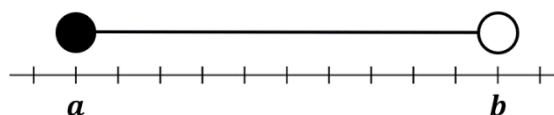
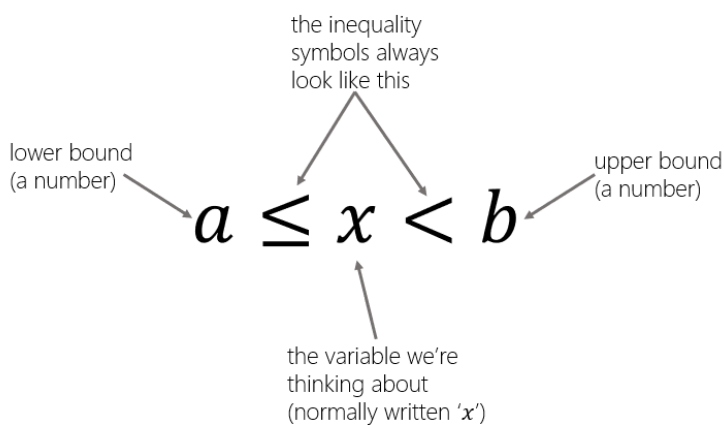
Fraction	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{3}{9} = \frac{1}{3}$	$\frac{4}{9}$	$\frac{5}{9}$	$\frac{6}{9} = \frac{2}{3}$	$\frac{7}{9}$	$\frac{8}{9}$	$\frac{9}{9} = 1$
Decimal	0.1̄	0.2̄	0.3̄	0.4̄	0.5̄	0.6̄	0.7̄	0.8̄	0.9̄ = 1
Percentage	11.1̄%	22.2̄%	33.3̄%	44.4̄%	55.5̄%	66.6̄%	77.7̄%	88.8̄%	99.9̄% = 100%

My mathematical journey

<p>What do I need to remember from before?</p> <p>Number lines: single and double (NP1 – NP8)</p> <p>Approximating numbers (NP1 – NP7)</p> <p>Inequalities (NP1)</p> <p>Fractions (NP7)</p> <p>Directed numbers (NP6)</p>	<p>What will I learn about in this unit?</p> <p>Using my calculator accurately and efficiently</p> <p>Approximating numbers</p> <p>Estimating answers to calculations</p> <p>Error intervals for rounding</p> <p>Truncation</p>	<p>Where does this lead?</p> <p>Solving complex problems using the calculator (all future units)</p> <p>Checking answers by estimating (all future units)</p> <p>Problems with bounds (NP14)</p>
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Key words and symbols: what I need to say and write accurately

- An **error interval** uses inequalities to show the range of values a number could be. We can show it with inequalities *and* on a number line.



- A **surd** is a root that does not have an integer or fraction answer, such as $\sqrt{2}$ or $\sqrt[3]{10}$.

Symbol	\approx	$<$	\leq	$>$	\geq
How to read it	is approximately equal to	is less than	is less than or equal to	is greater than	is greater than or equal to

Fingertip facts: what I need to learn by heart

<p><u>Time frame conversions</u></p> <p>1 minute = 60 seconds</p> <p>1 hour = 60 minutes</p> <p>1 day = 24 hours</p> <p>1 week = 7 days</p> <p>1 year = 52 weeks</p> <p>1 year = 365 days</p> <p>1 leap year = 366 days</p>	<p><u>Days in the months</u></p> <p>January: 31 days</p> <p>February: 28 days (and 29 days in a leap year)</p> <p>March: 31 days</p> <p>April: 30 days</p> <p>May: 31 days</p> <p>June: 30 days</p> <p>July: 31 days</p> <p>August: 31 days</p> <p>September: 30 days</p> <p>October: 31 days</p> <p>November: 30 days</p> <p>December: 31 days</p>
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My mathematical journey

What do I need to remember from before?

Exponents (NP4)
Directed numbers (NP6)
Expressions (A1)

What will I learn about in this unit?

Adding and subtracting expressions
Multiplying and dividing expressions
Index laws
Forming expressions

Where does this lead?

Expanding and factorising brackets (A3)
Solving equations (A4)
Quadratic expressions (A11)

Key words and symbols: what I need to say and write accurately

Word	Explanation
variable	a number that can change its value, represented by a letter such as x or a green tile when we do not know its value
constant	a number that does not change, is fixed
operation	something that takes input numbers and turns them into output numbers, such as addition (including subtraction), multiplication (including division), exponentiation (including roots)
expression	a collection of constants, variables and operations e.g. $4x$, $2p - 5$ and $x^2 + 3x + 6$ are all expressions
term	the parts of an expression separated by $+$ or $-$. e.g. in the expression $4x - \frac{1}{2}y$, the terms are $4x$ and $\frac{1}{2}y$

Fingertip facts: what I need to learn by heart

The index laws

1. When we multiply powers with the same base, we can add their exponents.

$$x^7 \cdot x^3 = x^{10}$$

2. When we divide powers with the same base, we can subtract their exponents.

$$\frac{x^7}{x^3} = x^4$$

3. When we find a power of a power, we can multiply the exponents together.

$$(x^2)^3 = x^6$$

My mathematical journey

What do I need to remember from before?

Lines and angles (KS2)

Measuring (KS2)

What will I learn about in this unit?

Labelling lines and angles

Drawing and measuring lines and angles

Using compasses and a protractor

Constructions and loci

Where does this lead?

Polygons and angles (GM2)

Congruence and similarity (GM4)

Advanced drawing, measuring and constructing (GM7)

Key words and symbols: what I need to say and write accurately

Word	Explanation
point	A point has no length or width (it exists in no dimensions, or 0D)
line	A line has infinite length and no width (it exists in one dimension, or 1D). We use arrows to show its infinity in both directions.
ray	A ray is a section of a line with a starting point that continues infinitely in one direction. We use an arrow to show its infinity in one direction.
line segment	A line segment is a section of a line with a starting point and an end point.
construct	We construct when we only use our compasses and straight edge (like a ruler).
bisector	'Bisect' means 'cut in half'. A bisector is a line that cuts another in half.
perpendicular	Perpendicular lines meet at a right angle.
equidistant	Equidistant means an equal distance from two points or lines.
locus (pl. loci)	The path of all points that fit a condition.

Angle types:

Acute $0^\circ < \theta < 90^\circ$	Right $90^\circ = \theta$	Obtuse $90^\circ < \theta < 180^\circ$	Straight $180^\circ = \theta$	Reflex $180^\circ < \theta < 360^\circ$	Full turn $360^\circ = \theta$
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Greek letters:

α (alpha)

β (beta)

γ (gamma)

θ (theta)

Fingertip facts: what I need to learn by heart

You will need to learn the constructions for:

1. a perpendicular bisector
2. an angle bisector
3. a perpendicular from a point on a line
4. a perpendicular from a point near a line

My mathematical journey

What do I need to remember from before?

Area models for multiplication
(NP3)
Collecting like terms (A2)

What will I learn about in this unit?

Expanding expressions with brackets
Factorising expressions as the opposite of expanding
Expanding two brackets

Where does this lead?

Solving equations (A4)
Formulae (A5)
Inequalities (A8)
Quadratic expressions (A11)

Key words and symbols: what I need to say and write accurately

Word	Explanation
variable	a number that can change its value, represented by a letter such as x or a green tile when we do not know its value
constant	a number that does not change, is fixed
operation	something that takes input numbers and turns them into output numbers, such as addition (including subtraction), multiplication (including division), exponentiation (including roots)
expression	a collection of constants, variables and operations e.g. $4x$, $2p - 5$ and $x^2 + 3x + 6$ are all expressions
term	the parts of an expression separated by $+$ or $-$. e.g. in the expression $4x - \frac{1}{2}y$, the terms are $4x$ and $\frac{1}{2}y$
expand	write an expression containing brackets <i>without</i> the brackets, by multiplying e.g. $2(x - 5) = 2x - 10$
factorise	write an expression without brackets as a multiplication <i>with</i> brackets e.g. $2x - 10 = 2(x - 5)$

My mathematical journey

What do I need to remember from before?

Equality & inverse operations
(NP2, NP3, NP4)

Solving equations (A1)

Simplifying expressions (A2)

Expanding brackets (A3)

What will I learn about in this unit?

Mathematical equality

Balancing an equation

Solving all types of linear equations

Where does this lead?

Rearranging formulae (A5)

Equations of a line (A6)

Quadratic equations (A12)

Using equations to solve geometry and probability problems
(GM2 – GM11, SP7)

Key words and symbols: what I need to say and write accurately

Word	Explanation
unknown	a number that we do not know, represented by a letter
expression	a collection of constants, variables and operations e.g. $4x$, $2p - 5$ and $x^2 + 3x + 6$ are all expressions
equation	when we write two expressions equal to one another e.g. $2 + 3 = 5$, $2x + 3 = 5$ and $2x + 3 = 5x - 6$ are all equations
term	the parts of an expression separated by + or – e.g. in the expression $4x - \frac{1}{2}y$, the terms are $4x$ and $\frac{1}{2}y$
solve	when we solve an equation, we find out what the value of the unknown is

Fingertip facts: what I need to learn by heart

An equation must always be balanced: whatever we do to one side we must also do to the other.

My mathematical journey

What do I need to remember from before?

Multiplicative reasoning (NP3)

Fractions (NP7)

Double number lines and ratio tables (NP8)

Percentages (NP8)

What will I learn about in this unit?

Direct and inverse proportion

Proportional reasoning in various contexts

Percentage changes and decimal multipliers

Where does this lead?

Ratio (NP11)

Advanced proportion and rates of change (NP13)

Contextual graphs (A9)

Probability (SP3)

Key words and symbols: what I need to say and write accurately

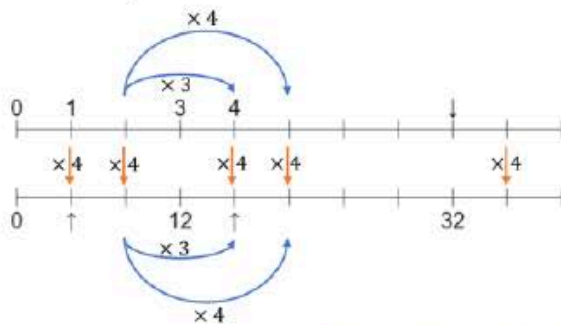
If two quantities are in **direct proportion**, the following two facts are true:

- There is a multiplicative relationship between them (e.g. if one doubles, the other doubles).
- If one is 0, the other is 0.

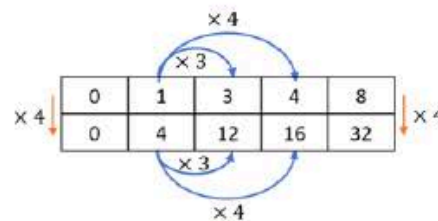
If two quantities are in **inverse proportion**, the following fact is true:

- There is an inverse multiplicative relationship between them (e.g. if one doubles, the other halves).

A **double number line** shows a multiplicative relationship.



A **ratio table** shows a multiplicative relationship, like a double number line but without the scale.



(Notice how both these diagrams show the same information.)

Fingertip facts: what I need to learn by heart

- When working with direct or inverse proportion, I can only multiply or divide.
- To increase a quantity by a percentage, I add the percentage onto 100%, convert this to a decimal and multiply.
 - e.g. To increase £40 by 12%, I find $100\% + 12\% = 112\% = 1.12$ and calculate $£40 \times 1.12$
- To decrease a quantity by a percentage, I subtract the percentage from 100%, convert this to a decimal and multiply.
 - e.g. To decrease £40 by 12%, I find $100\% - 12\% = 88\% = 0.88$ and calculate $£40 \times 0.88$

My mathematical journey

What do I need to remember from before?

Measuring and drawing angles
(Key Stage 2, GM1)

Basic angle facts (NP2)

What will I learn about in this unit?

Angle facts about lines and polygons

Types of quadrilaterals and other polygons

Bearings

Where does this lead?

Congruence and similarity
(GM4)

Trigonometry (GM5, GM9)

Solving geometric problems,
including circle theorems (GM6,
GM7, GM11)

Key words and symbols: what I need to say and write accurately

A vertex (plural, vertices) is made when two lines meet. Sometimes called a corner.

Lines: vertical, horizontal, parallel, perpendicular, oblique

Angles: acute, obtuse, reflex, alternate, corresponding, interior

Triangles: scalene, isosceles, equilateral

Quadrilaterals: square, rectangle, parallelogram, rhombus, (isosceles) trapezium, kite, arrowhead

Polygons: triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon

Symmetry can be reflective or rotational

Fingertip facts: what I need to learn by heart

Polygon	Number of sides	Interior angle sum
Triangle	3	180°
Quadrilateral	4	360°
Pentagon	5	540°
Hexagon	6	720°
Heptagon	7	900°
Octagon	8	1080°
Nonagon	9	1260°
Decagon	10	1440°

Angle facts

- Adjacent angles on a straight line sum to 180°.
- Angles around a point sum to 360°.
- Vertically opposite angles are equal.
- Angles in parallel lines on adjacent or corresponding sides of the transversal are equal.
- Three-figure bearings are measured clockwise starting from north.

Notice that the interior angle sum increases by 180° each time.

My mathematical journey

What do I need to remember from before?

Bar charts and pictograms (KS2)

Median (NP1)

Mean (NP2)

Range (NP2)

What will I learn about in this unit?

Presenting and analysing sets of discrete data using charts and summary statistics – mean, mode, median, and range

Comparing data sets through charts and summary statistics

Knowing the ways statistics can be used to tell a story

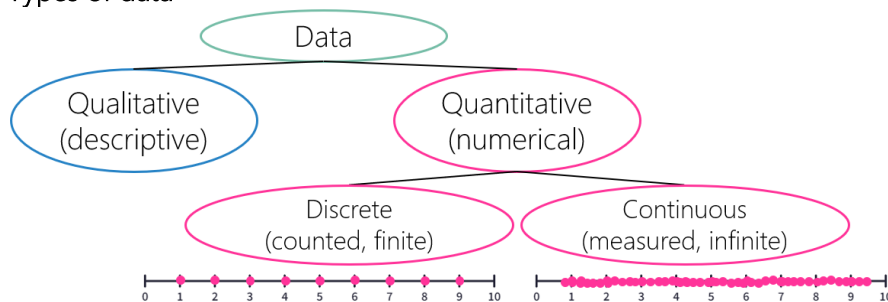
Where does this lead?

Presenting, analysing and comparing sets of continuous data, or bivariate data using charts and summary statistics (SP2, SP4, SP6)

Advanced statistical analysis (GCSE Statistics; A Level Statistics)

Key words and symbols: what I need to say and write accurately

Types of data



Bias: when one answer is more likely than another because of the people we ask

Set notation: a set of numbers can be written inside curly brackets, e.g. {1, 3, 3, 5}

\bar{x} is a symbol for the mean of a data set

Measures of location
(trying to capture where the data set is)

Mean
total shared equally

Median
middle data point

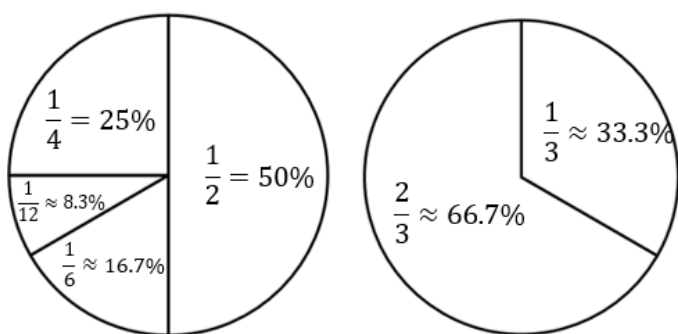
Mode
most frequent data point

Measures of spread
(trying to capture how wide the data set is)

Range
spread of all data points

Fingertip facts: what I need to learn by heart

Common fractions of a circle



The statistical enquiry cycle

