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 not 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 μg 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 *is* commutative e.g. $20 - 6 = 14$ and $6 - 20 = -14$, so subtraction *is not* 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

$$5 + 8 = 13$$

summand   summand   sum

summand + summand = sum

$$8 - 5 = 3$$

minuend   subtrahend   difference

minuend − subtrahend = difference

A function machine:
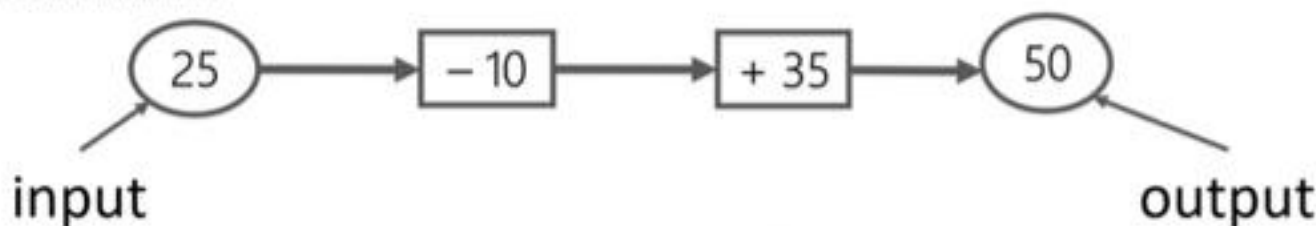
$$25 \rightarrow -10 \rightarrow +35 \rightarrow 50$$

input   output

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
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)	Multiplication and division with integers and decimals Area models for multiplication Multiples and factors Multiplying to stretch Area and volume	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

The times tables

×	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?	What will I learn about in this unit?	Where does this lead?
Multiplication and division (NP3)	Repeated multiplication	Order of operations (NP5)
Multiplying by composing and decomposing (NP3)	Powers and roots	Directed numbers (NP6)
Multiples and factors (NP3)	Prime numbers	Quadratics (A11)
	Composing and decomposing primes	Index laws (NP15)
		Exponential growth (NP16)

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

$$2^3 = 8$$

base — exponent (or index) — power

$$\sqrt[5]{32} = 2$$

index (of the root) — radicand — root
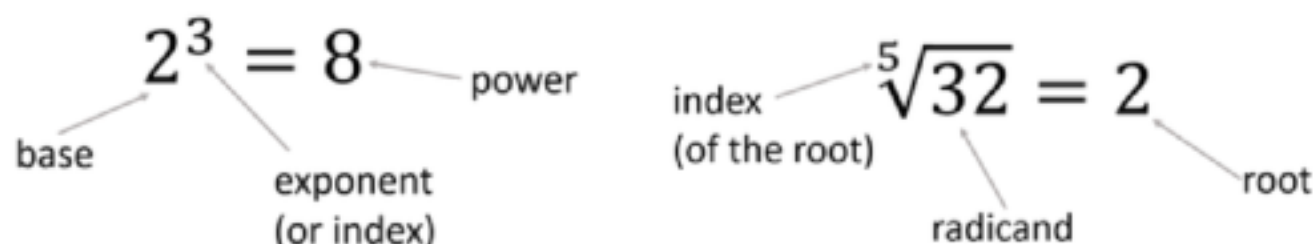
The "radical" or "root" symbol: $\sqrt{}$

Fingertip facts: what I need to learn by heart

The first fifteen square numbers:

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

The first ten cube numbers:

Cube number	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
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?	What will I learn about in this unit?	Where does this lead?
Addition and subtraction (NP2)	Flexible calculating	Directed numbers (NP6)
Multiplication and division (NP3)	The order of operations	Substitution (A1, A2, A5)
Exponents and roots (NP4)	Using visible and invisible brackets to break the order of operations	Linear equations (A4)

Fingertip facts: what I need to learn by heart

The order of operations is:

This group first → **Exponentiation**: Exponents / Roots

This group next → **Multiplication**: Multiplication / Division

This group last → **Addition**: Addition / Subtraction
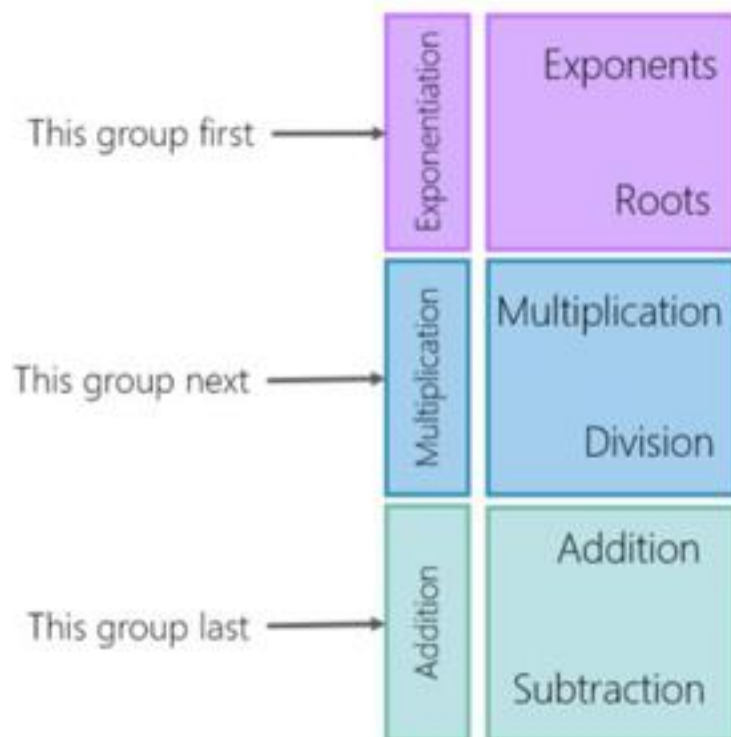
To break the order, use brackets.

( )

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?

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?
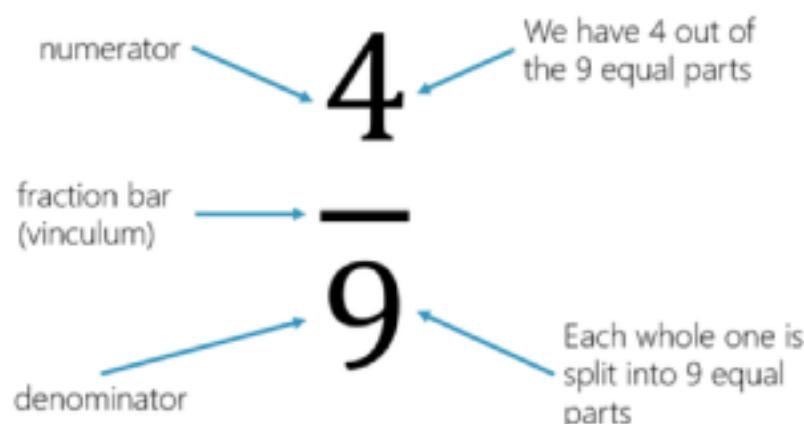
Percentages, decimals and fractions (NP8)

Proportional reasoning (NP10)

Ratio (NP11)

Linear equations (A4)

Algebraic fractions (A17)

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

numerator → **4** ← We have 4 out of the 9 equal parts

fraction bar (vinculum) → **—**

denominator → **9** ← Each whole one is split into 9 equal parts

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?	What will I learn about in this unit?	Where does this lead?
Directed numbers (NP6)	Variable unknowns Algebraic expressions Substitution Equations	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?	What will I learn about in this unit?	Where does this lead?
Repeated multiplications and exponents (NP4) Directed numbers (NP6) Expressions (A1)	Adding and subtracting expressions Multiplying and dividing expressions Index laws Forming expressions	Expanding and factorising brackets (A3) Solving equations (A4) Sequences (A7) Quadratic expressions (A11) Indices and surds (NP15)

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
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 <u>multiply</u> powers with the <u>same base</u>, we can <u>add their exponents</u>.

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

2. When we <u>divide</u> powers with the <u>same base</u>, we can <u>subtract their exponents</u>.

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

3. When we find a <u>power of a power</u>, we can <u>multiply the exponents together</u>.

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

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Area models for multiplication (NP3) Collecting like terms (A2)	Expanding expressions with brackets Factorising expressions as the opposite of expanding Expanding two brackets	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
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 *without* the brackets, by multiplying e.g. $2(x - 5) = 2x - 10$
factorise	write an expression without brackets as a multiplication *with* 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?

Arithmetic strategies (NP1, 2, 3, 4)

Order of operations (NP5)

Negative numbers (NP6)

Algebraic expressions (A1, 2, 3)

Solving equations (A4)

What will I learn about in this unit?

Substituting numbers into expressions and formulae

Writing and using formulae

Rearranging formulae to change the subject

Where does this lead?

All further algebra units

Using formulae in geometry (GM3 onwards)

Advanced proportion (NP13)

Advanced probability and statistics (A Level)

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

Word	Explanation
variable	A letter that represents many numbers (a letter whose value can vary) e.g. x, y, θ
constant	A fixed number e.g. 2, -1.8, π
expression	A collection of any variables, constants and operations e.g. $2x + 5$, $a - b$, $3p$, $\frac{n+5}{7}$, $3 \times 4 - 2^3$
substitute	Replace a variable with a constant e.g. When $x = 3$, the value of $2x - 1$ is $2 \times 3 - 1$, or 5.
evaluate	Work out the value of a calculation. e.g. "Evaluate 2 + 3" means "Work out the value of 2 + 3."
formula (pl. formulae or formulas)	A set of instructions to work something out. A formula can be written in words, as an expression or as an equation. Here is a formula in words: Area = length × width Here is the formula as an expression: lw Here is the formula as an equation: $A = lw$
subject	The subject of a formula is the variable that is 'on its own' on one side of the equation. e.g. In the formula $A = lw$, the subject is A.
rearrange	Rearranging a formula means changing its subject. e.g. $A = lw$ can be rearranged to make l the subject: $l = \frac{A}{w}$

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Lines and angles (KS2) Measuring (KS2)	Labelling lines and angles Drawing and measuring lines and angles Using compasses and a protractor Constructions and loci	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 uses 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	Right	Obtuse	Straight	Reflex	Full turn
$0° < \theta < 90°$	$90° = \theta$	$90° < \theta < 180°$	$180° = \theta$	$180° < \theta < 360°$	$360° = \theta$

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?	What will I learn about in this unit?	Where does this lead?
Measuring and drawing angles (Key Stage 2, GM1) Basic angle facts (NP2)	Angle facts about lines and polygons Types of quadrilaterals and other polygons Bearings	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?	What will I learn about in this unit?	Where does this lead?
Area of a rectangle (KS2)	Units of length and of area	Area and circumference of a circle (GM6)
Area of rectilinear shapes (NP3)	Area of a triangle	Surface area and volume (GM8)
Perimeter (KS2 & NP2)	Area of quadrilaterals	Advanced area (GM9)
Types of polygons (GM2)	Area of a circle	Solving geometric problems (GM11)

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

Word	Explanation
Area	A measure of the two-dimensional space inside a shape.
Perimeter	A measure of the one-dimensional boundary that creates a shape.
Perpendicular height	The height of a shape which is at a right angle to its base.
Radius	The length from the centre of a circle to its edge.
Diameter	The length straight across the centre of a circle from edge to edge. Double the radius.

Fingertip facts: what I need to learn by heart

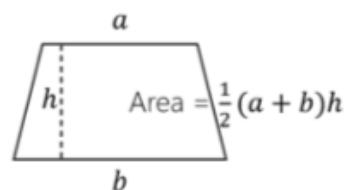Area of a rectangle = base × perpendicular height

h Area = bh b
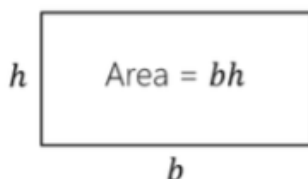
Area of a parallelogram = base × perpendicular height

h Area = bh b
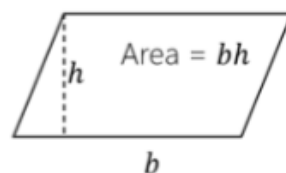
Area of a triangle =
$\frac{1}{2}$ × base × perpendicular height

h Area = $\frac{1}{2}bh$ b
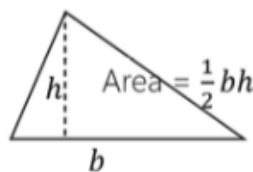
Area of a trapezium =
$\frac{1}{2}$ × sum of the parallel sides × perpendicular height

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

The area of other polygons can be found by splitting them into triangles.

Area of a circle = pi × square radius

r Area = πr^2
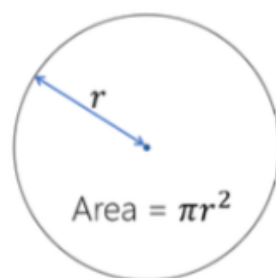
My mathematical journey

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

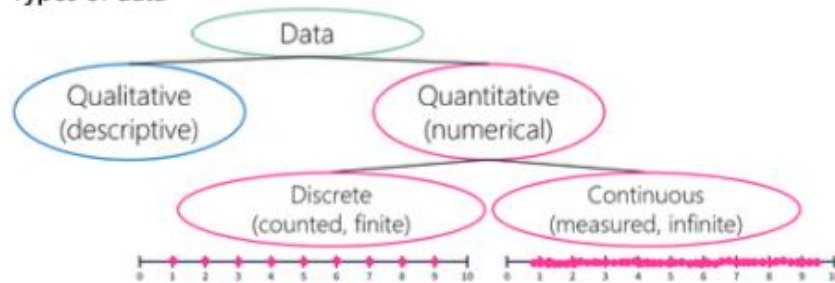Knowing the ways statistics can be used to tell a story

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

Data

Qualitative (descriptive)

Quantitative (numerical)

Discrete (counted, finite)

Continuous (measured, infinite)

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
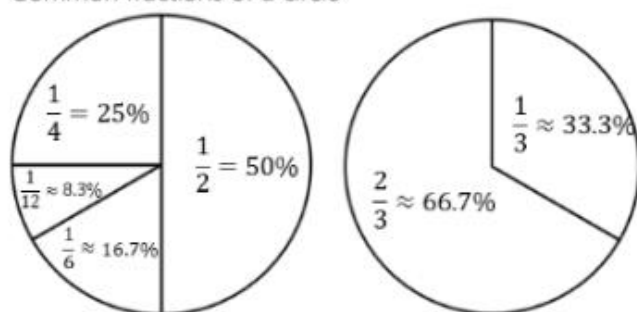most frequent data point

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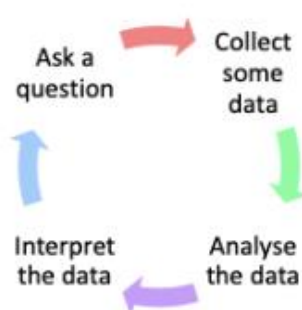(trying to capture how wide the data set it)

Range
spread of all data points

Fingertip facts: what I need to learn by heart

Common fractions of a circle

$\frac{1}{4} = 25\%$

$\frac{1}{2} = 50\%$

$\frac{1}{12} \approx 8.3\%$

$\frac{1}{6} \approx 16.7\%$

$\frac{1}{3} \approx 33.3\%$

$\frac{2}{3} \approx 66.7\%$

The statistical enquiry cycle

Ask a question

Collect some data

Analyse the data

Interpret the data

My mathematical journey

What do I need to remember from before?

Reading tables (SP1)

Interpreting graphs and charts (SP1)

Mean (SP1)

What will I learn about in this unit?

Drawing and reading scatter graphs

Identifying and interpreting correlations

Drawing and using lines of best fit

Drawing and reading time series graphs
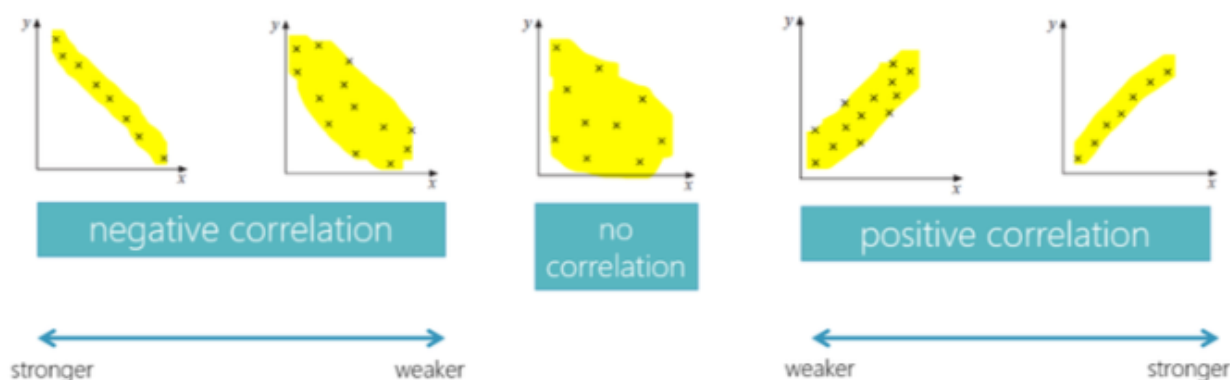
Where does this lead?

Advanced data analysis (SP4, SP5)

Data analysis in geography, science, psychology, business, economics and more

Correlation and regression analysis (A Level Maths)

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

Word	Explanation
variable	a quantity that can change in value
univariate data	data with one variable
bivariate	data with two variables
correlation	a mutual relationship between two variables, e.g. if one increases, so does the other
outlier	a value on a scatter graph that doesn't fit with the pattern of the others
line of best fit	a line on a scatter graph that shows the direction of increase/decrease and goes through the middle of the points
interpolation	making a prediction by reading values from a line of best fit inside the range of known data
extrapolation	making a prediction by reading values from a line of best fit outside the range of known data
trend	a general pattern in some data (e.g. a general decrease over time)

Fingertip facts: what I need to learn by heart

Types of linear correlation

negative correlation

no correlation

positive correlation

stronger ← → weaker

weaker ← → stronger

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

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

"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. $0.333333333\ldots = 0.\dot{3}$ e.g. $0.804804804\ldots = 0.\dot{8}0\dot{4}$

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	$0.\dot{1}$	$0.\dot{2}$	$0.\dot{3}$	$0.\dot{4}$	$0.\dot{5}$	$0.\dot{6}$	$0.\dot{7}$	$0.\dot{8}$	$0.\dot{9} = 1$
Percentage	$11.\dot{1}\%$	$22.\dot{2}\%$	$33.\dot{3}\%$	$44.\dot{4}\%$	$55.\dot{5}\%$	$66.\dot{6}\%$	$77.\dot{7}\%$	$88.\dot{8}\%$	$99.\dot{9}\% = 100\%$

My mathematical journey

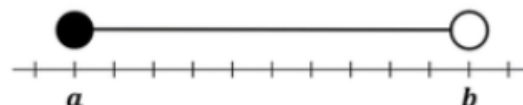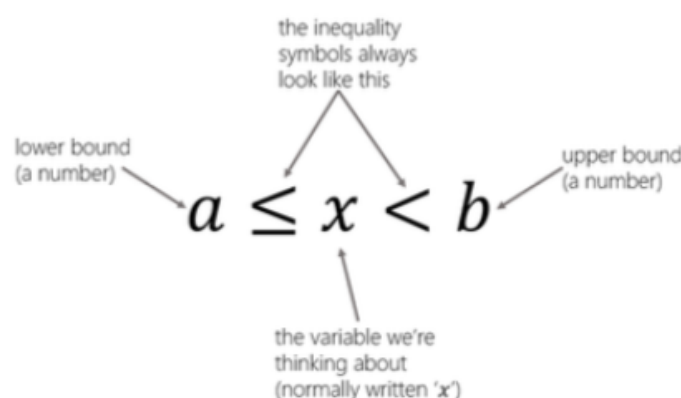| What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Number lines: single and double (NP1 – NP8) Approximating numbers (NP1 – NP7) Inequalities (NP1) Fractions (NP7) Directed numbers (NP6)	Using my calculator accurately and efficiently Approximating numbers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

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.

the inequality symbols always look like this

lower bound (a number)

upper bound (a number)

$$a \leq x < b$$

the variable we're thinking about (normally written '*x*')

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

Symbol	≈	<	≤	>	≥
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

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

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Multiplicative reasoning (NP3)	Direct and inverse proportion	Ratio (NP11)
Fractions (NP7)	Proportional reasoning in various contexts	Advanced proportion and rates of change (NP13)
Double number lines and ratio tables (NP8)	Percentage changes and decimal multipliers	Contextual graphs (A9)
Percentages (NP8)		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.
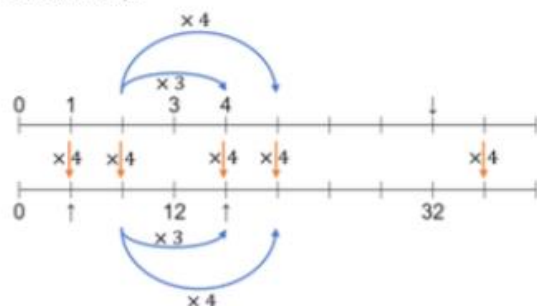
A **ratio table** shows a multiplicative relationship, like a double number line but without the scale.
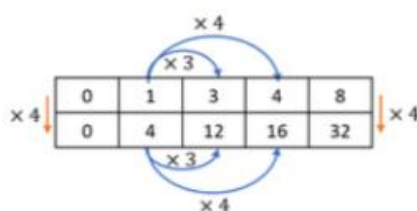
(Notice how both these diagrams show the same information.)

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 × 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 × 0.88

My mathematical journey

What do I need to remember from before?

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

Substitution (A1 and A5)

Writing expressions, equations and formulae
(A2, A3, A4 and A5)

What will I learn about in this unit?

Plotting and using coordinates

The links between graphical and algebraic representations of equations

Gradient as a measure of steepness

Where does this lead?
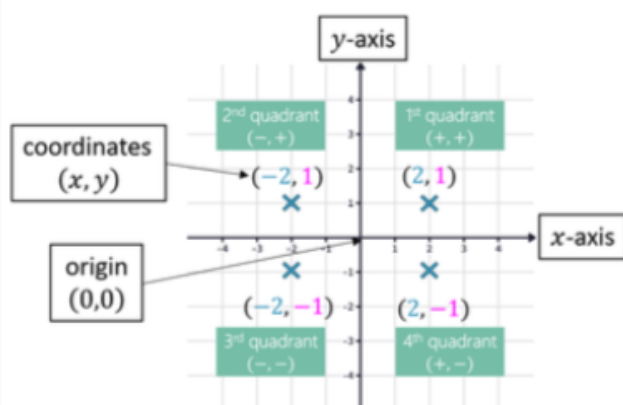
Sequences (A7)

Inequalities on graphs (A8, A10)

Advanced equations of lines (A10)

Quadratic graphs (A12)

Advanced graphs (A14, A15)

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

Word	Explanation
midpoint	the point exactly in the middle of two others
gradient	the steepness of a line
y-intercept	where a graph crosses the y-axis
x-intercept	where a graph crosses the x-axis
parallel	describing two lines that have the same gradient so will never intersect
to intersect	to cross – we say two lines intersect
simultaneously	at the same time
parabola	the name of the shape of a quadratic graph
vertex	the turning point of a quadratic graph

coordinates (x, y)

y-axis

2nd quadrant $(-, +)$ 1st quadrant $(+, +)$

$(-2, 1)$ $(2, 1)$

x-axis

origin $(0, 0)$

$(-2, -1)$ $(2, -1)$

3rd quadrant $(-, -)$ 4th quadrant $(+, -)$

Fingertip facts: what I need to learn by heart

The equation of any straight line can be written in the form $y = mx + c$.

The <u>coefficient</u> of x gives the <u>gradient</u>
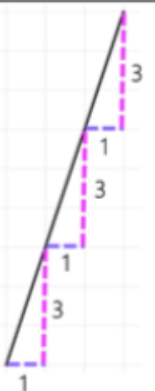
$$y = mx + c$$

The <u>constant</u> gives the <u>y intercept</u>

The steepness of a line is its gradient.

The value of the gradient is the number of units moved vertically for every unit moved horizontally. In other words: 1 right, ____ up/down.

This line goes 1 right, 3 up, so its gradient is 3.

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Arithmetic (NP2, NP3, NP4) Solving linear equations (A4) Formulae, including substitution (A5) Linear graphs (A6)	Linear sequences nth term formulae for linear sequences Recognising non-linear sequences	Advanced linear graphs (A10) Advanced sequences – quadratic and geometric (A13) Recurrence relations (A13) Exponential functions (A15) Sequences on A-Level maths

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

Word	Explanation
term	A number in a sequence. Terms have position 1, 2, 3, 4, and so on, and these positions are labelled with the variable n. e.g. in the sequence 5, 7, 9, 11, ... the 1st term (where $n = 1$) is 5 and the 4th term (where $n = 4$) is 11.
term-to-term rule	We can define a sequence with a term-to-term rule, which tells us where to start and how to get from one term to the next. e.g. in the sequence 5, 7, 9, 11, ... the term-to-term rule would be 'start at 5 and add 2 every time'
increasing sequence	A sequence where each term is greater than the one before. e.g. 5, 7, 9, 11, ...
decreasing sequence	A sequence where each term is less than the one before. e.g. 11, 9, 7, 5, ...
nth term formula	A formula that calculates the value of each term, using its position, n. For this reason it is sometimes called the position-to-term formula. e.g. For the sequence 5, 7, 9, 11, ... the nth term formula is $2n + 3$
coefficient	A number/letter that multiplies another in an expression. e.g. In the expression $2n + 3$, the coefficient of n is 2 and the coefficient of 2 is n.
linear sequence	A sequence where the difference between terms is constant (doesn't change). e.g. 5, 7, 9, 11, ... (the difference is 2) or 10, 7, 4, 1, ... (the difference is -3).
quadratic sequence	A sequence where the differences between terms form a linear sequence. e.g. 1, 4, 9, 16, 25, ... (the differences are 3, 5, 7, 9, ..., which is itself a linear sequence).
geometric sequence	A sequence where there is a constant multiplier between terms. e.g. 1, 2, 4, 8, 16, ... (each term is multiplied by 2 to get the next)
Fibonacci-style sequence	A sequence where each term is the sum of the previous two. e.g. 1, 4, 5, 9, 14, 23, ...

Fingertip facts: what I need to learn by heart

The sequence of square numbers: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, ...

The sequence of cube numbers: 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000, ...

The triangular (or triangle) numbers: 1, 3, 6, 10, 15, 21, 28, 36, 45, 55, ...

The Fibonacci sequence: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, ...

My mathematical journey

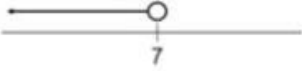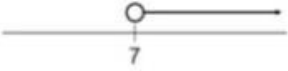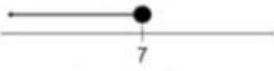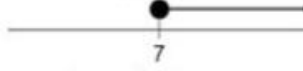| What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Inequality symbols, < and > (KS2) Solving linear equations (A4) Plotting vertical and horizontal graphs (A6)	Reading, writing and interpreting inequalities Solving linear inequalities, including in contexts Plotting simple inequalities in 2D	Inequalities in 2D (A??) Quadratic inequalities (A??) Non-linear inequalities (A Level Maths) Linear programming (A Level Further Maths)

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

Word or symbol	Explanation	Phrases meaning 'less than' $x < 7$	Phrases meaning 'greater than' $x > 7$
>	is greater than		
<	is less than		
≥	is greater than or equal to	*any number which is...*	*any number which is...*
≤	is less than or equal to	less than 7	greater than 7
equation	a statement that two quantities have equal value, e.g. $5 + 2 = 10 - 3$	up to (but not including) 7 up to (and excluding) 7	exceeding 7
Inequality	a statement that two quantities do not have equal value, e.g. $5 + 2 < 12 + 1$	Phrases meaning 'less than or equal to' $x \leq 7$	Phrases meaning 'greater than or equal to' $x \geq 7$
comparative inequality	an inequality that compares two values, e.g. $4 > 1$ or $x > 8$ or $1 \leq x$	*any number which is...* less than or equal to 7	*any number which is...* greater than or equal to 7
restrictive inequality	a 'double' inequality that puts an upper and lower limit on a number, e.g. $5 \leq x < 10$	at most 7 no greater/more than 7 up to (and including) 7	at least 7 no less than 7

Fingertip facts: what I need to learn by heart

Inequalities can be read in both directions.
These two statements mean the same thing.

$$5 > 3 \qquad\qquad 3 < 5$$

read this way
5 is greater than 3

read this way
5 is greater than 3

read this way
3 is less than 5

read this way
3 is less than 5

If we multiply or divide an inequality by a negative number, the direction of the sign reverses due to the rotating effect of multiplication by negatives.

If $-x > 2$,
then $x < -2$

My mathematical journey

What do I need to remember from before?
Multiplying to scale (NP3, NP10)
Reflective and rotational symmetry (GM2)
Properties of shapes (GM2)

What will I learn about in this unit?
Congruence and similarity
Congruent transformations: translation, reflection, rotation
Similar transformations: enlargement

| Where does this lead? |
| --- |
| Trigonometry (GM5) |
| Area and volume in similar solids (GM8) |
| Problems with congruence and similarity (GM11) |
| Transforming graphs (A15) |

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

Word	Explanation
congruent, ≅	identical in size and shape, but not necessarily orientation or direction
transformation	a mathematical change, using translation, rotation, reflection or enlargement
image	a shape *after* a transformation has happened
vector	a mathematical object that tells you how far to move and in what direction it can be shown with an arrow or with column notation e.g. this arrow and column vector both communicate "one left, two down" $\begin{pmatrix} -1 \\ -2 \end{pmatrix}$
similar	same shape, all angles the same, but one an enlargement of the other (all corresponding sides in the same ratio)

Fingertip facts: what I need to learn by heart

Congruent transformations
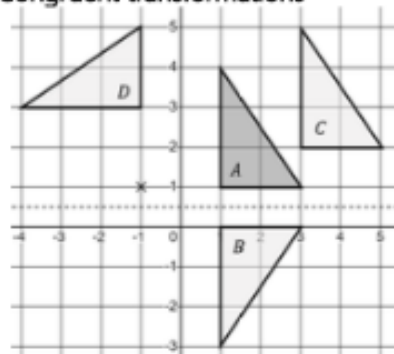
A to B is a reflection in the line $y = \frac{1}{2}$.

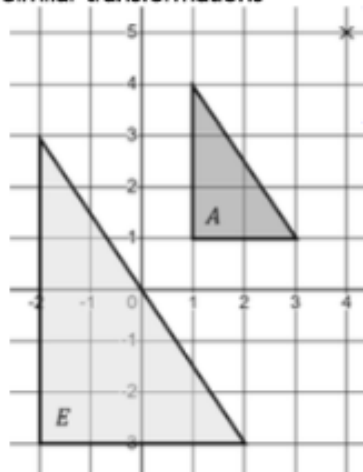A to C is a translation by the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$

A to D is a rotation 90° anticlockwise around the centre $(-1, 1)$.

Reflections need a mirror line.

Translations need a vector.

Rotations need an angle, direction and centre.

Similar transformations

A to E is an enlargement of scale factor 2 from $(4, 5)$.

Enlargements need a scale factor and centre.

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Number lines (NP1, 2, 3, and 6) Decimals (NP1, 2, and 3) Fractions (NP7) Frequency tables (SP1)	Systematic listing and the product rule Experimental and theoretical probability Probability diagrams	Sets and Venn diagrams (SP5) Sampling and data analysis (SP6) Advanced probability problems (SP7)

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

Word	Explanation
systematic	working in an organised way
relative frequency	the proportion of times something happens
outcome	a result we could get from a probability experiment e.g. rolling a fair six-sided die gives the outcomes 1, 2, 3, 4, 5, and 6
event	one or more outcomes e.g. rolling a square number on a die
fair	all outcomes are equally likely
biased	some outcomes are more likely than others
mutually exclusive	events which cannot happen at the same time
independent	If events are independent, they do not influence or affect each other. e.g. if I flip a coin twice, the outcome of the first flip has no effect on the outcome of the second flip: the events are independent.

Fingertip facts: what I need to learn by heart

$$P(\text{event}) = \frac{\text{outcomes we want}}{\text{total outcomes}}$$

Probabilities can be represented by a number between 0 and 1.

Impossible	←	Unlikely	→	Even chance	←	Likely	→	Certain

0   1

The sum of all mutually exclusive events is 1.

If events A and B are mutually exclusive, $P(A \text{ or } B) = P(A) + P(B)$

$P(\text{not } A) = 1 - P(A)$. This can also be written $P(A') = 1 - P(A)$

My mathematical journey

What do I need to remember from before?	What will I learn about in this unit?	Where does this lead?
Multiplication and division; multiples and factors (NP3) Writing values as a fraction; equivalent fractions (NP7) Ratio tables (NP10)	Using ratio notation Equivalent ratios and simplifying Ratios and fractions Finding values from parts or the whole	Combining ratios (NP13) Similar area and volume (GM8) Geometric sequences (A13) Advanced ratio (NP16) Vectors (GM10)

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

A **ratio** describes the **multiplicative relationship** between two quantities.

$$2 : 3$$

shaded parts — proportional to — unshaded parts

We use a **colon :** to separate parts of a ratio.

Key representations

We can use **bar models** and **ratio tables** to help us solve ratio problems. These two diagrams represent the same situation.