



Alderman White School

GCSE SoL

<http://aqamaths.aqa.org.uk/index.php>

All
Year 9

Foundation
Year 10

Foundation
Year 11

Higher
Year 10

Higher
Year 11

Year 9

All students

2021-22

Menu

2 days	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	October Half term	October Half term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Staggered start	Y8 catch-up from Term 3 or TTT	[02] Collecting, interpreting and representing data			AQA test 1		[03] Analysing Data	October Half term	[01] Working with integers	[04] Properties of integers		[06] Working with decimals		[12] Rounding and estimation	
Xmas Holidays	Xmas Holidays	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Feb Half Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Easter Holidays
		[07] Basic Algebra				AQA test 2			[09] Angles		[10] Perimeter		[11] Area		
Easter Holidays	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	May Half Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Summer Holidays
	[Y8-5a,b] 3D geometry BUFFER		[05] Working with fractions		[15] Percentages			[13] Powers and roots		[14] Standard Form		EoY test	[16] Further algebra		

Foundation Year 10

2021-22

Menu

2 days	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	October Half term	October Half term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Staggered start	[17] Equations			[22] Formulae			October Half term	October Half term	[35a] Pythagoras		[20] 3D objects		[21] Units and measure		Mock P1
Xmas Holidays	Xmas Holidays	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Feb Half Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Easter Holidays
		[23] Volume and surface area			[19+24] Probability				[26] Ratio			Mock P2			
		[27] Proportion													
Easter Holidays	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	May Half Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Summer Holidays
	[18] Functions and Sequences		[28] Graphs of linear functions		[25] Inequalities			[15] REVISE Percentages		[38] Growth & Decay			Mock 3		
													[02+03] Statistics revision		

Higher Year 10

2021-22

Menu

2 days	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	October Half term	October Half term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Staggered start	[17] Equations			[23] Formulae			October Half term	October Half term	[19] Surds		[37] Pythagoras	[38] RAT Trigonometry			Mock P1
Xmas Holidays	Xmas Holidays		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Easter Holidays
	[21] 3D-objects		[22] Units and measure		[24] Volume & surface area			Feb Half Term	[20+25] Probability		[27] Ratio		Mock P2	[28] Proportion	
Easter Holidays	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	May Half Term	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Summer Holidays
	[18] Functions and sequences		[29] Graphs of linear functions		[26] Inequalities		May Half Term	[15] REVISE Percentages		[40] Growth & Decay			Mock 3	[02+03] Statistics revision	

Foundation Year 11

2021-22

Menu

Easter Holidays	Xmas Holidays	Staggered start	2 days	
Mock 3	Week 1	[29] Interpreting Graphs	Week 1	
Revision	Week 2		[37] Graphs of other func'ns & equations	Week 2
	Week 3	Week 3		
	Week 4	Week 4		
	Week 5	Mock P3	Week 5	
	Week 6		Week 6	
	May Half Term	Week 6	October Half term	October Half term
Week 1	Feb Half Term	[30] Vector Geometry	Week 1	
Week 2	Revision / Just Maths		[33+34] Similarity & congruence	Week 2
Week 3		[35+36] RAT Trigonometry & Revise Pythagoras	Week 3	
Week 4			Week 4	
Week 5			Week 5	
Week 6		Week 6	WTM A	Week 6
Week 7		Week 7		Week 7
Summer Holidays	Easter Holidays			

Higher Year 11

2021-22

Menu

Easter Holidays		Xmas Holidays		Staggered start		2 days	
Mock 3	Week 1	WTM B	Week 1	[30] Interpreting Graphs		Week 1	Week 2
	Week 2		Week 2	[39] Graphs of other func'ns		Week 3	Week 4
Revision	Week 3	[31] Circles	Week 3			Mock P3	Week 5
	Week 4		[38b] Further Trigonometry	Week 4	October Half term		Week 5
	Week 5	Mock P2		Week 5		October Half term	Week 6
	Week 6		Week 6	Week 6	Week 7		
May Half Term	Week 1	Feb Half Term	Week 1	[33] Transformations in a plane	Week 1	Week 2	
Revision	Week 2	[40] Growth & Decay	Week 2	[35] Similarity	Week 3	Week 4	
	Week 3		Revision	Week 3	[36] Congruence	Week 5	
	Week 4	Revision		Week 4	[32] Vector geometry	Week 6	
	Week 5		Revision	Week 5	[34] Constructions & Loci	Week 7	
	Week 6	Revision		Week 6		WTM A	
	Week 7		Revision	Week 7			
	BUFFER	Summer Holidays		Easter Holidays	Week 7		

- Identify 3D shapes, draw their nets, find their volume (inc. cuboid, prism, composite solids)
- ~~To encompass:~~
 - ~~Rounding, significant figures and estimation~~

Carried over from year 8 temp for 2020/21 & 21/22

Suggestions for further depth:

The areas of the faces of a cuboid are 3,12 and 25 cm².

Further geometry (5b) (HA only)

Menu

- Circumference and area of a circle (may stop at this for LA students)
- Volume of cylinder, cone
- ~~To encompass:~~
 - ~~Rounding, significant figures and estimation~~

Carried over from year 8 temp for 2020/21 & 21/22

Suggestions for further depth:

Which is a better fit, a square peg in a round hole or a round peg in a square hole?

Working with integers

What your students need to know

Pupils should be confident with the items in the chapter's 'Before you start...' section. Specifically:

- The meanings of the words sum, quotient, product and difference.
- To be able to use formal and informal methods and algorithms, both mental and written, for the four operations of arithmetic.
- To understand the distributive law.
- To know that multiplication and addition are commutative.
- To know that addition and subtraction, and multiplication and division, are inverse operations.

ICCAMS

Consider LP12, LP15

Learning outcomes

Foundation

Section 1

- To identify the correct operations required and use written calculations to solve worded problems.
- To calculate with all four operations of arithmetic using positive and negative numbers.

Section 2

- To apply the hierarchy of operations to accurately work out calculations involving two or more operations.

Section 3

- To identify and write the inverses for operations and apply these to check the results of calculations and develop the skills required to solve equations.

Higher

Section 1

- To identify the correct operations required and use written calculations to solve worded problems.
- To calculate with all four operations of arithmetic using positive and negative numbers.

Section 2

- To apply the hierarchy of operations to accurately work out calculations involving two or more operations.

Section 3

- To identify and write the inverses for operations and apply these to check the results of calculations and develop the skills required to solve equations.

Vocabulary

- Integers, directed numbers

Collecting, interpreting and Representing Data

Menu

What your students need to know

- How to divide (360) by a given number and then multiply, possibly rounding the result.
- How to draw a circle using a pair of compasses.
- How to accurately measure angles.
- How to draw axes, including choosing appropriate scales.
- **(Higher only)** How to use inequality notation for class intervals.

Learning outcomes

Foundation

- To be able to infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling.
- To be able to interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use.

Higher

- To be able to infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling.
- To be able to interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data, histograms and cumulative frequency diagrams for continuous data and know their appropriate use.

Vocabulary

- Population, sample, representative sample, discrete data, categorical data, continuous data.
- **(Higher only)** Class intervals, cumulative frequency, grouped data, histogram.

Analysing Data

What your students need to know

- How to use their calculator accurately to perform calculations, especially how to divide using brackets for the dividend (numerator) or the fraction key.
- How to find the mean, median, mode and range of a set of data.
- How to plot coordinates on a set of axes.
- How to decide whether a gradient is positive or negative.
- **(Higher only)** How to construct cumulative frequency diagrams.

Additional useful prior knowledge

Inequality notation for class intervals.

Learning outcomes

Foundation

Section 1

- Calculate summary statistics from raw and grouped data.
- Compare two or more sets of data.

Section 2

- Identify why a graph may be misleading.

Section 3

- Construct scatter diagrams.
- Describe correlation.
- Draw a line of best fit.
- Identify outliers.

Higher

Section 1

- Calculate summary statistics from raw and grouped data.
- Compare two or more sets of data.
- Estimate quartiles from a cumulative frequency diagram.

Section 2

- Identify why a graph may be misleading.

Section 3

- Construct scatter diagrams.
- Describe correlation.
- Draw a line of best fit.
- Identify outliers.

Vocabulary

- Bivariate data, correlation, dependent variable, outlier.

Properties of Integers

What your students need to know

- Listing the factors and multiples of a number.
- Recognising square, cube and prime numbers.
- Expressing a number as a product of its prime factors.
- **(Higher only)** Writing a series of numbers that have been multiplied together in index form.

Learning outcomes

Foundation

Section 1

- To recall and understand key definitions.
- To consolidate understanding of basic place value.

Section 2

- To apply their knowledge of factors and primes to express a number as a product of its prime factors.
- To simplify a collection of numbers that have been multiplied together by writing them in index form.

Section 3

- To use the 'listing method' to find the highest common factor and lowest common multiple of a set of numbers.
- To use a prime factor tree to find the highest common factor and lowest common multiple of a set of numbers.

Higher

Section 1

- To recall and understand key definitions.
- To consolidate their understanding of basic place value.

Section 2

- To apply their knowledge of factors and primes to express a number as a product of its prime factors.
- To simplify a collection of numbers that have been multiplied together by writing them in index form.

Section 3

- To use the 'listing method' to find the highest common factor and lowest common multiple of a set of numbers.
- To use a prime factor tree to find the highest common factor and lowest common multiple of a set of numbers.

Vocabulary

- Consecutive, prime factor, whole number

Working with fractions

Menu

What your students need to know

- The meanings of the words: denominator, numerator, common denominator, multiple, factor, equivalent and reciprocal.
- To be able to use formal and informal methods, and algorithms, both mental and written, for the four operations.
- To be able to find the LCM and HCF of a set of numbers.
- To know and be able to apply the laws of operations (BIDMAS).
- To know that 'of' refers to the operation 'multiply'.

ICCAMS
Consider 9

Learning outcomes

Foundation

Section 1

- To apply knowledge of factors and multiples to simplify fractions and identify equivalent fractions.

Section 2

- To apply the four operations to fractions
- To apply knowledge of completing the four operations with fractions to solve problems.

Section 3

- To calculate fractions of amounts
- To express one number as a fraction of another.

Higher

Section 1

- To apply knowledge of factors and multiples to simplify fractions and identify equivalent fractions.
- To apply and explain an algorithm to find the median fraction.

Section 2

- To apply the four operations to fractions .
- To apply knowledge of completing the four operations with fractions to solve problems.

Section 3

- To calculate fractions of amounts.
- To express one number as a fraction of another.

Vocabulary

- Common denominator, numerator, reciprocal.

Working with decimals

What your students need to know

- A concrete understanding of place value.
- How to multiply and divide by powers of 10.
- How to compare decimals and arrange them in order of size.
- The fractional equivalents of common decimals.
- How to use formal or informal methods to divide numbers that lead to decimals.
- How to round numbers to various significant figures or decimal places.

Additional useful prior knowledge

- How to compare and order integers.
- How to complete the four rules with integers.
- Be able to work confidently with place value.
- Know the fractional equivalents of some decimals.

Learning outcomes

Foundation

Section 1

- To apply knowledge of place value to convert decimals to fractions and order fractions.

Section 2

- To apply knowledge of rounding to estimate calculations that involve decimals.
- To be able to add, subtract multiply and divide decimals.
- To use a calculator to complete more complicated calculations that involve decimals.

Higher

Section 1

- To apply knowledge of place value to convert decimals to fractions and order fractions.

Section 2

- To be able to add, subtract multiply and divide decimals.
- To use a calculator to complete more complicated calculations that involve decimals.
- To be able to add, subtract, multiply and divide decimals without using a calculator.

Section 3

- To convert recurring decimals to fractions.

Basic Algebra

What your students need to know

- How to add, subtract, multiply and divide directed numbers.
- What a power is and does, for example squaring and cubing.
- **(Higher only)** Laws of indices.
- **(Higher only)** Addition, subtraction, multiplication and division of fraction...

Learning outcomes

Foundation

Section 1

- Interpret and work with algebraic notation including an understanding of correct, formal language and notation.
- Form algebraic expressions from worded instructions and geometric problems.
- Substitute to evaluate algebraic expressions for a given value.

Section 2

- Simplify algebraic expressions by collecting like terms.
- Simplify products and quotients.

Section 3

- Expand the product of a single term and binomial.

Section 4

- Factorise out common factors and recognise that the HCF must be factored out for an expression to be fully factorised.

Section 5

- Form expressions from word problems and use algebra to solve problems in different contexts including number problems.

Vocabulary

- Variable, expression, term, expanding

Additional useful prior knowledge

- How the laws of commutativity, associativity and distributivity apply to numerical operations, for example that addition is commutative but that subtraction isn't so whilst $3 + 5 = 5 + 3$ the same does not hold for subtraction. The language of these laws is used in the chapter and whilst it would be beneficial for students to know the formal language of these laws, understanding what they mean for each operation will be enough for foundation students.

Higher

Section 1

- Interpret and work with algebraic notation including an understanding of correct, formal language and notation.
- Simplify products and quotients and apply the index laws to simplify.
- Form algebraic expressions from worded instructions and geometric problems.

Section 2

- Simplify algebraic expressions by collecting like terms.
- Simplify products and quotients.

Section 3

- Expand the product of a single term and binomial.

Section 4

- Factorise out common factors and recognise that the HCF must be factored out for an expression to be fully factorised.

Section 5

- Form expressions from word problems and use algebra to solve problems in different contexts including number problems.

ICCAMS

Consider

LP4,

LP3 and LP13 (harder version of LP3 with substitution),

LP12,

LP14,

Lesson 19A,

Lesson 21A

(extension of 4B)

Properties of Polygons and 3D objects

What your students need to know

- Use correct geometrical terms to talk about lines, angles and shapes.
- How to identify 2D and 3D objects.
- Be able to describe the symmetrical properties of various polygons.
- Be able to classify and identify triangles and quadrilaterals.

Learning outcomes

Foundation

Section 1

- Know the names and features of common polygons and polyhedra.
- Know how to describe and label common features (congruent, parallel, etc.) of plane figures.

Section 2

- Identify and describe line and rotational symmetry in plane figures.

Section 3

- Know and use properties of triangles, including their interior angle sum.

Section 4

- Know and use properties of quadrilaterals, including their interior angle sum.

Section 5

- Know and use properties of 3D solids.

Higher

Section 1

- Know the names and features of common polygons and polyhedra.
- Know how to describe and label common features (congruent, parallel, etc.) of plane figures.

Section 2

- Identify and describe line and rotational symmetry in plane figures.

Section 3

- Know and use properties of triangles, including their interior angle sum.

Section 4

- Know and use properties of quadrilaterals, including their interior angle sum.

Section 5

- Know and use properties of 3D solids.

Vocabulary

- Plane shape, polygon, regular polygon, irregular polygon, polyhedron, reflection, line of symmetry, rotational symmetry, adjacent, bisect, congruent, equidistant

What your students need to know

- The sum of the interior angles in a triangle.
- Notation conventions for labelling angles and lines; including naming a line, for example DE, and an angle, for example $\angle FED$.
- Properties of shapes.
- Ability to use basic arithmetic to find complements to 180 and 360 degrees.
- **(Foundation only)** How to form and solve linear equations with the unknown on one side of the equation.
- **(Higher only)** How to form and solve linear equations where the unknown is on both sides of the equation.

Additional useful prior knowledge

- How to measure an angle using a protractor.
- What a variable is and how it can be used to form a formula.

For Both Tiers
Extend to Pythagoras

For Higher Tier
Extend to problems
involving SOCAHTOA

Learning outcomes

Foundation

Section 1

- Recall knowledge of basic angle facts including: vertically opposite angles, angles on a line and around a point.
- Application of basic and parallel angle facts to find the size of angles in various scenarios.

Section 2

- Recall knowledge of parallel line angle facts including: alternate angles, co-interior angles and corresponding angles.
- Application of basic and parallel angle facts to find the size of angles in various scenarios.

Section 3

- Understand a proof for the sum of the interior angles of a triangle being 180 degrees.
- Understand a proof for the exterior angle of a triangle being equal to the sum of the opposite interior angles.

Section 4

- Calculate the sum of the interior angles of any polygon.
- Calculate the size of a single interior angle of a regular polygon.
- Calculate the size of a single exterior angle of a regular polygon.

Higher

Section 1

- Recall knowledge of basic angle facts including: vertically opposite angles, angles on a line and around a point.
- Application of basic and parallel angle facts to find the size of angles in various scenarios.

Section 2

- Recall knowledge of parallel line angle facts including: alternate angles, co-interior angles and corresponding angles.
- Application of basic and parallel angle facts to find the size of angles in various scenarios.

Section 3

- Understand a proof for the sum of the interior angles of a triangle being 180 degrees.
- Understand a proof for the exterior angle of a triangle being equal to the sum of the opposite interior angles.

Section 4

- Calculate the sum of the interior angles of any polygon.
- Calculate the size of a single interior angle of a regular polygon.
- Calculate the size of a single exterior angle of a regular polygon.

Perimeter

Menu

What your students need to know

- Properties of shapes.
- Properties and labels associated with circles.
- How to convert metric units.
- How to form algebraic expressions and formulae from geometric problems.
- How to change the subject of a formula.
- Simplifying by collecting like terms.
- Angles around a point sum to 360 degrees.
- How to round to a given or appropriate accuracy.

Additional useful prior knowledge

- Using formula for average speed.
- Simplifying and expanding single brackets.
- **(Higher)** Knowledge of averages and compound percentages.

Learning outcomes

Foundation and Higher

Section 1

- Calculate the perimeter of a given simple shape, including using properties of triangles, quadrilaterals and regular polygons.
- Understand that the perimeter of a shape is its boundary and what a boundary is for a composite shape where a smaller shape has been removed from the centre of a larger shape.
- Calculate the perimeter of composite shapes.
- Form expressions and equations for the perimeter of a given shape and solve their equations to find unknown lengths.

Section 2

- Know and use a formula (either $C = \pi D$ or $C = 2\pi r$) for the circumference of a circle to find the value of one variable given any other, for example D given C.
- How find the arc length of a given sector and hence the perimeter of this shape.

Section 3

- Use known perimeter formulae from section 1 and 2 to solve contextual problems.

Vocabulary

- Perimeter

For Both Tiers
Extend to Pythagoras

For Higher Tier
Extend to problems
involving SOCAHTOA

Area

What your students need to know

- Properties and definitions of polygons, particularly triangles and quadrilaterals.
- Properties of circles.
- Convert metric units of length.
- Convert metric units of area.
- Substitute into algebraic formulae and expressions.
- Solve linear and quadratic equations formed from area formulae to calculate the value of the unknown (and recognise that where lengths of shapes are involved the value of the unknown must be positive).
- **(Higher only)** Simplify algebraic expressions including expanding the products of binomials and cancelling common factors in fractions.
- **(Higher only)** Knowledge and use of Pythagoras' theorem to find the length of the hypotenuse.

Additional useful prior knowledge

- Know that finding the square root gives the initial value that had been squared.
- Rearrange a formula to change the subject (some students prefer this option to substitution followed by solving, particularly where there is a repetition in the calculation).
- Know that multiplication is commutative and hence products can be calculated in any order (area of a triangle) but that laws of distributivity must be held and hence the sum of the two parallel sides must be found first when calculating the area of a trapezium.
- Appreciate that dividing by a value is the same as multiplying by the reciprocal of the value for example multiplying by a half is equal to dividing by 2.
- Calculate fractions of amounts.
- How to calculate the perimeter of a shape.
- Know and use formula for circumference of a circle.

Learning outcomes

Foundation Section 1

- Know and use the formulae for calculating the area of rectangles, triangles, parallelograms and trapeziums.
- Identify how composite shapes have been formed using these four shapes and use the formulae to calculate the total area of the composite shape.

Section 2

- Know and use the formula for calculating the area of a circle.
- Adapt this formula to find the area of a sector given the angle formed at the centre between the radii using fractions of the whole.

Section 3

- Split composite shapes into the sum of known shapes from sections 1 and 2.
- Recognise that the area of some composite shapes can be found by subtracting known areas from a larger shape.

ICCAMS Consider LP2

Higher Section 1

- Know and use the formulae for calculating the area of rectangles, triangles, parallelograms and trapeziums.
- Identify how composite shapes have been formed using these four shapes and use the formulae to calculate the total area of the composite shape.
- Form algebraic expressions for the area of a shape given expressions for lengths of the shape.

Section 2

- Know and use the formula for calculating the area of a circle.
- Adapt this formula to find the area of a sector given the angle formed at the centre between the radii using fractions of the whole.

Section 3

- Split composite shapes into the sum of known shapes from sections 1 and 2.
- Recognise that the area of some composite shapes can be found by subtracting known areas from a larger shape.

For Both Tiers
Extend to Pythagoras

For Higher Tier
Extend to problems
involving SOCAHTOA

Rounding and estimation

What your students need to know

- Have a strong understanding of place value.
- Be confident with using decimals, particularly involving division.
- Be able to make estimates for calculations to decide if a solution is reasonable.
- To have an understanding of inequality notation (in order to help understanding of bounds).

Learning outcomes

Foundation

Section 1

- To be able to round to the nearest positive integer power of ten and apply this to some real-life examples.
- To round values to a specified number of decimal places.
- To round values to a specified number of significant figures.
- To truncate values and understand when this is useful to apply in context.

Section 2

- To apply the ability to round to one significant figure in order to estimate answers to more complex calculations without using a calculator.

Section 3

- To use inequalities and identify the lower and upper bounds for measurements and use these within calculations to find maximum and minimum solutions.

Higher

Section 1

- To be able to round to the nearest positive integer power of ten and apply this to some real-life examples.
- To round values to a specified number of decimal places.
- To round values to a specified number of significant figures.
- To truncate values and understand when this is useful in context.

Section 2

- To apply the ability to round to one significant figure in order to estimate answers to more complex calculations without using a calculator.

Section 3

- To use inequalities and identify the lower and upper bounds for measurements and use these within calculations to find maximum and minimum solutions.
- Calculate the upper and lower bounds of a calculation (for discrete and continuous quantities).

Vocabulary

- Rounding, degree of accuracy, significant figure, round to significant figures, truncation, estimate, lower bound, upper bound, error interval
- **(Higher only)** discrete values, continuous values, supplementary angles

Percentages

What your students need to know

- How to multiply and divide by powers of 10.
- How to express a fraction in its simplest form.
- How to express a percentage as a decimal.

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Consider LP16

Learning outcomes

Foundation

Section 1

- To be able to convert between fractions, decimals and percentages.

Section 2

- To use fractions, multipliers or calculators to calculate percentages of amounts.
- To be able to express a quantity as a percentage of another.

Section 3

- To calculate percentage increase or decrease.
- To calculate the original amount given an increase or decrease.

Higher

Section 1

- To be able to convert between fractions, decimals and percentages.

Section 2

- To use fractions, multipliers or calculators to calculate percentages of amounts.
- To be able to express a quantity as a percentage of another.

Section 3

- To calculate the original amount given an increase or decrease.
- To calculate percentage increase or decrease.

Powers and roots

What your students need to know

- How to add and subtract integers mentally.
- How to find the squares, square roots, cubes and cube roots of numbers.
- How to find the reciprocal of a number.
- How to use the power, root and reciprocal buttons on a calculator.
- The difference between the words 'evaluate' and 'simplify'.

Learning outcomes

Foundation

Section 1

- To write a series of numbers multiplied together in index form.
- To write an exponent on a calculator.
- To understand zero and negative indices.

Section 2

- To apply the laws of indices for multiplying and dividing, and for powers of indices.

Section 3

- To calculate roots of a number fraction.
- To solve problems involving powers and roots.

Higher

Section 1

- To write a series of numbers multiplied together in index form.
- To write an exponent on a calculator.
- To understand zero and negative indices.

Section 2

- To work with fractional indices and understand the link to surds.
- To apply the laws of indices for multiplying and dividing, and for powers of indices.

Section 3

- To estimate powers and roots of a number.
- To solve problems involving powers and roots.

Vocabulary

- Index, index notation

Standard Form

What your students need to know

- How to multiply and divide by powers of ten, applying their understanding of place value.
- How to use the four arithmetic operations to calculate efficiently with decimals.
- How to round to a given number of significant figures.
- That multiplication and division are commutative.
- How to use the Index laws when multiplying and dividing.

Learning outcomes

Foundation

Section 1

- To apply understanding of multiplying and dividing by powers of ten to convert numbers to and from standard form.

Section 2

- To use a scientific calculator efficiently for standard form calculations.

Section 3

- To apply the laws of Indices to multiply and divide numbers in standard form without the use of a calculator.
- To apply understanding of place value, and previously learned conversion between standard form and ordinary numbers, to add and subtract numbers in standard form.

Higher

Section 1

- To apply understanding of multiplying and dividing by powers of ten to convert numbers to and from standard form.

Section 2

- To use a scientific calculator efficiently for standard form calculations.

Section 3

- To apply the Laws of Indices to multiply and divide numbers in standard form without the use of a calculator.
- To apply understanding of place value, and previously learned conversion between standard form and ordinary numbers, to add and subtract numbers in standard form.
- To solve problems, including contextualised ones, involving standard form.

Vocabulary

- Place value, Indices, standard form

What your students need to know

- How to simplify expressions by collecting like terms including those with different powers.
- How to simplify products of expressions.
- **(Higher only)** How to find the HCF of one or more expressions.
- **(Higher only)** How to simplify fractions by cancelling common factors.

Additional useful prior knowledge

- Area formulae.
- **(Higher only)** Volume formulae.
- Pythagoras' theorem.

Learning outcomes

Foundation

Section 1

- Know what a quadratic expression is.
- Expand the product of two binomials.

Section 2

- Factorise expressions in the form $x^2 + bx + c$.

Section 3

- Form algebraic expressions to solve problems.

Higher

Section 1

- Know what a quadratic expression is.
- Expand the product of two binomials.

Section 2

- Factorise expressions in the form $ax^2 + bx + c$.

Section 3

- Simplify and manipulate algebraic fractions.

Section 4

- Form algebraic expressions to solve problems.

Vocabulary

- Binomial, binomial product, quadratic expression, trinomial, perfect square, coefficient, constant.

Equations

What your students need to know

- Use variables correctly to form algebraic expressions.
- **(Foundation only)** How to factorise quadratics in the form: $x^2 + bx + c$.
- **(Higher only)** How to factorise quadratics in the form: $ax^2 + bx + c$.
- **(Higher only)** How to simplify fractions by cancelling common factors.
- Inverse operations.
- How to graph linear functions.
- How to graph quadratic functions.

Foundation students will not have done expanding or factorising double brackets [further algebra Ch16]

ICCAMS

Consider LP18 and Lesson 21B

Additional useful prior knowledge

- Angle facts including sums of angles in polygons.
- Properties of shapes.
- Area and perimeter formulae.
- Speed, distance, time formulae.

Learning outcomes

Foundation

- Ability to form equations from a variety of problems including geometric scenarios.

Section 1

- Solve linear equations.
- Understand identities are equations in which there are infinite solutions as they are true for all values x can take.

Section 2

- Form and solve quadratic equations.
- Understand that different types of equations have a different possible number of solutions.

Section 3

- Solve linear simultaneous equations.

Section 4

- How to read and interpret graphs in various contexts.
- How to use graphs to approximate solutions.

Higher

- Ability to form equations from a variety of problems including geometric scenarios.

Section 1

- Solve linear equations.
- Understand identities are equations in which there are infinite solutions as they are true for all values x can take.

Section 2

- Form and solve quadratic equations.
- Understand that different types of equations have a different possible number of solutions.

Section 3

- Solve linear simultaneous equations.
- Solve linear and quadratic simultaneous equations.

Section 4

- How to read and interpret graphs in various contexts.
- How to use graphs to approximate solutions.

Section 5

- Use iterative methods to approximate solutions.

Section 6

- Using equations and graphs to solve problems.

Functions and sequences

Menu

What your students need to know

- Recall of multiplication tables
- Recognition of square and cube numbers
- An ability to spot numerical patterns
- An ability to substitute into formulae, particularly with negative numbers

Learning outcomes

Foundation

Section 1

- To generate terms of a sequence from a term-to-term rule.

Section 2

- To generate terms of a sequence from a position-to-term rule and find the n th term of linear sequences.

Section 3

- To generate terms of a sequence from a function.

Section 4

- To identify special sequences.

Higher

Section 1

- To generate terms of a sequence from a term-to-term rule.

Section 2

- To generate terms of a sequence from a position-to-term rule and find the n th term of linear sequences.

Section 3

- To generate terms of a sequence from a function.

Section 4

- To identify special sequences.
- To find the n th term of quadratic sequences.

Vocabulary

- Sequence, term, consecutive terms, first difference, term-to-term rule, arithmetic sequence, geometric sequence, position-to-term rule, function

(Higher only) Composite function, inverse function

And...



Buffer Week 1

- This week could be used for the following;
- WTM for targeted students
- Revise Pythagoras

Basic Probability

Menu

What your students need to know

- How to calculate confidently with fractions, decimals and percentages.
- How to convert between fractions, decimals and percentages.

Learning outcomes

Foundation

Section 1

- Understand and use the vocabulary of probability.
- Express probabilities as a number between 0 (impossible) and 1 (certain), either as a decimal, fraction or percentage.

Section 2

- Understand that outcomes are equally likely if there is the same chance of each outcome occurring.
- Calculate the theoretical probability of a desired outcome.
- Calculate the probability of an event **not** happening.

Section 3

- Relate relative frequency to theoretical probability.
- Represent and analyse outcomes of probability experiments.
- Use tables and frequency trees to organise outcomes.

Section 4

- Calculate probabilities in different contexts.

Higher

Section 1

- Understand and use the vocabulary of probability.
- Express probabilities as a number between 0 (impossible) and 1 (certain), either as a decimal, fraction or percentage.
- Relate relative frequency to theoretical probability.
- Represent and analyse outcomes of probability experiments.

Section 2

- Calculate the probability of an event **not** happening.
- Understand that the probabilities of mutually exclusive events sum to 1.
- Use tables and frequency trees to organise outcomes, understanding that a frequency tree is not the same as a probability tree.

Section 3

- Calculate probabilities in different contexts.

And Further Probability chapter at the same time

Vocabulary

- Event, outcome, equally likely, random, mutually exclusive.

Further Probability

What your students need to know

- How to carry out the basic operations on fractions and decimals.
- Methods of multiplication, including larger numbers.
- Basic probability.

Additional prior knowledge

- Terminology of probability, especially events, outcomes, etc.

Learning outcomes

Foundation

Section 1

- Construct and use representations (tables, tree diagrams and Venn diagrams).
- Use the language and notation of basic set theory.

Section 2

- Use the addition rule, including an understanding of mutually exclusive events.
- Use the multiplication rule, including an understanding of independent events.

Higher

Section 1

- Construct and use representations (tables, tree diagrams and Venn diagrams).
- Use the language and notation of basic set theory.

Section 2

- Calculate numbers of possible outcomes using the product rule for counting.
- Use the addition rule, including an understanding of mutually exclusive events.
- Use the multiplication rule, including an understanding of independent events.

Section 3

- Use methods of conditional probability, including questions phrased in the form 'given that'.

Vocabulary

- Combined events, sample space, independent events, dependent events.

3D Objects

What your students need to know

- How to identify common 3D objects.
- Basic properties of polygons and common 3D objects.
- How to accurately construct lines and angles using ruler and compasses.

Additional useful prior knowledge

- Know how to calculate interior angles in polygons.

Learning outcomes

Foundation

Section 1

- Apply what you already know about the properties of 3D objects.

Section 1 and 2

- Work with 2D representations of 3D objects.

Section 3

- Construct and interpret plans and elevations of 3D objects.

Higher

Section 1

- Apply what you already know about the properties of 3D objects.

Section 1 and 2

- Work with 2D representations of 3D objects.

Section 3

- Construct and interpret plans and elevations of 3D objects.

Vocabulary

- Isometric grid, plan view, elevation view.

Units and measure

What your students need to know

- How to multiply and divide by powers of 10.
- Index notation, for example, $10^2 = 10 \times 10$.
- **(Higher only)** How to use inequalities appropriately in mathematical statements.
- How to find the volume of a cuboid.
- How to measure accurately using a ruler and protractor.

Learning outcomes

Foundation

Section 1

- Convert metric units for capacity, mass and length.
- Convert metric units of area and volume.
- Understand units of time are not metric.
- Convert units of time and use to solve related problems.
- Convert currencies using scale factors.

Section 2

- Convert compound measurements.
- Use formulae: $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$, $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$ and $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$ to find any one of the variables given values for the other two.

Section 3

- Read and use scales on maps including both line/bar scales and ratio scales.
- Form their own scales to construct their own scale drawings to fit a given dimension.
- Read and use bearings in scale drawings.

Additional useful prior knowledge

- Non-calculator methods for multiplying decimals.
- Calculations involving related sums.
- Knowledge of rounding to 1 or 2 significant figures.
- Rounding to estimate solutions to problems.
- Work with equivalent fractions including cancelling to simplest form.

Higher

Section 1

- Convert metric units for capacity, mass and length.
- Convert metric units of area and volume.
- Understand units of time are not metric.
- Convert units of time and use to solve related problems.
- Convert currencies using scale factors.

Section 2

- Convert compound measurements.
- Use formulae: $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$, $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$ and $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$ to find any one of the variables given values for the other two.

Section 3

- Read and use scales on maps including both line/bar scales and ratio scales.
- Form their own scales to construct their own scale drawings to fit a given dimension.
- Read and use bearings in scale drawings.
- Understand the connection between a bearing of B from A and A from B on a given line segment.

ICCAMS

Consider LP6 and LP7

ICCAMS

Consider LP13, LP19 and Lesson 21A

Use of SUVAT equations

Formulae

What your students need to know

- The order in which mathematical operations are processed, i.e. BIDMAS.
- Common formulae used in mathematics and science, for example $A = \frac{1}{2} \text{ base} \times \text{perpendicular height}$.
- The meaning of an unknown, variable and constant.
- The difference between an expression and an equation.
- Fluency in algebraic manipulation: simplifying, substitution, expanding, factorising and solving.
- Know what a 'coefficient' is.

Additional useful prior knowledge

- Number work including operating with negative number, rounding and working with fractions.
- Calculator skills. For example, the use of extra brackets in calculations to force your calculator to do the correct calculations.
- **(Higher only)** Formulae relating to physical events, for example, the equations of motion.
- Substitution into trigonometric functions.

Learning outcomes

Foundation

Section 1

- To be able to write formulae to represent real life contexts.

Section 2

- To be able to substitute numerical values into formulae.
- To be able to use formulae from the topic of kinematics.

Section 3

- To be able to rearrange formulae to change the subject.

Section 4

- To be able to work with formulae in a variety of contexts.

Higher

Section 1

- To be able to write formulae to represent real life contexts.

Section 2

- To be able to substitute numerical values into formulae.
- To be able to use formulae from the topic of kinematics.

Section 3

- To be able to rearrange formulae to change the subject.

Section 4

- To be able to work with formulae in a variety of contexts.

Vocabulary

- Formula, subject, substitute, evaluate.

Buffer Week 2

- This week could be used for the following;
- WTM for targeted students
- Redo Basic Trigonometry

Volume and surface area

What your students need to know

- How to identify 3D objects from a description.
- How to calculate area and perimeter of 2D shapes.
- The definition and properties of 2D and 3D shapes.
- Application of Pythagoras' theorem to calculate unknown lengths in right-angled triangles.

Additional prior knowledge

- Understand what it means for two shapes to be congruent.
- Units of measurement and metric conversions for lengths, area and volumes.
- How to form and solve equations with an unknown from a given text.
- How to use mathematical formulae; either to substitute first and solve for an unknown or to rearrange to change the subject then substitute to calculate the value of the unknown.

Learning outcomes

Foundation

Section 1

- How to calculate the volume of prisms (including cylinders).
- How to calculate the surface area of prisms (including cylinders).

Section 2

- How to calculate the volume and surface area of a cone.
- How to calculate the volume and surface area of a sphere.
- How to calculate the volume and surface area of composite 3D shapes.

Section 3

- How to find the volume and surface area of a pyramid.

Higher

Section 1

- How to calculate the volume of prisms (including cylinders).
- How to calculate the surface area of prisms (including cylinders).

Section 2

- How to calculate the volume and surface area of a cone.
- How to calculate the volume and surface area of a sphere.
- How to calculate the volume and surface area of composite 3D shapes.

Section 3

- How to find the volume and surface area of a pyramid.

Vocabulary

- Right prism

Inequalities

What your students need to know

- How to solve linear equations.
- **(Foundation only)** How to rank numbers in ascending or descending order.
- **(Foundation only)** How to use the rules for operations with negative numbers.
- **(Higher only)** How to solve quadratic equations.
- **(Higher only)** How to use linear graphs.

Additional prior knowledge

- **(Higher only)** How to factorise quadratic equations allowing quick sketches to be drawn.

Learning outcomes

Foundation

Section 1

- Understanding and interpreting inequalities and using the correct symbols to express inequalities.

Section 2

- Using a number line to represent an inequality.

Section 3

- Solving linear inequalities in one variable and representing the solution set on a number line.

Section 4

- Solving problems involving inequalities.

Higher

Section 1

- Using the correct symbols to express inequalities.

Section 2

- Using a number line and set notation to represent an inequality.

Section 3

- Solving linear inequalities in one variable and representing the solution set on a number line and in set notation.

Section 4

- Solving quadratic inequalities.

Section 5

- Solving (several) linear inequalities in two variables, representing the solution set on a graph.

Vocabulary

- Inequality, number line
- **(Higher only)** Set, equalities

What your students need to know

- How to divide quantities using efficient methods.
- That multiplication is a more efficient form of repeated addition.
- The multiplication tables and how to apply them.
- How to write one amount as a fraction of another.
- How to identify highest common factors.
- That multiplication is commutative.

ICCAMS

Consider LP6, LP7, LP8, Lesson 10B, LP11 and LP17

Learning outcomes

Foundation

Section 1

- To use ratio notation to write ratios for diagrams and word statements and to simplify ratios.

Section 2

- To divide a quantity into two or more parts given a specified ratio and to specify the division of quantities into parts as a ratio.

Section 3

- To use a unitary method to solve ratio and proportion problems and relate ratios to fractions and linear functions in order to solve problems, including real-life ones such as conversions and scaling.

Higher

Section 1

- To use ratio notation to write ratios for diagrams and word statements and to simplify ratios.

Section 2

- To divide a quantity into two or more parts given a specified ratio and to specify the division of quantities into parts as a ratio.

Section 3

- To use a unitary method to solve ratio and proportion problems and relate ratios to fractions and linear functions in order to solve problems, including real-life ones such as conversions and scaling.

Vocabulary

- Ratio, proportion, equivalent

Proportion

What your students need to know

- How to work with numbers including extensive fractions work.
- How to write ratios and interpret them.
- How many minutes there are in fractions of an hour.
- How to perform a substitution into a formula.
- What a reciprocal is.
- **(Higher only)** How to square and square root numbers.

Learning outcomes

Foundation

Section 1

- To be able to use direct proportion to solve problems.
- To be able to use the unitary method to solve proportion problems.

Section 2

- To be able to solve direct proportion questions graphically.
- To be able to solve direct proportion questions using algebraic manipulation.

Section 3

- To be able to solve inverse proportion questions, based on $y = \frac{1}{x}$.

Vocabulary

- Ratio, direct proportion, mathematical model, inverse proportion.

Additional prior knowledge

- How money works and different currencies.
- Clear understanding of speed, distance and time.
- Highest common factor and lowest common multiple.

ICCAMS

Consider LP6, LP7, LP8, Lesson 10B, LP11 and LP17

Higher

Section 1

- To be able to use direct proportion to solve problems.
- To be able to use the unitary method to solve proportion problems.

Section 2

- To be able to solve direct proportion questions graphically.
- To be able to solve direct proportion questions using algebraic manipulation.

Section 3

- To be able to solve direct proportion problems involving the square or square root of a variable.

Section 4

- To be able to solve inverse proportion questions, based on $y = \frac{1}{x}$.

Graphs of linear functions

Menu

What your students need to know

- How to generate terms in a sequence from a given rule.
- How to identify coordinates of a given point.
- How to manipulate and solve equations.
- How to change the subject of a formula.

Learning outcomes

Foundation

Section 1

- Use a table of values to plot graphs of linear functions.

Section 2

- Identify the main features of straight-line graphs and use them to sketch graphs.
- Sketch graphs from linear equations in the form of $y = mx + c$.
- Find the equation of a straight line using gradient and points on the line.

Section 3

- Identify lines that are parallel by considering their equations.
- Find the equation of a line parallel to a given line (perhaps passing through a known point).

Section 4

- Solve problems involving straight-line graphs.

Vocabulary

- Function, coordinates, gradient, y-intercept, x-intercept, coefficient, constant.
- **(Higher only)** Reciprocal, tangent.

Additional prior knowledge

- How to substitute values into a formula.
- How to plot points on a coordinate grid.

Higher

Section 1

- Use a table of values to plot graphs of linear functions.

Section 2

- Identify the main features of straight-line graphs and use them to sketch graphs.
- Sketch graphs from linear equations in the form of $y = mx + c$.
- Find the equation of a straight line using gradient and points on the line.

Section 3

- find the equation of a tangent that touches a circle centred on the origin.

Section 4

- Solve problems involving straight-line graphs.

ICCAMS

Consider LP5,
Lesson 18B and
Lesson 21A

Interpreting graphs

Menu

What your students need to know

- How to distinguish between direct and inverse proportion.
- How to calculate the gradient of a straight line.
- How to calculate the area of composite shapes.

ICCAMS

Consider LP3 (easy) and LP13

Additional prior knowledge

- $\text{Speed} = \frac{\text{distance}}{\text{time}}$.
- $\text{Acceleration} = \frac{\text{speed}}{\text{time}}$.

Learning outcomes

Foundation

Section 1

- Constructing and interpreting graphs in real-world contexts.

Section 2

- Interpreting the gradient of a straight-line graph as a rate of change.

Higher

Section 1

- Constructing and interpreting graphs in real-world contexts.

Section 2

- Interpreting the gradient of a straight-line graph as a rate of change.
- Finding and interpreting the gradient at a point on a curve as the instantaneous rate of change.

Section 3

- Calculating and interpreting the area under a graph.

Vector geometry

Menu

What your students need to know

- Basic arithmetic skills including addition, subtraction, multiplication and division (for finding fractions of amounts) of both positive and negative numbers.
- How to plot coordinates in all four quadrants, understanding that the x- and y- coordinates are distances in horizontal and vertical directions from the origin.
- Basic ratio including connections to proportion e.g. 2:3 is $\frac{2}{5}$ and $\frac{3}{5}$ of the whole.
- How to solve simple linear equations.
- How to solve simultaneous linear equations.

Additional useful prior knowledge

- What the laws of associativity, commutativity and distributivity are and how they apply to basic arithmetic operations.
- Form and solve simultaneous equations.
- How to use Pythagoras' Theorem to find the length of a line segment in 2D.
- How to use the Tangent function to find angles in right-angled triangles.
- **(Higher only)** What a Mathematical proof is.

Learning outcomes

Foundation

Section 1

- Represent vectors as a diagram or column vector.

Section 2

- Apply add and subtract vectors.
- Multiply vectors by a scalar.
- Recognise parallel vectors.

Higher

Section 1

- Represent vectors as a diagram or column vector.

Section 2

- Apply add and subtract vectors.
- Multiply vectors by a scalar.
- Recognise parallel vectors.

Section 3

- Use vectors to construct geometric arguments and proofs.

Transformations in a plane

What your students need to know

- What angles of 90, 180 and 270 degrees look like.
- Which way a clockwise and which way an anti-clockwise movement goes.
- How to fluently use the (x, y) coordinates on the 2D plane.
- How to plot straight lines of the form $x = c$, $y = c$ and $y = x$ (where c is any number).
- What a column vector is (i.e. that it describes movement in the x and y directions).

Additional prior knowledge

- Basic number skills for translations.
- The names of polygons, their definitions and properties.

Learning outcomes

Foundation

Section 1

- Carry out, identify and describe reflections.

Section 2

- Carry out, identify and describe translations using 2D vectors.

Section 3

- Carry out, identify and describe rotations.

Higher

Section 1

- Carry out, identify and describe reflections.

Section 2

- Carry out, identify and describe translations using 2D vectors.
- Find the centre of rotation by construction.

Section 3

- Carry out, identify and describe rotations.

Section 4

- Carry out, identify and describe combined transformations.

Vocabulary

- Object, image, congruent, mirror line, perpendicular bisector, orientation.

Constructions and Loci

Menu

What your students need to know

- Properties of angles.
- Properties of shapes and associated language, including circles.
- Read and write angles and lines using formal notation conventions.
- Measure and construct angles using a protractor.
- Notation conventions including: \perp for 'perpendicular to' and \parallel for 'parallel to'.
- Knowledge of basic ratio and scale.

Additional prior knowledge

- Use knowledge of complements of angles around a point to accurately construct reflex angles using a 180° protractor.
- Convert metric units of length.

Learning outcomes

Foundation

Section 1

- Use ruler, protractor and pair of compasses to accurately construct angles and shapes.
- Accurately copy diagrams using rulers and a pair of compasses only.

Section 2

- Construct the perpendicular bisector of a line.
- Construct the perpendicular at a given point on a line.
- Construct a perpendicular from a given point to a line.
- Bisect an angle.

Section 3

- Use constructions to solve loci problems.

Section 4

- Apply appropriate constructions and loci knowledge to a variety of problems including those with a context.

Higher

Section 1

- Use ruler, protractor and pair of compasses to accurately construct angles and shapes.
- Accurately copy diagrams using rulers and a pair of compasses only.

Section 2

- Construct the perpendicular bisector of a line.
- Construct the perpendicular at a given point on a line.
- Construct a perpendicular from a given point to a line.
- Bisect an angle.

Section 3

- Use constructions to solve loci problems.

Section 4

- Apply appropriate constructions and loci knowledge to a variety of problems including those with a context.

Similarity

Menu

What your students need to know

- How to label angles correctly.
- What the symbols corresponding to parallel, perpendicular and equality look like on a diagram.
- How to prove that two triangles are congruent.
- How to solve simple linear equations.
- How to recognise numbers in equivalent ratios.
- **(Higher only)** How to calculate squares and cubes of rational numbers.

Learning outcomes

Foundation

Section 1

- To know what is meant by the phrase 'mathematically similar'.
- To be able to determine when two objects are mathematically similar.

Section 2

- To know what is meant by a 'mathematical enlargement'.
- To be able to enlarge a shape given a positive rational scale factor.
- To know what the centre of enlargement is.
- To be able to enlarge a shape given a scale factor and centre of enlargement.
- To determine a given centre of enlargement and scale factor from a diagram.

Section 3

- To be able to determine similar polygons.

Teach congruence at the same time
(see next slide)

Additional prior knowledge

- How to work with ratio and proportion.
- Using coordinates to define an object in the plane.
- Definitions of the types of triangles and quadrilaterals.
- Multiplication and division by rational numbers.
- **(Higher only)** Calculating area and volume of 2D and 3D shapes.
- **(Higher only)** The dimensions that are needed for area and volume.

Higher

Section 1

- To know what is meant by the phrase 'mathematically similar'.
- To be able to determine when two objects are mathematically similar.

Section 2

- To know what is meant by a 'mathematical enlargement'.
- To be able to enlarge a shape given a positive rational scale factor.
- To know what the centre of enlargement is.
- To be able to enlarge a shape given a scale factor and centre of enlargement.
- To determine a given centre of enlargement and scale factor from a diagram.
- To be able to enlarge a shape given a negative rational scale factor.

Section 3

- To be able to determine similar polygons.
- To be able to determine similar 3D shapes.
- To know the relationship between lengths, areas and volumes of similar shapes.

ICCAMS

Consider Lesson 8B

Congruence

What your students need to know

- How to label equal angles and edges in shapes. The basic angle facts, including polygons and parallel lines.
- How to justify geometric proofs using known geometric facts.
- The definitions and properties of triangles and quadrilaterals.

Additional prior knowledge

- Constructions and loci

Learning outcomes

Foundation

Section 1

- To know what it means for two objects to be congruent.
- To know the conditions for which congruence for a pair of triangles is then implied:
 - SSS – three sides are the same in both triangles.
 - ASA – two angles and one side length are the same in both triangles.
 - SAS – two sides and the angle between them are the same in both triangles.
- RHS – the hypotenuse and another side of a right-angled triangle are the same in both triangles.

Section 2

- To be able to apply the conditions for congruency to a variety of situations.

Higher

Section 1

- To know what it means for two objects to be congruent.
- To know the conditions for which congruence for a pair of triangles is then implied:
 - SSS – three sides are the same in both triangles.
 - ASA – two angles and one side length are the same in both triangles.
 - SAS – two sides and the angle between them are the same in both triangles.
- RHS – the hypotenuse and another side of a right angled triangle are the same in both triangles.

Section 2

- To be able to apply the conditions for congruency to a variety of situations.

Vocabulary

- Congruent

Pythagoras' Theorem

Menu

What your students need to know

- Understand how to correctly use labels in geometry, particularly those that are unique to a triangle for example, vertices (A, B ...), sides (AB or, for triangles only, lowercase c as it is opposite vertex C), symbol for a right angle.
- How to use a calculator to find squares and square roots.
- How to round to a given accuracy (either significant figures or decimal places).
- **(Higher only)** How to work with exact and approximate values of surds.
- The properties and categories of triangles.
- How to substitute into and rearrange formulae including squares and square roots.
- **(Higher only)** The properties of polygons.

Additional prior knowledge

- Conversion of metric units.
- Area and perimeter formulae of polygons and circles.

Learning outcomes

Foundation

Section 1

- Derive Pythagoras' theorem and use it to find the length of the hypotenuse in any right-angled triangle.

Section 2

- Know and use Pythagoras' theorem to find any missing length in a right-angled triangle.

Section 3

- Use Pythagoras' theorem to show whether a triangle is right-angled or not.

Section 4

- Apply Pythagoras' theorem to 2D problems.
- Link Pythagoras' theorem to real-life skills for industry.

Higher

Section 1

- Know and use Pythagoras' theorem to find any missing length in a right-angled triangle.

Section 2

- Use Pythagoras' theorem to show whether a triangle is right-angled or not.
- Apply Pythagoras' theorem to 2D problems.

Section 3

- Apply Pythagoras' theorem to 3D problems.

Section 4

- Link Pythagoras' theorem to real-life skills for industry.

Trigonometry

What your students need to know

- Properties of triangles including notation conventions for angles and sides.
- How to round to a given accuracy and recognise the effect of rounding.
- What it means for triangles to be similar and how to use scale factors to calculate side lengths.
- How to identify and apply knowledge of alternate angles in parallel lines.
- How to apply Pythagoras' theorem to calculate unknown lengths.

- **(Higher only)** Properties of 3D solids.
- **(Higher only)** Know the formula for calculating the area of a triangle

Additional prior knowledge

- How to calculate with surds including manipulating expressions, for example, $\frac{\sqrt{3}}{3} + \frac{\sqrt{3}}{3}$

Learning outcomes

Foundation

Section 1

- Use the trigonometric ratios given by the sine, cosine and tangent functions to find unknown lengths and angles in 2D right-angled triangles.

Section 2

- Know the exact ratios given by sine and cosine of 0, 30, 45, 60 and 90 degrees and the exact ratios given by the tangent function for 0, 30, 45 and 60 degrees.

Section 3

- Know the difference between an angle of depression and an angle of elevation.
- Identify when the trigonometric ratios must be used instead of Pythagoras' theorem to solve 2D problems relating to right-angled triangles, including contextual problems.

Higher

Section 1

- Use the trigonometric ratios given by the sine, cosine and tangent functions to find unknown lengths and angles in 2D right-angled triangles.

Section 2

- Know the exact ratios given by sine and cosine of 0, 30, 45, 60 and 90 degrees and the exact ratios given by the tangent function for 0, 30, 45 and 60 degrees.

Section 3

- Use the sine, cosine and sine area rules to solve problems relating to unknown sides, angles and areas in non-right-angled triangles.

Section 4

- Know the difference between an angle of depression and an angle of elevation.
- Identify when the trigonometric ratios must be used instead of Pythagoras' theorem to solve 2D and 3D problems relating to right-angled triangles, including contextual problems.

Graphs of other functions and equations

Menu

What your students need to know

- Plot and interpret straight-line graphs including identifying gradients and y-intercepts.
- Solving linear equations to find the y or x coordinate given the x or y coordinate respectively.
- Identifying or constructing parallel lines given an equation of a straight line (in any form).
- **(Higher only)** Identifying or constructing perpendicular lines given an equation of a straight line (in any form).
- Generate a table of values from a given function.
- How to find roots of a quadratic equation algebraically (including completing the square).
- **(Higher only)** Knowledge of the trigonometric functions: sine, cosine and tangent.

Learning outcomes

Foundation

Section 1

- Able to work fluently with equations of straight-line graphs.

Section 2

- Identify and plot graphs of quadratic functions, for example, parabolas.
- Find roots of quadratic equations from the x -intercept of the parabola of the quadratic equation that defines the graph.
- Know the features of graphs of quadratic equations.
- Be able to sketch parabolas.

Section 3

- Work fluently with cubic polynomials and their graphs.
- Be able to sketch cubic graphs.
- Work fluently to calculate reciprocals of numbers and plot functions involving reciprocals.
- Identify hyperbolas and match them to their equations.

Section 4

- Plot and sketch graphs from given functions.
- Recognise linear, quadratic and reciprocal graphs.

Additional prior knowledge

- Fluency with calculating square and cube numbers.
- Fluency when calculating negative numbers.
- Fluency with the laws of indices.
- Ability to set up and solve simultaneous equations.
- How to describe a line of symmetry as a straight-line equation.
- Properties and definitions of quadrilaterals.
- **(Higher only)** Exact trigonometric ratio values. for example, $\sin 90$, $\cos 90$, $\sin 45$ etc.

Higher

Section 1

- Able to work fluently with equations of straight-line graphs.

Section 2

- Identify and plot graphs of quadratic functions, for example, parabolas.
- Find roots of quadratic equations from the x -intercept of the parabola of the quadratic equation that defines the graph.
- Know the features of graphs of quadratic equations.
- Be able to sketch parabolas.

Section 3

- Work fluently with cubic polynomials and their graphs.
- Be able to sketch cubic graphs.
- Work fluently to calculate reciprocals of numbers and plot functions involving reciprocals.
- Identify hyperbolas and match them to their equations.

Section 4

- Plot and sketch graphs from given functions.
- Recognise linear, quadratic and reciprocal graphs.
- Identify and plot exponential graphs.
- Identify and plot trigonometric graphs.

Section 5

- Represent a circle given its centre on the origin and radius r by a function.
- Identify equations of circles from their graphs.

Growth and Decay

What your students need to know

- How to convert percentages to decimals.
- How to find a percentage of a quantity using multiplication.
- How to increase or decrease a quantity by a given percentage by multiplying by a suitable decimal.
- **(Higher only)** How to plot and interpret functions of the form $y = ab^x$, where b is a positive number and a, x are real numbers.

Additional prior knowledge

- How to extract information regarding percentage increase or decrease from a word problem.
- How to substitute values into a formula.

Learning outcomes

Foundation

Section 1

- To be able to calculate with simple growth, such as simple interest rates.
- To be able to calculate with compound growth, such as compound interest rates.
- To be able to solve word problems using simple and/or compound growth.

Section 2

- To be able to calculate with simple decay.
- To be able to calculate with compound decay, such as depreciation.
- To be able to solve word problems using simple and/or compound decay.

Higher

Section 1

- To be able to calculate with simple growth, such as simple interest rates.
- To be able to calculate with compound growth, such as compound interest rates.
- To be able to solve word problems using simple and/or compound growth.
- To be able to use the formula $y = a(1 + r)^n$ for compound growth.

Section 2

- To be able to calculate with simple decay.
- To be able to calculate with compound decay, such as depreciation.
- To be able to solve word problems using simple and/or compound decay.
- To be able to use the formula $y = a(1 - r)^n$ for compound decay.

What your students need to know

- How to round an answer to a required number of decimal places or significant figures.
- How to use Pythagoras' Theorem (from KS3 study).
- How to write numbers as products of their prime factors (perform prime factor decomposition).
- How to expand brackets and simplify expressions by collecting like terms (so as to have an understanding of basic algebra since manipulation of surds uses similar techniques).
- How to create equivalent fractions by multiplying or dividing both numerator and denominator by the same value.

Additional prior knowledge

- To be able to use the trigonometric ratios in order to solve more complex extension problems involving Pythagoras' theorem and trigonometry.
- To be able to find the circumference and area of a circle in order to tackle a few of the contextualised questions.

Learning outcomes

Section 1

- To use a calculator to approximate the values of numbers involving surds.
- To calculate exact solutions to problems using surds.

Section 2

- To simplify expressions containing surds.
- To manipulate surds when multiplying and dividing.
- To rationalise the denominator of a fraction.

Section 3

- To apply an understanding of surds to solve more complex problems.

Circles

What your students need to know

- The sum of angles on a straight line, interior angles of a polygon and around a point.
- How to calculate an exterior angle (and what it is).
- How to calculate the size of missing angles in geometry problems; including polygons and parallel lines.
- How to identify congruent and similar triangles.
- How to label the circumference and a diameter/radius of a circle.
- How to find the circumference and area of circles and arc length and area of sectors.
- How to add geometric reasoning to calculations that find missing angles.
- What a mathematical proof involves.

Additional prior knowledge

- What the words perpendicular and bisector mean.
- How to use Pythagoras' theorem in a variety of settings.
- How to identify the different types of quadrilaterals.
- How to form and solve equations with an unknown from a given text.
- How to use mathematical formulae; either by substituting first and then solving for an unknown or by first changing the subject and then substituting.

Learning outcomes

Section 1

- To review the names of parts of a circle.
- How to correctly label and refer to angles in a diagram involving a circle.

Section 2

- To learn how to prove the following circle theorems:
 - Angles subtended at centre and circumference
 - Angles in a semicircle
 - Angles in the same segment
 - Angle between radius and chord
 - Angle between the radius and tangent
 - Two tangent theorem
 - Alternate segment theorem
 - Angles in a cyclic quadrilateral

Section 3

- To be able to use the circle theorems.
- To be able to construct geometric 'proofs' using circle theorems.

Transformations of curves

What your students need to know

- How to recognise the graphs of linear, quadratic and reciprocal functions.
- How to sketch the trigonometric functions: $y = \sin x$, $y = \cos x$ and $y = \tan x$ and recognise the features of each including the period and amplitude.
- How to manipulate quadratic expressions to factorised form and completed square form.

Additional prior knowledge

- Language for features of quadratic functions including roots and turning point or vertex.
- Knowledge of graphing software such as Geogebra or Desmos (freely available) to plot functions.
- Index laws including $a^0 = 1$.

Learning outcomes

Section 1

- Know the features of a quadratic function (parabola): axis of symmetry, roots and vertex, and identify these features from the sketch of a quadratic.
- Sketch vertical translations of quadratic functions.
- Sketch horizontal translations of quadratic functions.
- Sketch quadratic functions that have been translated in both the horizontal and vertical directions.
- Know the effect translations have on the axis of symmetry and vertex of a quadratic.
- Use graph sketching to identify the effect of multiplying $f(x)$ by -1 .
- Use algebraic manipulation skills to identify the features above and sketch any quadratic of the form $y = ax^2 + bx + c$.

Section 2

- Identify reflections and translations in the graphical representations of trigonometric functions.
- Sketch a transformed trigonometric curve for a given domain.

Section 3

- Sketch translations and reflections of cubic, reciprocal and exponential functions.

Section 4

- Apply transformations learnt in this chapter to a variety of problems including identifying the effect of a transformation on a feature of a graph and finding the equation of a function once a transformation has been applied.