GCSE

Rewarding Learning

CCEA GCSE TEACHER GUIDANCE

Mathematics

New Specification

For first teaching from September 2017

Part 1: Summary Information

1 Key features

The following are important features of this specification.

- It offers opportunities to build on the skills and capabilities developed through the delivery of the Northern Ireland Curriculum at Key Stage 3.
- It provides a strong foundation for progression to GCSE Further Mathematics and/or AS level Mathematics and for other disciplines where understanding and application of mathematics is essential.
- It gives students the appropriate mathematical skills, knowledge and understanding to help them progress to further academic and vocational study and to employment.
- This specification has two tiers: Foundation and Higher.
- Each tier offers a choice of units that are suited to a wide range of abilities and enable students to demonstrate achievement.
- At Foundation Tier, students can achieve a Level 1 or Level 2 in Functional Mathematics as well as a grade in GCSE Mathematics.
- The assessment model enables students to monitor their progress and offers opportunities to improve their results.
- Each assessment unit gives students enough time to consider various problem-solving strategies and to decide on the best approach.

2 Assessment objectives

There are three assessment objectives for this specification.

AO1 Use and apply standard techniques

Candidates must:

- accurately recall facts, terminology and definitions;
- use and interpret notation correctly; and
- accurately carry out routine procedures or set tasks requiring multi-step solutions.

AO2 Reason, interpret and communicate mathematically

Candidates must:

- make deductions, inferences and draw conclusions from mathematical information;
- construct chains of reasoning to achieve a given result;
- interpret and communicate information accurately;
- present arguments and proofs; and
- assess the validity of an argument and critically evaluate a given way of presenting information.

AO3 Solve problems in mathematics and other contexts

Candidates must:

- translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes;
- make and use connections between different parts of mathematics;
- interpret results in the context of a given problem;
- evaluate methods used and results obtained; and
- evaluate solutions to identify how they may have been affected by assumptions made.

3 Assessment Objective weightings

The table below sets out the assessment objective weightings for each assessment component and the overall GCSE qualification.

Assessment Objective	Unit Weighting (%)	
	Foundation Tier **M1 and M5** **or** **M2 and M6**	**Higher Tier** **M3 and M7** **or** **M4 and M8**
AO1	47–53	37–43
AO2	22–28	27–33
AO3	22–28	27–33

4 Functional mathematics

In this specification, the term Functional Mathematics refers to the skills and abilities students need to develop as a young person and as an individual, as a contributor to society and as a contributor to the economy and environment. Functional Mathematics requires students to use mathematics effectively in a wide range of contexts. The introduction of functional mathematics is a response to employers' perceptions that many students are not achieving a sufficiently firm grounding in the basics. Units M1 and M2 are designed to assess the functional elements in Mathematics.

The following table details the specific units that we use to determine the award in Functional Mathematics:

GCSE Units	Functional Award Available
M1	Level 1
M2	Level 1 or Level 2

5 Specification at a Glance

The tables below and on the next page summarise the structure of this GCSE course. All units address the three assessment objectives and, where appropriate, questions may require students to know and use problem-solving strategies. Each written paper has a range of question types. Questions are set in both mathematical and non-mathematical contexts. Students take two units, one from M1, M2, M3 or M4 and one from M5, M6, M7 or M8. To receive an award, one of these must be a completion test. Recommended pathways are summarised below.

5.1 Foundation Tier Option 1

Content	Assessment	Weightings	Availability
Unit M1: Foundation Tier	External written examination **with** calculator 1 hour 45 mins	45%	Summer from 2018 and January from 2019
Unit M5: Foundation Tier Completion Test	Two external written examinations: • Paper 1 **without** calculator 1 hour • Paper 2 **with** calculator 1 hour	55%	Summer from 2019 and January from 2020

5.2 Foundation Tier Option 2

Content	Assessment	Weightings	Availability
Unit M2: Foundation Tier	External written examination **with** calculator 1 hour 45 mins	45%	Summer from 2018 and January from 2019
Unit M6: Foundation Tier Completion Test	Two external written examinations: • Paper 1 **without** calculator 1 hour • Paper 2 **with** calculator 1 hour	55%	Summer from 2019 and January from 2020

5.3 Higher Tier Option 1

Content	Assessment	Weightings	Availability
Unit M3: Higher Tier	External written examination **with** calculator 2 hours	45%	Summer from 2018 and January from 2019
Unit M7: Higher Tier Completion Test	Two external written examinations: • Paper 1 **without** calculator 1 hour 15 mins • Paper 2 **with** calculator 1 hour 15 mins	55%	Summer from 2019 and January from 2020

5.4 Higher Tier Option 2

Content	Assessment	Weightings	Availability
Unit M4: Higher Tier	External written examination **with** calculator 2 hours	45%	Summer from 2018 and January 2019
Unit M8: Higher Tier Completion Test	Two external written examinations: • Paper 1 **without** calculator 1 hour 15 mins • Paper 2 **with** calculator 1 hour 15 mins	55%	Summer from 2019 and January from 2020

Students must take at least 40 percent of the assessment (based on unit weightings) at the end of the course as terminal assessment i.e must sit at least one unit which must count towards the final result.

6 Reporting, Grading and Uniform Marks Grid

6.1 Reporting and Grading

We report the results of individual assessment units on a uniform mark scale that reflects the assessment weighting of each unit.

Each unit in GCSE Mathematics is targeted at a specific grade range as shown below:

Assessment unit	Targeted unit grades	Comment
M1	D, E, F and G	Level 1 Functional Mathematics awarded
M2	C*, C, D, E, F and G	Level 1 or Level 2 Functional Mathematics awarded
M3	B, C*, C, D and E	
M4	A, B, C*, C and allowable D	A* awarded at qualification level and is dependent on total marks gained from M4 and M8 assessment units
M5	D, E, F and G	
M6	C*, C, D, E, F and G	
M7	B, C*, C, D and E	
M8	A, B, C*, C and allowable D	A* awarded at qualification level and is dependent on total marks gained from M4 and M8 assessment units

Candidates may enter any one of Units M1, M2, M3 or M4 together with any one of Units M5, M6, M7 or M8 to receive a GCSE grade. See the table on the next page for the most common combinations.

We determine the grades awarded by aggregating the uniform marks that candidates obtain in individual assessment units. We award GCSE qualifications on a grade scale from A* to G, with A* being the highest. The nine grades available are as follows:

Grade	A*	A	B	C*	C	D	E	F	G

If candidates fail to attain a grade G or above, we report their result as unclassified (U).

The following table details the overall qualification grades available when units are combined as specified below:

Assessment Unit Combinations	Available Final GCSE Grades	Comment
M1 and M5	D – G	All grades in this range are available.
M2 and M6	C* – G	All grades in this range are available.
M3 and M7	B – E	All grades in this range are available.
M4 and M8	A* – D	All grades in this range are available.

Examinations for Units M1, M2, M3 and M4 take place at the same time, so candidates can take only one examination. Therefore, candidates may enter only one of these examinations in each session.

Completion assessment Units M5, M6, M7 and M8 are timetabled concurrently, on a different day to M1, M2, M3 and M4. For both Foundation and Higher Tier completion assessment units, Paper 2 (with calculator) takes place immediately after Paper 1 (without calculator).

Functional Mathematics

The achievement in Functional Mathematics is based on the candidate's performance in Units M1 or M2. In Unit M1, recognition is at Level 1 and in M2 at Level 1 or Level 2. In Unit M2, where a candidate does not achieve a Level 2, Level 1 may be awarded if the required standard is reached. The standard required to achieve a level will be based on a minimum raw mark threshold that we set for each series. Functional Mathematics is awarded within the context of GCSE study and is reported with the results for GCSE Mathematics as a 'pass' at either Level 1 or Level 2.

6.2 Uniform Marks Grid

All results will be reported on a Uniform Mark Scale (UMS)

	Unit M1, M2, M3, M4	Completion Test M5, M6	Completion Test M7, M8	AWARD
Max UMS	**180**	**160**	**220**	**400**
Grade				
A*	**Not awarded at unit level**		**Not awarded at unit level**	
A	**144 - 180**		**176 - 220**	**320 - 400**
B	**132 - 143**		**161 - 175**	**292 - 319**
C*	**121 - 131**	**148 - 160**	**148 - 160**	**268 - 291**
C	**108 - 120**	**132 - 147**	**132 - 147**	**240 - 267**
D	**90 - 107**	**110 - 131**	**110 - 131**	**200 - 239**
E	**72 - 89**	**88 - 109**	**88 - 109**	**160 - 199**
F	**54 - 71**	**66 - 87**	**(66 – 87)**	**120 - 159**
G	**36 - 53**	**44 - 65**	**(44 – 65)**	**80 - 119**
U	**0 - 35**	**0 - 43**	**0 - 43**	**0 - 79**

Notes: This qualification will be graded A* - G.

Candidates who fail to reach the minimum requirement for a grade G will be recorded as U, unclassified.

A candidate cannot achieve a uniform mark on a paper higher than the range of grades for that paper; for example, on Unit M2 a candidate cannot obtain more than 131 UMS as C* is the maximum grade available in this Unit.

A* is awarded at qualification level and is dependent on the total marks gained from assessment units M4 and M8.

Part 2: Elaboration of Subject Content

Unit M1: Foundation Tier

This unit targets grades D, E, F and G at GCSE Level and Level 1 in Functional Mathematics.

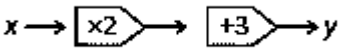
Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • use the four operations applied to positive and negative integers, including efficient written methods;	Write numbers in words and figures. Understand and use the language of number, for example, whole, decimal, terminating, fraction, percentage, prime, square, cube, root, factor (divisor), multiple, common factor; positive and negative, integer, natural, sum, difference, product, numerator, denominator, common denominator, equivalent. Consolidation knowledge of number facts, including multiplication to 10 × 10 For example: Work out in a variety of ways how many buses are needed to carry 234 people to a football match if each bus holds 57 people. How many seats are not filled?
	• order positive and negative integers, decimals and fractions;	For example: Understand that 0.24 is greater than 0.235 Write numbers in order, such as 0.8, 0.89, 0.9 or $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$ or $-6, -2, 0, 4$
	• use symbols = , ≠, <, >, ≤, ≥;	

Number and Algebra (cont.)	• use calculators effectively and efficiently;	For example: Understand the use of brackets to distinguish between $9 + \frac{46}{80}$ and $\frac{9 + 46}{80}$
	• understand and use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals;	For example, use BODMAS/BIDMAS to distinguish correctly between: $3 + 2 \times 5$ and $(3 + 2) \times 5$, $\frac{7.2}{9.8 + 12.7}$ and $\frac{7.2}{9.8} + 12.7$ Solve problems requiring application of order of precedence.
	• recognise and use relationships between operations, including inverse operations;	For example: Know that multiplying by $\frac{1}{2}$ is equivalent to dividing by 2; Understand that the inverse of square is square root; Know that 457 – 95 = 457 – 100 + 5
	• use index notation for squares, cubes and powers of 10;	For example: Work out 10^2, 6^3
	• use the concepts and vocabulary of factor, multiple, common factor, common multiple and prime;	For example: Find all primes between 0 and 100
	• use the terms square, positive and negative square root, cube and cube root;	For example, Understand that the inverse of cube is cube root. Understand that if $x^2 = 16$, $x = \pm 4$

Number and Algebra (cont.)	• understand place value and decimal places;	For example: Know that 0.235 is 2 tenths and 3 hundredths and 5 thousandths or 235 thousandths.
	• read, write and compare decimals up to three decimal places;	
	• add, subtract, multiply and divide decimals up to 3 decimal places;	
	• round to a specified or appropriate degree of accuracy, number of decimal places or 1 significant figure, including a given power of 10;	For example: Round 235 to the nearest hundred. Round 5620 to the nearest thousand. Round 0.356 to one decimal place. An appropriate degree of accuracy means that if the values in the question are given to 2 decimal places, the final answer should be given to no more than 2 decimal places.
	• use correct decimal notation when working with money;	When using a calculator to find a sum of money in £, a display of 26.3 should be written as £26.30
	• understand and use equivalent fractions;	Know that, for example $\frac{4}{8} = \frac{2}{4} = \frac{1}{2}$
	• write a simple fraction as a terminating decimal;	For example: $\frac{3}{5} = 0.6$
	• add and subtract simple fractions and simple mixed numbers;	For example: Work out $\frac{7}{8} - \frac{1}{3}$ Work out $1\frac{3}{5} + 2\frac{1}{5}$

Number and Algebra (cont.)	• calculate a fraction of a quantity;	For example: Find $\frac{2}{3}$ of £51
	• express one quantity as a fraction of another;	
	• understand that percentage means number of parts per 100;	For example: Know that 7 books out of a total of 100 books represents 7%
	• calculate a percentage of a quantity;	For example: Find 20% of £3.00
	• express one quantity as a percentage of another;	For example: Write 12 out of 40 as a percentage.
	• calculate percentage increase/ decrease;	For example: A train ticket increases from £10 to £15 Find (a) the increase (b) the percentage increase Calculate percentage profit or percentage loss.
	• use equivalences between fractions, decimals and percentages in a variety of contexts;	Know that, for example 50% = 0.5 = $\frac{1}{2}$ 60% = 0.6 = $\frac{3}{5}$

Number and Algebra (cont.)	• calculate with money and solve simple problems in the context of finance, for example profit and loss, discount, wages and salaries, bank accounts, simple interest, budgeting, debt, APR and AER;	For example: £1500 is invested at a rate of 8% p.a. Find the total amount of interest earned after 3 years. Work out the cost of a laptop which is offered at 15% discount in a sale. Compare the cost of borrowing £200 for one year at 12% APR with the cost of borrowing £250 for one year at 10% APR
	• distinguish the different roles that letter symbols play in algebra, using the correct notation;	$1a$ is written as a $b + b + b$ is written as $3b$ $3c + 4c$ is written as $7c$ $7x - 2x + y$ is written as $5x + y$ $a \times b \times 2$ is written as $2ab$ $y \times y$ is written as y^2 $2x^2 + 3x^2$ is written as $5x^2$ $a \div b$ is written as $\frac{a}{b}$

Number and Algebra (cont.)	• understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors;	Know that letter symbols represent definite unknown numbers in equations [e.g. $5x + 1 = 16$], defined quantities or variables in formulae [e.g. $V = IR$], general unspecified and independent numbers in expressions [e.g. $3x + 2x = 5x$ for all values of x] and in functions they define new expressions or quantities by referring to known quantities [e.g. $y = 2x$]. Write expressions from a given problem.
	• interpret simple expressions as functions with inputs and outputs;	For example $y = 2x + 3$ 
	• simplify and manipulate algebraic expressions by collecting like terms and multiplying a constant over a bracket;	For example: Know that $2(a + b)$ is the same as $2a + 2b$
	• manipulate algebraic expressions by taking out common factors which are constants;	For example: Factorise $3a + 6b$ to give $3(a + 2b)$
	• write simple formulae and expressions from real life contexts;	For example: A trainee hairdresser earns £12 per hour. She works h hours per week. Write down a formula to work out her total pay, P
	• substitute numbers into formulae (which may be expressed in words or algebraically) and expressions;	For example: Work out the time needed to cook a chicken, using an appropriate formula. Evaluate expressions.

Number and Algebra (cont.)	• use standard formulae;	For example: Use perimeter, area and volume formulae.
	• set up and solve linear equations in one unknown;	For example, solve $5x - 3 = 7$
	• work with coordinates in all four quadrants;	In 2 dimensions only. Use the conventions for coordinates in the plane, and plot points in all four quadrants, including using geometric information. Name shapes formed by plotting coordinates.
	• recognise and plot equations that correspond to straight line graphs in the coordinate plane;	For example: Draw the line $x = 3$ Plot the graph of $y = 2x + 1$ by completing a table of values.
	• construct and interpret linear graphs in real world contexts;	For example: Plot a graph of Cost against Quantity to determine the total cost of buying a given number of items.

Geometry and Measures	• use conventional terms and notations such as points, lines, vertices, edges, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries;	Know and use the terms: vertical, horizontal, diagonal, acute, obtuse and reflex. Explore shape through drawing and practical work using a wide range of materials.
	• use the standard conventions for labelling and referring to the sides and angles of shapes;	
	• draw diagrams from a written description;	For example: Draw triangles and other 2D shapes using a ruler and protractor.
	• apply the properties of angles: - at a point; - at a point on a straight line; and - vertically opposite;	Understand the notion of angle in the context of turning; give and understand instructions for moving through $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{3}{4}$ turns and right angles. Understand clockwise and anticlockwise.
	• understand and use alternate and corresponding angles on parallel lines;	Use appropriate language and notation including vertically opposite, adjacent, alternate and corresponding angles; explain why the angle sum of any quadrilateral is 360°
	• identify and apply circle definitions and properties, including centre, radius, chord, diameter and circumference;	Use a compass to draw a circle of given size.
	• apply the properties and definitions of triangles and quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus;	Classify and define types of triangles including scalene, right angled, equilateral and isosceles.

Geometry and Measures (cont.)	• identify properties of the faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres;	
	• draw and interpret 2D representations of 3D shapes, for example nets, plans and elevations;	Recognise and describe a range of regular and irregular 2D and 3D shapes, including squares, rectangles, triangles, hexagons, pentagons, circles, cubes, cuboids, cylinders and pyramids. Construct plans and elevations of simple 3D solids, and representations (e.g. using isometric paper) of solids from plans and elevations.
	• understand and use metric units of measurement;	
	• make sensible estimates of a range of measures;	For example: Estimate the length of a car, the capacity of a teacup, the "weight" of a school bag. Estimate the time taken to complete a task.
	• convert metric measurements from one unit to another;	For example: Use two units, such as millilitres and litres to measure the capacity of the same jug. Work out that 2.4 kg is equivalent to 2400g.
	• solve problems involving length, area, volume/capacity, mass, time, and temperature;	Use of 12 and 24 hour clock and timetables. Read digital and analogue displays, use a calendar. Use positive and negative temperatures.

Geometry and Measures (cont.)	• measure line segments and angles in geometric figures;	
	• use compound measures/units such as speed, heart beats per minute and miles per gallon;	Know that Speed = $\frac{\text{Distance}}{\text{Time}}$
	• calculate perimeters and areas of triangles and rectangles and simple compound shapes made from triangles and rectangles;	
	• calculate circumferences and areas of circles;	For example: Calculate the perimeter and area of a semicircle with radius 7cm.
	• calculate surface area and volumes of cubes and cuboids;	
Statistics	• understand the handling data cycle to solve problems;	1. Specifying a problem or hypothesis and planning. 2. Collecting data. 3. Processing and presenting the data. 4. Interpreting and discussing the results.
	• understand what is meant by a sample and a population;	Understand the terms population, census and sample. Understand the problems associated with surveying a whole population and why it is preferable to take a sample and estimate results.
	• understand simple random sampling and the effect of sample size on the reliability of conclusions;	Know that the greater the sample size the more reliable the results.

Statistics (cont.)	• design an experiment or survey to test hypotheses;	For example: Conduct a survey of cars passing with one, two, three . . . occupants. Determine the best location for a pedestrian crossing.
	• design data collection sheets, distinguishing between different types of data;	Distinguish between discrete and continuous data. Design and criticise questions for a questionnaire. Use a given decision tree diagram to sort a collection of items.
	• identify possible sources of bias;	Know that, in order to reduce bias, a sample must, as far as possible, represent the whole population.
	• sort, classify and tabulate qualitative (categorical) data and discrete or continuous quantitative data; including the use of 2 circle Venn diagrams to sort data;	Understand the reasons for grouping data. Know when to use $0 - 4$ or $0 \leq t < 4$ when grouping data. Use a Venn diagram, for example to identify the common factors of 12 and 20
	• extract data from printed tables and lists;	
	• design and use two way tables for discrete and grouped data;	For example: Use a table of distances between towns to plan a journey.
	• find mean, median, mode and range for ungrouped data and understand their uses;	Consider the suitability of the mean, mode or median in different circumstances.
	• calculate mean from an ungrouped frequency table and identify the mode and median;	

Statistics (cont.)	• construct and interpret a wide range of graphs and diagrams including frequency tables and diagrams, pictograms, bar charts, pie charts, line graphs, frequency trees and flow charts, recognising that graphs may be misleading;	Includes stem and leaf diagrams, for example identify the median from a stem and leaf diagram. Construct and interpret a composite bar chart. Excludes frequency polygons. Recognise that graphs may be misleading due to scales, labels, etc
	• look at data to find patterns and exceptions;	
	• compare distributions and make inferences; and	Compare sets of data using the mean, median, mode and range.
	• plot and interpret scatter diagrams and recognise correlation.	Draw conclusions such as: 'As the age of a car increases, its value decreases'.

Unit M2: Foundation Tier

This unit targets grades C*, C, D, E and F at GCSE Level and Level 2 in Functional Mathematics.

Students should know the content of Unit M1 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • use index notation and index laws for whole number powers;	For example: Evaluate $3^2 \times 2^3$ Know that $2^3 \times 2^4 = 2^7$; $4^5 \div 4^2 = 4^3$; $(3^2)^4 = 3^8$
	• use the concepts and vocabulary of divisor, highest common factor, least (lowest) common multiple and prime factor decomposition;	Find the Highest Common Factor (HCF) and Lowest Common Multiple (LCM) of two whole numbers. Know that there is a unique way of writing a number as a product of prime factors. Express, for example: 147 as $3 \times 7 \times 7$ or 3×7^2
	• add, subtract, multiply and divide decimals of any size;	Add, subtract, multiply and divide any numbers, including negative numbers and fractions.
	• round to a specified or appropriate number of significant figures;	
	• recognise that recurring decimals are exact fractions and that some exact fractions are recurring decimals;	Use division to convert a simple fraction to a decimal e.g. $\frac{1}{6} = 0.1\dot{6}$
	• add, subtract, multiply and divide fractions, including mixed numbers	For example: Work out $3\frac{1}{5} + 2\frac{3}{4}$

Number and Algebra (cont.)	• use percentage and repeated proportional change;	For example, calculate how much the value of a car has depreciated after 3 years.
	• calculate with money and solve problems in the context of finance, for example compound interest, insurance, taxation, mortgages and investments;	Calculation of compound interest is restricted to a maximum of three iterations.
	• simplify and manipulate algebraic expressions by multiplying a single term over a bracket;	For example: Know that $x(2x+3) = 2x^2 + 3x$
	• manipulate algebraic expressions by taking out common factors which are terms;	Know that, for example $x^2 - 3x = x(x-3)$ and vice versa.
	• set up and solve linear equations in one unknown, including those with the unknown on both sides of the equation and equations of the form: $\frac{x}{4} + 3 = 7$	Use algebra to solve a problem such as 'If I double a number, then add 1 and the result is 49, what is the number?'
	• find the midpoint and length of a line given in 2D coordinates;	Application of Pythagoras' theorem.
	• find and interpret gradients and intercepts of linear graphs, for example plot and interpret the graph of the cost of hiring a car at £40 per day plus 20p per mile;	For example: A graph shows the cost of hiring a plumber. Identify the *y*-intercept as the call out charge and the gradient as the cost per hour.

Geometry and Measures	• use compound measures/units such as density;	Know that Density = $\frac{\text{Mass}}{\text{Volume}}$
	• calculate perimeters and areas of kite, parallelogram, rhombus and trapezium;	
	• calculate perimeters and areas of composite shapes;	For example: Calculate the perimeter of a shape made up of a rectangle and a semicircle at one end.
	• calculate volumes of right prisms;	Know that a prism is an object with a uniform cross section. For example: Calculate the volume and surface area of a triangular prism. Calculate the volume of a cylinder.
	• use Pythagoras' theorem in 2D problems;	Calculate the side of a right angled triangle when the other two sides are known.

Statistics	• use 3 circle Venn diagrams to sort data;	For example: Draw a Venn diagram showing the results of a survey on pet owners owning cats, dogs and fish.
	• estimate mean from a grouped frequency distribution;	Prepare tables; calculate an estimate for the mean for discrete or continuous data. (i) Measurement of heights: Use 10 cm intervals from 120 – 150 cm. Class intervals defined as: **Interval** **Mid Point** $120 \leq h < 130$cm 125 cm $130 \leq h < 140$cm 135cm $140 \leq h < 150$cm 145cm (ii) Examination marks: Range 0 − 100, intervals of 10 marks **Interval** **Mid Point** 0 − 9 4.5 10 − 19 14.5 20 − 29 24.5 etc.
	• identify the modal class and the median class from a grouped frequency distribution;	
	• draw and/or use lines of best fit by eye, understanding what these lines represent;	Know that there should be roughly the same number of points either side of the line of best fit. Know that the line of best fit can be used to estimate values.
	• draw conclusions from scatter diagrams;	
	• use terms such as positive correlation, negative correlation and little or no correlation;	

Statistics (cont.)	• interpolate and extrapolate from data whilst knowing the dangers of doing so;	Know that results obtained by interpolation are usually reasonably accurate; however, results obtained from extrapolation may not be accurate.
	• identify outliers; and	Use a scatter graph to identify outliers by eye.
	• appreciate that correlation does not imply causality.	

Unit M3: Higher Tier

This unit targets grades B, C*, C, D and E.

Students should know the content of Units M1 and M2 before taking unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • find the LCM and HCF of numbers written as the product of their prime factors;	For example: Given that $60 = 2^2 \times 3 \times 5$ and $126 = 2 \times 3^2 \times 7$, deduce the HCF or LCM of 60 and 126
	• find the original quantity given the result of a proportional change;	
	• calculate the upper and lower bounds in calculations involving addition and multiplication of numbers expressed to a given degree of accuracy;	For example: Given the sides of a rectangle correct to the nearest unit, calculate the range of values within which the area lies.
	• know the difference between an equation and an identity;	Know the meaning of and use the word 'identity'. Understand the identity symbol.
	• multiply two linear expressions;	For example, expand and simplify $(x + 4)(x – 2)$ Know that $(a \pm b)^2 = a^2 \pm 2ab + b^2$
	• factorise quadratic expressions of the form $x^2 + bx + c$;	For example: $x^2 – 8x + 15 = (x – 3)(x – 5)$
	• factorise using the difference of two squares;	$x^2 – 16 = (x – 4)(x + 4)$, for example.
	• add or subtract algebraic fractions, for example simplify $\frac{4x+3}{10} + \frac{6x-5}{5}$	Adding and subtracting fractions such as $\frac{a}{b} + \frac{c}{d} = \frac{ad+bc}{bd}$

Number and Algebra (cont.)	• simplify, multiply and divide algebraic fractions with linear or quadratic numerators and denominators;	For example, simplify **(i)** $\frac{6x^2y}{8xy^2} = \frac{3x}{4y^2}$ **(ii)** $\frac{2x^2}{y} \times \frac{3y^2}{6x}$ **(iii)** $\frac{x^2+x-6}{x^2-4}$ Multiplying and dividing fractions such as $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$
	• set up and solve linear equations of the form: $\frac{4x+3}{10}+\frac{6x-5}{5}=\frac{13}{2}$	
	• set up and solve quadratic equations using factors;	
	• understand that the form $y = mx + c$ represents a straight line and that m is the gradient of the line and c is the value of the y-intercept;	Derive a linear relationship from a straight line graph, for example draw the graph of $3x - 4y = 7$; Determine the x-intercept and y-intercept of a graph.
	• find the equation of a line through two given points or through one point with a given gradient;	
	• understand and use the gradients of parallel lines;	Know that, for example $y = -5x$ and $y = -5x + 3$ represent parallel lines with gradient -5 Find the equation of a line that passes through a given point and is parallel to a given line.

Geometry and Measures	• identify and apply circle definitions and properties, including: tangent, arc, sector and segment;	Know that a tangent to a circle is a straight line that touches the circle at a point.
	• use compound measures/units such as pressure;	Know that Pressure = $\frac{\text{Force}}{\text{Area}}$
	• solve mensuration problems that involve arc length and area of sector, volume and surface area of a cylinder, cone and sphere;	Including simple arcs, simple sectors and composite shapes. For example: Calculate the perimeter of a sector of a circle with radius 10cm and angle 60°
	• understand and use the trigonometric ratios of sine, cosine and tangent to solve 2D problems, including those involving angles of elevation and depression;	
Statistics	• calculate quartiles and interquartile range from ungrouped data and understand their uses;	
	• construct and interpret cumulative frequency tables and the cumulative frequency curve;	Find the median, the upper quartile, the lower quartile and the interquartile range; describe the dispersion of data.
	• estimate the median, quartiles and interquartile range; display information using box plots; and	Know that the median and interquartile range are not affected by extreme values. Draw valid conclusions by comparing two box plots.
	• infer properties of populations or distributions from a sample, and know the limitations of doing so.	Use a measure of central tendency and a measure of dispersion to compare 2 distributions. Understand that different samples may provide different results.

Unit M4: Higher Tier

This unit targets grades A*, A, B, C* and C. The awarding of an A* grade is dependent on the total marks gained from the M4 and M8 assessment units.

Students should know the content of Units M1, M2, and M3 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • calculate the upper and lower bounds in calculations involving subtraction and division of numbers expressed to a given degree of accuracy;	For example: Given the dimensions of a rectangular piece of paper and the radius of a circle to 1 decimal place, calculate the greatest area of paper remaining when the circle is cut out.
	• factorise quadratic expressions of the form $ax^2 + bx + c$;	Factorise more complex expressions, for example: $3x^2 - 75$ $x^2 + xy - 6y^2$ $2px - qx - 2py + qy$
	• add or subtract algebraic fractions with linear denominators, for example simplify: $\frac{2}{x+2} + \frac{3}{2x-1}$	Excluding addition or subtraction of fractions with quadratic denominators
	• set up and solve equations such as: $\frac{2}{x+2} + \frac{3}{2x-1} = 1$	Excluding equations with quadratic denominators

Number and Algebra (cont.)	• set up and solve quadratic equations using factors and the formula, where the coefficient of $x^2 \neq 1$ and more complex equations;	Solve, for example $2x^2 - 18 = 0$ $6x^2 + 5x - 4 = 0$ The equation may not be given in the form $ax^2 + bx + c = 0$, for example solve $2x(x - 1) = (x + 1)^2 - 5$ The method of completing the square to solve quadratic equations is excluded.
	• understand and use the gradients of perpendicular lines;	For example: Know that $y = -5x$ and $5y = x + 4$ are perpendicular. Given the equation and midpoint of one of the diagonals of a rhombus, find the equation of the other diagonal.
Geometry and Measures	• solve more complex mensuration problems (example frustums);	Find surface area and volume of compound solids constructed from cubes, cuboids, cones, spheres, hemispheres, cylinders and prisms. Questions on frustums of a cone will not require knowledge and understanding of similar shapes.
	• understand and use circle theorems;	To include: Angle in a semicircle, angle at the centre and at the circumference, angles in the same segment, cyclic quadrilaterals, angle between tangent and radius, tangent kite, alternate segment theorem. Proofs of circle theorems are excluded.
Statistics	• understand and use stratified sampling techniques; and	
	• construct and interpret histograms for grouped continuous data with unequal class intervals.	For example: Use a histogram to estimate the mean or median of a distribution

Unit M5: Foundation Tier Completion Test

This unit targets grades D, E, F and G at GCSE Level.

Students should know the content of Unit M1 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • solve problems involving whole numbers, fractions, decimals and percentages without a calculator;	Multiply and divide mentally single digit multiples of any power of ten, and realise that, when multiplying or dividing by a number less than one, multiplication has a decreasing effect, and division an increasing effect. For example: Work out mentally 80×0.2 and $600 \div 0.2$ How much heavier is an object weighing 75kg than one weighing 48kg?
	• estimate answers and check calculations using approximation and estimation;	For example: Estimate that $278 \div 39$ is about 7 Estimate $\sqrt{97}$ Estimate that $1472 - 383$ is about 1100 Estimate that $\frac{0.25 \times 83.4}{5.7}$ is about 3 or 4

Number and Algebra (cont.)	• use ratio notation, including reduction to its simplest form and its various links to fraction notation;	For example: Simplify 12:18 to give 2:3 Understand that: • if money is divided between John and Mary in the ratio 1:3 this means that John receives $\frac{1}{4}$ of the money; • if the ratio of boys to girls in a class is 3 : 5 then $\frac{3}{8}$ of the class is boys and $\frac{5}{8}$ of the class is girls.
	• divide a quantity in a given ratio;	For example: Divide £10 between two people in the ratio 3:5
	• apply ratio and proportion to real life contexts and problems such as conversion, best buy, comparison, scaling, mixing, concentrations, exchange rates;	For example: State that the lengths 8cm and 12cm in a drawing are in the ratio 2:3 Adapt a recipe for six people to one for eight people.
	• recognise and use sequences of, for example triangular, square and cube numbers;	Understand the patterns in addition and multiplication tables, including symmetry of results and relationships between multiplication by 2, 4 and 8 etc.
	• generate terms of a sequence using term to term or a position to term rule;	Understand that 1, 2, 4 . . . may be part of the sequence 1, 2, 4, 8, 16 . . or the sequence 1, 2, 4, 7, 11 . . . etc Use the difference method to explore sequences. Determine possible rules for generating a sequence, for example produce a sequence in which the third and each subsequent number is the sum of the previous two numbers. Generalise, mainly in words, patterns which arise in various

		situations, for example, through spatial arrangement. Construct match stick squares using the appropriate number of match sticks to make 1,2,3,4… squares. Understand the use of a counter example.
	• plot and interpret graphs modelling real situations, for example conversion graphs, distance/time graphs and intersecting travel graphs;	
Geometry and Measures	• interpret scales on a range of measuring instruments and recognise the continuous nature of measure and approximate nature of measurement;	For example: Realise that a length of l written as 9.7cm correct to one decimal place means that $9.65 \leq l < 9.75$
	• know and use imperial measures still in common use and their approximate metric equivalents;	Know that 5miles = 8km 1 kg = 2.2 lbs; All other conversions will be given.
	• use and interpret maps, scale factors and scale drawings;	Use the eight points of the compass to specify direction. Understand and use scale in the context of maps and drawings, for example, calculate the actual distance as the crow flies between two places on a map.
	• use the sum of angles in a triangle, for example to deduce the angle sum in any polygon;	Polygons may be regular or irregular. For example, given 4 interior angles in an irregular pentagon, deduce the size of the 5^{th} angle.

Geometry and Measures (cont.)	• describe and transform 2D shapes using single transformations;	Reflect shapes in a mirror line. Rotate shapes using tracing paper. For example, complete a given diagram so that it has rotational symmetry of order 4
	• describe and transform 2D shapes using reflections about the *x* and *y* axes;	
	• describe and transform 2D shapes using single rotations about the origin;	Rotations will be limited to ± 90° and 180°
	• describe and transform 2D shapes using translations;	For example, translate a given shape 2 left and 3 up.
	• describe and transform 2D shapes using enlargements by a (positive) whole number scale factor;	Recognise that enlargements preserve angle but not length. Use of a given centre of enlargement and scale factor to enlarge a shape.
	• draw triangles and other 2D shapes using a ruler and protractor;	
Probability	• understand and use the vocabulary of probability, including notions of uncertainty and risk;	Place events in order of 'likelihood' and use appropriate words to identify chance.
	• use the terms fair, random, evens, certain, likely, unlikely and impossible;	Understand possible outcomes of random trials or experiments; understand that there is a degree of uncertainty about the occurrence of some events, and others are certain or impossible. Know that you do not always get 5 heads in 10 tosses of a 'fair' coin and very occasionally there will be none.

	• understand and use the probability scale from 0 to 1;	
	• list all outcomes for single events, and for two successive events;	For example: List all the outcomes when tossing two coins, HH, TT, TH, HT.
	• apply systematic listing strategies;	For example: List all the ways that the letters A, B and C can be written to form a 3 letter code. List the possible outcomes of trials in an experiment.
	• work out probabilities expressed as fractions or decimals from simple experiments with equally likely outcomes and simple combined events;	Know that for equally likely outcomes, the probability of an event is the number of desirable outcomes divided by the number of possible outcomes. For example: Know that if there are six identical beads numbered, 1, 1, 2, 2, 3 and 4, the probability of selecting a bead labelled 1 is $\frac{2}{6}$ Probability may be given as a percentage but **not** as a ratio.
	• identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1;	
	• understand the probability of an event not occurring is one minus the probability that it occurs; and	Recognise that if the probability of a machine failing is 0.05 then the probability of it not failing is 0.95
	• use probabilities to calculate expectation.	

Unit M6: Foundation Tier Completion Test

This unit targets grades C*, C, D, E and F at GCSE Level.

Students should know the content of Units M1, M2 and M5 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • understand the principles of number systems;	Know that other number systems were used in the past e.g. Roman Numerals; (Questions will not be asked on number systems, with the exception of Decimal and Binary) Understand that the binary system only uses 2 symbols.
	• convert numbers from decimal to binary (base 2) and vice versa;	For example: Convert 15 to binary. Convert 1011 to decimal.
	• use index laws in algebra for positive powers;	Know that, for example, $y^2 \times y^3 = y^5$ Simplify expressions such as $6x^6 \div 3x^4$, $2x^2 \times 3x^3$, $(x^2)^3$
	• use systematic trial and improvement to find approximate solutions of equations where there is no simple analytical method of solving them;	Trial and improvement will require confirmation of solutions, e.g. using a half way test, rather than settling on a solution by eye, or by saying 'closest'**.** For example: Find the side of a square whose area is 78cm^2 in the following way: $9^2 = 81$, $8^2 = 64$, so the side is more than 8cm, but less than 9cm. As 8.5^2 is 72.25, the side is greater than 8.5cm etc. Solve $x^2 + x = 10$ or $x^3 + x = 20$ by such a method.

Number and Algebra (cont.)	• solve linear inequalities in one variable, and represent the solution set on a number line;	For example: List the values of the integer n such that $-10 < 2n \leq 20$ Solve $2n - 3 \geq 7$ illustrating the solution on a number line. Solve $x \leq 3x - 5$ where x is a real number. Know that, when representing a solution on a number line, an empty circle represents $<$ or $>$ and a full circle represents $\leq$ or $\geq$
	• change the subject of a simple formula;	For example: Make t the subject of the formula $v = u + at$
	• find the nth term of a sequence where the rule is linear;	For example: Express in symbols the rule for the following sequence: 1, 3, 5, 7 . . . Know that n^{th} term $= 2n$ will generate a sequence of even numbers and that n^{th} term $= 2n - 1$ will generate a sequence of odd numbers.
	• solve two linear simultaneous equations graphically;	
	• generate points and plot graphs of simple quadratic functions and use these to find approximate solutions for points of intersection with lines of the form $y = \pm a$ only;	To include drawing graphs of: $y = ax^2 + bx + c$ Use the graph of $y = x^2 + 5x$ to solve $x^2 + 5x = 7$
Geometry and Measures	• understand and use bearings;	Use three figure bearings to specify direction.
	• calculate and use the sums of the interior and exterior angles of polygons;	Explain why some regular polygons can fit together without gaps, while others do not.

Geometry and Measures (cont.)	• distinguish properties that are preserved under particular transformations;	Recognise that translations, rotations and reflections preserve length and angle; recognise that enlargements preserve angle but not length. Use transformations to create and analyse spatial patterns. Find the inverse of transformations.
	• describe and transform 2D shapes using reflections in lines parallel to the *x* or *y* axis;	
	• describe and transform 2D shapes using rotations about any point;	Rotations will be limited to ± 90° and 180° about a point.
	• describe and transform 2D shapes using translations, to include use of vector notation;	For example: Give a shape a translation $\binom{-2}{3}$
	• understand and use the effect of enlargement on perimeter and area of shapes;	Know that when a 2D shape is enlarged by scale factor k, the area will be enlarged by a factor of k^2
	• understand the term congruent;	Group together congruent shapes from a range of triangles and quadrilaterals.
	• use the standard ruler and compass constructions;	Including: an equilateral triangle with a given side; the midpoint and perpendicular bisector of a line segment; the perpendicular from a point to a line; the perpendicular from a point on a line and the bisector of an angle. Know that the perpendicular distance from a point to a line is the shortest distance to the line.

Geometry and Measures (cont.)	• identify the loci of points, including real life problems;	The locus of all points which are a given distance from a fixed point; A locus that is equidistant from 2 given points; The locus of all points that are a given distance from a line; A locus that is equidistant from 2 intersecting lines. Including the region bounded by a circle and an intersecting line.
Probability	• systematically list all outcomes for single events and for two successive events;	For example: Recording the outcomes for the sum of two dice. Problems with two different spinners.
	• understand and use estimates or measures of probability from relative frequency;	Recognise situations where probabilities can be based on equally likely outcomes and others where estimates must be based on sufficient experimental evidence and make these estimates; understand and use relative frequency as an estimate of probability.
	• compare experimental data and theoretical probabilities; and	
	• understand that increasing sample size generally leads to better estimates of probability.	

Unit M7 Higher Tier Completion Test

This unit targets grades B, C*, C, D, and E.

Students should know the content of Units M1, M2, M3, M5 and M6 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • use surds and π in **exact** calculations;	For example: Know that $\sqrt{5}$ is a surd; Leave an answer in the form $\sqrt{5}$ or 10π. For example, finding the area of a circle with radius 5cm as 25π. Note that, the question will indicate when answers are required in this form.
	• use index notation and index laws for zero, positive and negative powers;	Know that $10^{-1} = \frac{1}{10}$ etc
	• interpret, order and calculate with numbers written in standard index form;	Calculate with numbers in standard index form using both positive and negative powers of ten. Convert numbers between ordinary form and standard form and vice versa. Calculate, for example $\frac{3.2 \times 10^4}{1.6 \times 10^{-3}}$ without a calculator. Use standard index form on a calculator. Know that standard form is sometimes called scientific notation.

Number and Algebra (cont.)	• use index laws in algebra for integer powers;	Use $x^0 = 1$, $\frac{1}{x} = x^{-1}$ For example Write $\frac{12a^2b}{6ab^3}$ as $2ab^{-2}$
	• set up and solve two linear simultaneous equations algebraically;	
	• solve linear inequalities in two variables representing the solution set on a graph;	For example: On a graph, show by shading the region which satisfies all the inequalities: $x \geq 1$, $y \geq x$, $x + 2y \leq 6$ Hence work out the greatest value of $2x + y$ in this region.
	• change the subject of a formula, including cases where a power or root of the subject appears and including cases where the subject appears in more than one term;	Transform formulae such as $A = \pi r^2$ $P = \frac{100(s - c)}{c}$
	• find the *n*th term of non-linear sequences;	For example: Express in symbols the rule for each of the following sequences: $\frac{1}{3}, \frac{2}{5}, \frac{3}{7}, \frac{4}{9}$..... [$\frac{n}{2n+1}$] 2, 5, 10, 17, 26, …….[$n^2 + 1$] Use of second differences to determine the rule for the *n*th term of more complex quadratic sequences is excluded.

Number and Algebra (cont.)	• recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{a}{x}$ with $x \neq 0$;	Make tables of such functions, sketch and interpret their graphs using graphical calculators and computers to understand their behaviour. Identify intercepts and, using symmetry, the turning point of graphs of quadratic functions. Understand 'reciprocal' as multiplicative inverse, knowing that any non-zero number multiplied by its reciprocal is one and that zero has no reciprocal, because division by zero is not defined.
	• generate points and plot graphs of simple quadratic functions and use these to find approximate solutions for points of intersection with lines of the form $y = mx + c$;	For example: Solve $y = 5x - 6$ and $y = x^2$ by drawing the graph of each function.
	• set up equations and solve problems involving direct proportion, including graphical and algebraic representations;	For example: The power P varies as the square of the current I. When $I = 2$, P = 1000 Find P when $I = 5$ Know that quantities are in direct proportion if $\frac{y}{x}$ is a constant value.
Geometry and Measures	• describe and transform 2D shapes using combined transformations;	
	• describe and transform 2D shapes using reflections in the lines $y = \pm x$;	
	• describe and transform 2D shapes using enlargements by a fractional scale factor;	

Geometry and Measures (cont.)	• understand and use the effect of enlargement on volume of solids;	Know that when a 3D shape is enlarged by scale factor k, the volume will be enlarged by a factor of k^3
	• use the relationship between the ratios of lengths and areas of similar 2D shapes;	Understand the term similar. Use mathematical similarity and prove triangles are similar. Know that angles remain unchanged and corresponding sides are in the same ratio. Problems may involve reverse situations, for example where the areas of two similar shapes are given and a length of one of the shapes is to be found.
Probability	• use the product rule for counting: if there are *m* ways of doing one task and for each of these, there are *n* ways of doing another task, then the total number of ways the two tasks can be done is $m \times n$;	For example: If a building has two doors to enter and three to exit then there would be 2×3 ways you could enter and exit the building. If you had 3 options for a starter, 4 for a main and 5 for dessert, then there would be $3 \times 4 \times 5$ different combinations of options altogether.
	• know when to add or multiply two probabilities: if A and B are mutually exclusive, then the probability of A or B occurring is P(A) + P(B), whereas if A and B are independent events, the probability of A and B occurring is P(A) × P(B); and	

Probability (cont.)	• use tree diagrams to represent successive events which are independent.	Understand selection with replacement. For example: Draw a tree diagram to define all of the possible outcomes when a coin is tossed 3 times. Understand that when dealing with two independent events, the probability of them both happening is less than the probability of either of them happening (unless the probability is 0 or 1).

Unit M8: Higher Tier Completion Test

This unit targets grades A, B, C* and C with an allowance grade D at GCSE level. The awarding of an A* grade is dependent on the total marks gained from the M4 and M8 assessment units. A* is awarded at subject level only.

Students should know the content of Units M1, M2, M3, M4, M5, M6 and M7 before taking this unit.

Content	Learning Outcomes	Elaboration
Number and Algebra	Students should be able to: • distinguish between rational and irrational numbers;	For example: Know that $\sqrt{5}$ or 10π are irrational
	• change a recurring decimal to a fraction;	Know the significance of recurring and non-recurring decimals.
	• use index notation and index laws for integer, fractional and negative powers;	For example: Evaluate $27^{2/3}$, $8^{-4/3}$
	• set up, solve and interpret the answers in growth and decay problems, for example use the formula for compound interest;	For example: The level of activity of a radioactive source decreases by 5% per hour. If the activity is 1500 counts per second, what will it be 12 hours later?
	• simplify numerical expressions involving surds, including the rationalisation of the denominator of a fraction such as: $\frac{5}{3\sqrt{2}}$;	For example: Write $\sqrt{12}$ as $2\sqrt{3}$; $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$; Write $(5 - \sqrt{5})^2$ in the form $a + b\sqrt{5}$
	• use index laws in algebra for integer, fractional and negative powers;	$y^{½} \times y^{3/2} = y^2$, for example.

Number and Algebra (cont.)	• set up and solve two simultaneous equations, one linear and one non-linear;	For example, solve $2x + y = 1$ and $x^2 + y = 1$ (Degree of $x \leq 2$) Methods of solving simultaneous equations involving one linear and one quadratic include equating, or using an arrangement of the linear equation to substitute into the quadratic equation.
	• recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k, for example growth and decay rates;	Know about rates of economic growth and decline and the half-life of radioactive elements.
	• find the intersection points of the graphs of a linear and quadratic function, knowing that these are the approximate solutions of the corresponding simultaneous equations representing the linear and quadratic functions, which may require algebraic manipulation;	For example, given the graph of $y = 6x – x^2$, draw a suitable straight line to solve the equation $2 + 5x – x^2 = 0$
	• interpret the gradient at a point on a curve as the instantaneous rate of change;	For example: In a graph of Temperature against Time, interpret the gradient of the curve as the rate at which the temperature is increasing or decreasing at a specific time. Gradients are to be estimated using a tangent at a point.
	• recognise and use the equation of a circle, centre the origin, radius *r;*	Know that, for example $x^2 + y^2 = 25$ represents the equation of a circle, centre the origin, radius 5.

Number and Algebra (cont.)	• find the equation of a tangent to a circle at a given point on the circle;	For example, find the equation of the tangent to the circle $x^2 + y^2 = 25$ at the point (–3, 4) Use the fact that the tangent at (–3, 4) is perpendicular to the radius from the centre (0, 0) to (–3, 4). This leads to a method for finding the equation of the tangent.
	• set up equations and solve problems involving indirect proportion, including graphical and algebraic representations;	For example, the current, I amps, in a circuit is inversely proportional to the resistance R ohms. The current is 2 amps when the resistance is 250 ohms. Find I when $R = 200$ Know that quantities are in inverse proportion if xy is a constant value.
Geometry and Measures	• understand and use the sine and cosine rules;	The ambiguous case of the sine rule is excluded.
	• calculate the area of a triangle using $A = \frac{1}{2}ab\sin C$;	
	• use Pythagoras' theorem and trigonometry to solve 2D and 3D problems;	For example: Find the length of a space diagonal. Find the angle between a line and a plane.
	• enlarge 2D shapes using negative scale factors;	
	• use the relationship between the ratios of lengths, areas and volumes of similar 3D shapes;	Use the relationship between the surface areas of similar 3D shapes and between volumes of similar 3D shapes, including the frustum of a cone.

Probability	• use the most appropriate method when solving complex problems; and	
	• use tree diagrams to represent successive events which are not independent.	Understand selection without replacement, for example a bag contains 6 red and 4 green beads. A bead is selected, not replaced and a second bead is then selected. Calculate the probability that both beads are red.