Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9-1)

MATHEMATICS

J560

For first teach in 2015

Higher student revision checklist

Version 1

Revision checklist – Higher

There are three Assessment Objectives in the OCR GCSE (9-1) in Mathematics. These are detailed in the table below:

	Assessment Objectives	Weighting Higher
AO1	**Use and apply standard techniques** Learners should be able to: • accurately recall facts, terminology and definitions • use and interpret notation correctly • accurately carry out routine procedures or set tasks requiring multi-step solutions.	**40%**
AO2	**Reason, interpret and communicate mathematically** Learners should be able to: • 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 • assess the validity of an argument and critically evaluate a given way of presenting information Where problems require learners to 'use and apply standard techniques' or to independently 'solve problems' a proportion of those marks should be attributed to the corresponding Assessment Objective.	**30%**
AO3	**Solve problems within mathematics and in other contexts** Learners should be able to: • translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • make and use connnections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods used and results obtained • evaluate solutions to identify how they may have been affected by assumptions made. Where problems require users to 'use and apply standard techniques' or to 'reason, interpret and communicate mathematically' a proportion of those marks should be attributed to the corresponding Assessment Objective.	**30%**

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OCR 1	**Number Operations and Integers**					
1.01	**Calculations with integers**					
1.01a	Four rules	Use non-calculator methods to calculate the sum, difference, product and quotient of positive and negative whole numbers.				
1.02	**Whole number theory**					
1.02a	Definitions and terms	Understand and use the terms odd, even, prime, factor (divisor), multiple, common factor (divisor), common multiple, square, cube, root. Understand and use place value.				
1.02b	Prime numbers	Identify prime numbers less than 20. Express a whole number as a product of its prime factors. e.g. $24 = 2 \times 2 \times 2 \times 3$ Understand that each number can be expressed as a product of prime factors in only one way.	Identify prime numbers. Use power notation in expressing a whole number as a product of its prime factors. e.g. $600 = 2^3 \times 3 \times 5^2$			

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1.02c	Highest Common Factor (HCF) and Lowest Common Multiple (LCM)	Find the HCF and LCM of two whole numbers by listing.	Find the HCF and LCM of two whole numbers from their prime factorisations.			
1.03	**Combining arithmetic operations**					
1.03a	Priority of operations	Know the conventional order for performing calculations involving brackets, four rules and powers, roots and reciprocals.				
1.04	**Inverse operations**					
1.04a	Inverse operations	Know that addition and subtraction, multiplication and division, and powers and roots, are inverse operations and use this to simplify and check calculations, for example in reversing arithmetic in "I'm thinking of a number" or "missing digit" problems. e.g. $223-98=223+2-100=125$ $25\times12=50\times6=100\times3=300$ *[see also Calculation and estimation of powers and roots, 3.01b]*				

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OCR 2	**Fractions, Decimals and Percentages**					
2.01	**Fractions**					
2.01a	Equivalent fractions	Recognise and use equivalence between simple fractions and mixed numbers. e.g. $\frac{2}{6}=\frac{1}{3}$ $2\frac{1}{2}=\frac{5}{2}$				
2.01b	Calculations with fractions	Add, subtract, multiply and divide simple fractions (proper and improper), including mixed numbers and negative fractions. e.g. $1\frac{1}{2}+\frac{3}{4}$ $\frac{5}{6}\times\frac{3}{10}$ $^{-}3\times\frac{4}{5}$	Carry out more complex calculations, including the use of improper fractions. e.g. $\frac{2}{5}+\frac{5}{6}$ $\frac{2}{3}+\frac{1}{2}\times\frac{3}{5}$	*[see also Algebraic fractions, 6.01g]*		
2.01c	Fractions of a quantity	Calculate a fraction of a quantity. e.g. $\frac{2}{5}$ of £3.50 Express one quantity as a fraction of another. *[see also Ratios and fractions, 5.01c]*	Calculate with fractions greater than 1.			

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2.02	**Decimal fractions**					
2.02a	Decimals and fractions	Express a simple fraction as a terminating decimal or vice versa, without a calculator. e.g. $0.4 = \frac{2}{5}$ Understand and use place value in decimals.	Use division to convert a simple fraction to a decimal. e.g. $\frac{1}{6} = 0.16666...$	Convert a recurring decimal to an exact fraction or vice versa. e.g. $0.\dot{4}\dot{1} = \frac{41}{99}$		
2.02b	Addition, subtraction and multiplication of decimals	Add, subtract and multiply decimals including negative decimals, without a calculator.				
2.02c	Division of decimals	Divide a decimal by a whole number, including negative decimals, without a calculator. e.g. $0.24 \div 6$	Without a calculator, divide a decimal by a decimal. e.g. $0.3 \div 0.6$			
2.03	**Percentages**					
2.03a	Percentage conversions	Convert between fractions, decimals and percentages. e.g. $\frac{1}{4} = 0.25 = 25\%$ $1\frac{1}{2} = 150\%$				

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2.03b	Percentage calculations	Understand percentage is 'number of parts per hundred'. Calculate a percentage of a quantity, and express one quantity as a percentage of another, with or without a calculator.				
2.03c	Percentage change	Increase or decrease a quantity by a simple percentage, including simple decimal or fractional multipliers. Apply this to simple original value problems and simple interest. e.g. Add 10% to £2.50 by either finding 10% and adding, or by multiplying by 1.1 or $\frac{110}{100}$. Calculate original price of an item costing £10 after a 50% discount.	Express percentage change as a decimal or fractional multiplier. Apply this to percentage change problems (including original value problems). *[see also Growth and decay, 5.03a]*			
2.04	**Ordering fractions, decimals and percentages**					
2.04a	Ordinality	Order integers, fractions, decimals and percentages. e.g. $\frac{4}{5}$, $\frac{3}{4}$, 0.72, $^{-}0.9$				
2.04b	Symbols	Use <, >, ≤, ≥, =, ≠				

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OCR 3	**Indices and Surds**					
3.01	**Powers and roots**					
3.01a	Index notation	Use positive integer indices to write, for example, $2\times2\times2\times2=2^4$	Use negative integer indices to represent reciprocals.	Use fractional indices to represent roots and combinations of powers and roots.		
3.01b	Calculation and estimation of powers and roots	Calculate positive integer powers and exact roots. e.g. $2^4=16$ $\sqrt{9}=3$ $\sqrt[3]{8}=2$ Recognise simple powers of 2, 3, 4 and 5. e.g. $27=3^3$ *[see also Inverse operations,1.04a]*	Calculate with integer powers. e.g. $2^{-3}=\frac{1}{8}$ Calculate with roots.	Calculate fractional powers. e.g. $16^{\frac{-3}{4}}=\frac{1}{\left(\sqrt[4]{16}\right)^3}=\frac{1}{8}$ Estimate powers and roots. e.g. $\sqrt{51}$ to the nearest whole number		
3.01c	Laws of indices	*[see also Simplifying products and quotients,6.01c]*	Know and apply: $a^m\times a^n=a^{m+n}$ $a^m\div a^n=a^{m-n}$ $\left(a^m\right)^n=a^{mn}$ *[see also Calculations with numbers in standard form, 3.02b, Simplifying products and quotients,6.01c]*			

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3.02	**Standard form**					
3.02a	Standard form	Interpret and order numbers expressed in standard form. Convert numbers to and from standard form. e.g. $1320 = 1.32 \times 10^3$, $0.00943 = 9.43 \times 10^{-3}$				
3.02b	Calculations with numbers in standard form	Use a calculator to perform calculations with numbers in standard form.	Add, subtract, multiply and divide numbers in standard form, without a calculator. *[see also Laws of Indices, 3.01c]*			
3.03	**Exact calculations**					
3.03a	Exact calculations	Use fractions in exact calculations without a calculator.	Use multiples of π in exact calculations without a calculator.	Use surds in exact calculations without a calculator.		
3.03b	Manipulating surds			Simplify expressions with surds, including rationalising denominators. e.g. $\sqrt{12} = 2\sqrt{3}$ $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$ $\frac{1}{\sqrt{3}+1} = \frac{\sqrt{3}-1}{2}$		

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OCR 4	**Approximation and Estimation**					
4.01	**Approximation and estimation**					
4.01a	Rounding	Round numbers to the nearest whole number, ten, hundred, etc or to a given number of significant figures (sf) or decimal places (dp).	Round answers to an appropriate level of accuracy.			
4.01b	Estimation	Estimate or check, without a calculator, the result of a calculation by using suitable approximations. e.g. Estimate, to one significant figure, the cost of 2.8 kg of potatoes at 68p per kg.	Estimate or check, without a calculator, the result of more complex calculations including roots. Use the symbol $\approx$ appropriately. e.g. $\sqrt{\frac{2.9}{0.051\times 0.62}} \approx 10$			

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4.01c	Upper and lower bounds		Use inequality notation to write down an error interval for a number or measurement rounded or truncated to a given degree of accuracy. e.g. If $x = 2.1$ rounded to 1 dp, then $2.05 \leq x < 2.15$. If $x = 2.1$ truncated to 1 dp, then $2.1 \leq x < 2.2$. Apply and interpret limits of accuracy.	Calculate the upper and lower bounds of a calculation using numbers rounded to a known degree of accuracy. e.g. Calculate the area of a rectangle with length and width given to 2 sf. Understand the difference between bounds of discrete and continuous quantities. e.g. If you have 200 cars to the nearest hundred then the number of cars n satisfies: $150 \leq n < 250$ and $150 \leq n \leq 249$.		
OCR 5	**Ratio, Proportion and Rates of Change**					
5.01	**Calculations with ratio**					
5.01a	Equivalent ratios	Find the ratio of quantities in the form $a : b$ and simplify. Find the ratio of quantities in the form $1 : n$. e.g. 50 cm : 1.5 m = 50 : 150 = 1 : 3				

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5.01b	Division in a given ratio	Split a quantity into two parts given the ratio of the parts. e.g. £2.50 in the ratio 2 : 3. Express the division of a quantity into two parts as a ratio. Calculate one quantity from another, given the ratio of the two quantities.	Split a quantity into three or more parts given the ratio of the parts.			
5.01c	Ratios and fractions	Interpret a ratio of two parts as a fraction of a whole. e.g. £9 split in the ratio 2 : 1 gives parts $\frac{2}{3} \times £9$ and $\frac{1}{3} \times £9$. *[see also Fractions of a quantity, 2.01c]*				
5.01d	Solve ratio and proportion problems	Solve simple ratio and proportion problems. e.g. Adapt a recipe for 6 for 4 people. Understand the relationship between ratio and linear functions.				

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5.02	**Direct and inverse proportion**					
5.02a	Direct proportion	Solve simple problems involving quantities in direct proportion including algebraic proportions. e.g. Using equality of ratios, if $y \propto x$, then $\frac{y_1}{y_2} = \frac{x_1}{x_2}$ or $\frac{y_1}{x_1} = \frac{y_2}{x_2}$. Currency conversion problems. *[see also Similar shapes, 9.04c]*	Solve more formal problems involving quantities in direct proportion (i.e. where $y \propto x$). Recognise that if $y = kx$, where k is a constant, then y is proportional to x.	Formulate equations and solve problems involving a quantity in direct proportion to a power or root of another quantity.		
5.02b	Inverse proportion	Solve simple word problems involving quantities in inverse proportion or simple algebraic proportions. e.g. speed–time contexts (if speed is doubled, time is halved).	Solve more formal problems involving quantities in inverse proportion (i.e. where $y \propto \frac{1}{x}$). Recognise that if $y = \frac{k}{x}$, where k is a constant, then y is inversely proportional to x.	Formulate equations and solve problems involving a quantity in inverse proportion to a power or root of another quantity.		

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5.03	**Discrete growth and decay**					
5.03a	Growth and decay	Calculate simple interest including in financial contexts.	Solve problems step-by-step involving multipliers over a given interval, for example compound interest, depreciation, etc. e.g. A car worth £15 000 new depreciating by 30%, 20% and 15% respectively in three years. *[see also Percentage change, 2.03c]*	Express exponential growth or decay as a formula. e.g. Amount £A subject to compound interest of 10% p.a. on £100 as $A = 100 \times 1.1^n$. Solve and interpret answers in growth and decay problems. *[see also Exponential functions, 7.01d, Formulate algebraic expressions, 6.02a]*		
OCR 6	**Algebra**					
6.01	**Algebraic expressions**					
6.01a	Algebraic terminology and proofs	Understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors.	Recognise the difference between an equation and an identity, and show algebraic expressions are equivalent. e.g. Show that $(x+1)^2 + 2 = x^2 + 2x + 3$ Use algebra to construct arguments.	Use algebra to construct proofs and arguments. e.g. Prove that the sum of three consecutive integers is a multiple of 3.		
6.01b	Collecting like terms in sums and differences of terms	Simplify algebraic expressions by collecting like terms. e.g. $2a + 3a = 5a$				

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6.01c	Simplifying products and quotients	Simplify algebraic products and quotients. e.g. $a \times a \times a = a^3$ $2a \times 3b = 6ab$ $a^2 \times a^3 = a^5$ $3a^3 \div a = 3a^2$ *[see also Laws of indices, 3.01c]*		Simplify algebraic products and quotients using the laws of indices. e.g. $a^{\frac{1}{2}} \times 2a^{-3} = 2a^{-\frac{5}{2}}$ $2a^2b^3 \div 4a^{-3}b = \frac{1}{2}a^5b^2$		
6.01d	Multiplying out brackets	Simplify algebraic expressions by multiplying a single term over a bracket. e.g. $2(a+3b) = 2a+6b$ $2(a+3b)+3(a-2b) = 5a$	Expand products of two binomials. e.g. $(x-1)(x-2) = x^2-3x+2$ $(a+2b)(a-b) = a^2+ab-2b^2$	Expand products of more than two binomials. e.g. $(x+1)(x-1)(2x+1) = 2x^3+x^2-2x-1$		
6.01e	Factorising	Take out common factors. e.g. $3a-9b = 3(a-3b)$ $2x+3x^2 = x(2+3x)$	Factorise quadratic expressions of the form x^2+bx+c. e.g. $x^2-x-6 = (x-3)(x+2)$ $x^2-16 = (x-4)(x+4)$ $x^2-3 = \left(x-\sqrt{3}\right)\left(x+\sqrt{3}\right)$	Factorise quadratic expressions of the form ax^2+bx+c (where $a \neq 0$ or 1) e.g. $2x^2+3x-2 = (2x-1)(x+2)$		
6.01f	Completing the square			Complete the square on a quadratic expression. e.g. $x^2+4x-6 = (x+2)^2-10$ $2x^2+5x+1 = 2\left(x+\frac{5}{4}\right)^2-\frac{17}{8}$		

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6.01g	Algebraic fractions			Simplify and manipulate algebraic fractions. e.g. Write $\frac{1}{n-1}+\frac{n}{n+1}$ as a single fraction. Simplify $\frac{n^2+2n}{n^2+n-2}$.		
6.02	**Algebraic formulae**					
6.02a	Formulate algebraic expressions		Formulate simple formulae and expressions from real-world contexts. e.g. Cost of car hire at £50 per day plus 10p per mile. The perimeter of a rectangle when the length is 2 cm more than the width.	*[See, for example, Direct proportion, 5.02a, Inverse proportion, 5.02b, Growth and decay, 5.03a]*		
6.02b	Substitute numerical values into formulae and expressions	Substitute positive numbers into simple expressions and formulae to find the value of the subject. e.g. Given that $v = u + at$, find v when $t = 1$, $a = 2$ and $u = 7$.	Substitute positive or negative numbers into more complex formulae, including powers, roots and algebraic fractions. e.g. $v = \sqrt{u^2 + 2as}$ with $u = 2.1$, $s = 0.18$, $a = {}^{-}9.8$.			

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6.02c	Change the subject of a formula	Rearrange formulae to change the subject, where the subject appears once only. e.g. Make d the subject of the formula $c = \pi d$. Make x the subject of the formula $y = 3x - 2$.	Rearrange formulae to change the subject, including cases where the subject appears twice, or where a power or reciprocal of the subject appears. e.g. Make t the subject of the formulae (i) $s = \frac{1}{2}at^2$ (ii) $v = \frac{x}{t}$ (iii) $2ty = t + 1$	*[Examples may include manipulation of algebraic fractions, 6.01g]*		
6.02d	Recall and use standard formulae	Recall and use: Circumference of a circle $2\pi r = \pi d$ Area of a circle πr^2	Recall and use: Pythagoras' theorem $a^2 + b^2 = c^2$ Trigonometry formulae $\sin\theta = \frac{o}{h}$, $\cos\theta = \frac{a}{h}$, $\tan\theta = \frac{o}{a}$	Recall and use: The quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$ Area of a triangle $\frac{1}{2}ab\sin C$		

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6.02e	Use kinematics formulae	Use: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from position when $t = 0$ and t is time taken.				
6.03	**Algebraic equations**					
6.03a	Linear equations in one unknown	Solve linear equations in one unknown algebraically. e.g. Solve $3x - 1 = 5$.	Set up and solve linear equations in mathematical and non-mathematical contexts, including those with the unknown on both sides of the equation. e.g. Solve $5(x - 1) = 4 - x$. Interpret solutions in context.	*[Examples may include manipulation of algebraic fractions, 6.01g]*		
6.03b	Quadratic equations		Solve quadratic equations with coefficient of x^2 equal to 1 by factorising. e.g. Solve $x^2 - 5x + 6 = 0$. Find x for an x cm by $(x + 3)$ cm rectangle of area 40 cm^2.	Know the quadratic formula. Rearrange and solve quadratic equations by factorising, completing the square or using the quadratic formula. e.g. $2x^2 = 3x + 5$ $\frac{2}{x} - \frac{2}{x+1} = 1$		

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6.03c	Simultaneous equations		Set up and solve two linear simultaneous equations in two variables algebraically. e.g. Solve simultaneously $2x+3y=18$ and $y=3x-5$	Set up and solve two simultaneous equations (one linear and one quadratic) in two variables algebraically. e.g. Solve simultaneously $x^2+y^2=50$ and $2y=x+5$		
6.03d	Approximate solutions using a graph	Use a graph to find the approximate solution of a linear equation.	Use graphs to find approximate roots of quadratic equations and the approximate solution of two linear simultaneous equations.	Know that the coordinates of the points of intersection of a curve and a straight line are the solutions to the simultaneous equations for the line and curve.		
6.03e	Approximate solutions by iteration			Find approximate solutions to equations using systematic sign-change methods (for example, decimal search or interval bisection) when there is no simple analytical method of solving them. Specific methods will not be requested in the assessment.		

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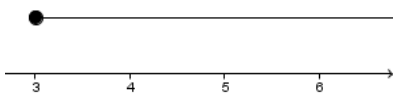
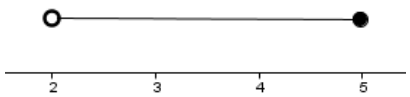
6.04	**Algebraic inequalities**					
6.04a	Inequalities in one variable	Understand and use the symbols <, ≤, > and ≥	Solve linear inequalities in one variable, expressing solutions on a number line using the conventional notation. e.g. $2x+1\geq 7$  $1<3x-5\leq 10$  	Solve quadratic inequalities in one variable. e.g. $x^2-2x<3$ Express solutions in set notation. e.g. $\{x : x\geq 3\}$ $\{x : 2<x\leq 5\}$ *[See also Polynomial and exponential functions, 7.01c]*		
6.04b	Inequalities in two variables			Solve (several) linear inequalities in two variables, representing the solution set on a graph. *[See also Straight line graphs, 7.02a]*		

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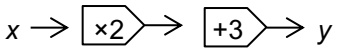
6.05	**Language of functions**					
6.05a	Functions	Interpret, where appropriate, simple expressions as functions with inputs and outputs. e.g. $y = 2x + 3$ as  		Interpret the reverse process as the 'inverse function'. Interpret the succession of two functions as a 'composite function'. [Knowledge of function notation will not be required] *[see also Translations and reflections, 7.03a]*		
6.06	**Sequences**					
6.06a	Generate terms of a sequence	Generate a sequence by spotting a pattern or using a term-to-term rule given algebraically or in words. e.g. Continue the sequences 1, 4, 7, 10, ... 1, 4, 9, 16, ... Find a position-to-term rule for simple arithmetic sequences, algebraically or in words. e.g. 2, 4, 6, … $2n$ 3, 4, 5, … $n + 2$	Generate a sequence from a formula for the nth term. e.g. nth term = $n^2 + 2n$ gives 3, 8, 15, … Find a formula for the nth term of an arithmetic sequence. e.g. 40, 37, 34, 31, … $43 - 3n$	Use subscript notation for position-to-term and term-to-term rules. e.g. $x_n = n + 2$ $x_{n+1} = 2x_n - 3$ Find a formula for the nth term of a quadratic sequence. e.g. 0, 3, 10, 21, … $u_n = 2n^2 - 3n + 1$		
6.06b	Special sequences	Recognise sequences of triangular, square and cube numbers, and simple arithmetic progressions.	Recognise Fibonacci and quadratic sequences, and simple geometric progressions (r^n where n is an integer and r is a rational number > 0).	Generate and find nth terms of other sequences. e.g. $1, \sqrt{2}, 2, 2\sqrt{2}, \ldots$ $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \ldots$		

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OCR 7	**Graphs of Equations and Functions**					
7.01	**Graphs of equations and functions**					
7.01a	*x*- and *y*-coordinates	Work with *x*- and *y*-coordinates in all four quadrants.				
7.01b	Graphs of equations and functions	Use a table of values to plot graphs of linear and quadratic functions. e.g. $y = 2x + 3$ $y = 2x^2 + 1$	Use a table of values to plot other polynomial graphs and reciprocals. e.g. $y = x^3 - 2x$ $y = x + \frac{1}{x}$ $2x + 3y = 6$	Use a table of values to plot exponential graphs. e.g. $y = 3 \times 1.1^x$		
7.01c	Polynomial functions	Recognise and sketch the graphs of simple linear and quadratic functions. e.g. $y = 2$, $x = 1$, $y = 2x$, $y = x^2$	Recognise and sketch graphs of: $y = x^3$, $y = \frac{1}{x}$. Identify intercepts and, using symmetry, the turning point of graphs of quadratic functions. Find the roots of a quadratic equation algebraically.	Sketch graphs of quadratic functions, identifying the turning point by completing the square.		
7.01d	Exponential functions			Recognise and sketch graphs of exponential functions in the form $y = k^x$ for positive k.		
7.01e	Trigonometric functions			Recognise and sketch the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$.		
7.01f	Equations of circles			Recognise and use the equation of a circle with centre at the origin.		

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7.02	**Straight line graphs**					
7.02a	Straight line graphs	Find and interpret the gradient and intercept of straight lines, graphically and using $y = mx + c$.	Use the form $y = mx + c$ to find and sketch equations of straight lines. Find the equation of a line through two given points, or through one point with a given gradient.	Identify the solution sets of linear inequalities in two variables, using the convention of dashed and solid lines.		
7.02b	Parallel and perpendicular lines		Identify and find equations of parallel lines.	Identify and find equations of perpendicular lines. Calculate the equation of a tangent to a circle at a given point. *[See also Equations of circles, 7.01f]*		

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7.03	**Transformations of curves and their equations**					
7.03a	Translations and reflections			Identify and sketch translations and reflections of a given graph (or the graph of a given equation). [Knowledge of function notation will not be required] *[see also Functions, 6.05a]* e.g. Sketch the graph of $y = \sin x + 2$ $y = (x+2)^2 - 1$ $y = -x^2$		
7.04	**Interpreting graphs**					
7.04a	Graphs of real-world contexts	Construct and interpret graphs in real-world contexts. e.g. distance-time money conversion temperature conversion *[see also Direct proportion, 5.02a, Inverse proportion, 5.02b]*	Recognise and interpret graphs that illustrate direct and inverse proportion.			

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7.04b	Gradients	Understand the relationship between gradient and ratio.	Interpret straight line gradients as rates of change. e.g. Gradient of a distance-time graph as a velocity.	Calculate or estimate gradients of graphs and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs. Apply the concepts of average and instantaneous rate of change (gradients of chords or tangents) in numerical, algebraic and graphical contexts.		
7.04c	Areas			Calculate or estimate areas under graphs and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs.		

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OCR 8	**Basic Geometry**					
8.01	**Conventions, notation and terms** Learners will be expected to be familiar with the following geometrical skills, conventions, notation and terms, which will be assessed in questions at both tiers.					
8.01a	2D and 3D shapes	Use the terms points, lines, line segments, vertices, edges, planes, parallel lines, perpendicular lines.				
8.01b	Angles	Know the terms acute, obtuse, right and reflex angles. Use the standard conventions for labelling and referring to the sides and angles of triangles. e.g. AB, ∠ABC, angle ABC, *a* is the side opposite angle A				
8.01c	Polygons	Know the terms: • regular polygon • scalene, isosceles and equilateral triangle • quadrilateral, square, rectangle, kite, rhombus, parallelogram, trapezium • pentagon, hexagon, octagon.				
8.01d	Polyhedra and other solids	Recognise the terms face, surface, edge, and vertex, cube, cuboid, prism, cylinder, pyramid, cone and sphere.				
8.01e	Diagrams	Draw diagrams from written descriptions as required by questions.				
8.01f	Geometrical instruments	Use a ruler to construct and measure straight lines. Use a protractor to construct and measure angles. Use compasses to construct circles.				
8.01g	*x*- and *y*-coordinates	Use *x*- and *y*-coordinates in plane geometry problems, including transformations of simple shapes.				

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8.02	**Ruler and compass constructions**					
8.02a	Perpendicular bisector		Construct the perpendicular bisector and midpoint of a line segment.			
8.02b	Angle bisector		Construct the bisector of an angle formed from two lines.			
8.02c	Perpendicular from a point to a line		Construct the perpendicular from a point to a line. Construct the perpendicular to a line at a point. Know that the perpendicular distance from a point to a line is the shortest distance to the line.			
8.02d	Loci		Apply ruler and compass constructions to construct figures and identify the loci of points, to include real-world problems. Understand the term ‘equidistant’.			
8.03	**Angles**					
8.03a	Angles at a point	Know and use the sum of the angles at a point is 360°.	Apply these angle facts to find angles in rectilinear figures, and to justify results in simple proofs. e.g. The sum of the interior angles of a triangle is 180°.	Apply these angle properties in more formal proofs of geometrical results.		
8.03b	Angles on a line	Know that the sum of the angles at a point on a line is 180°.				

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8.03c	Angles between intersecting and parallel lines	Know and use: vertically opposite angles are equal alternate angles on parallel lines are equal corresponding angles on parallel lines are equal.	Apply these angle facts to find angles in rectilinear figures, and to justify results in simple proofs. e.g. The sum of the interior angles of a triangle is 180°.	Apply these angle properties in more formal proofs of geometrical results.		
8.03d	Angles in polygons	Derive and use the sum of the interior angles of a triangle is 180°. Derive and use the sum of the exterior angles of a polygon is 360°. Find the sum of the interior angles of a polygon. Find the interior angle of a regular polygon.				
8.04	**Properties of polygons**					
8.04a	Properties of a triangle	Know the basic properties of isosceles, equilateral and right-angled triangles. Give geometrical reasons to justify these properties.	Use these facts to find lengths and angles in rectilinear figures and in simple proofs.	Use these facts in more formal proofs of geometrical results, for example circle theorems.		

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8.04b	Properties of quadrilaterals	Know the basic properties of the square, rectangle, parallelogram, trapezium, kite and rhombus. Give geometrical reasons to justify these properties.	Use these facts to find lengths and angles in rectilinear figures and in simple proofs.	Use these facts in more formal proofs of geometrical results, for example circle theorems.		
8.04c	Symmetry	Identify reflection and rotation symmetries of triangles, quadrilaterals and other polygons.				
8.05	**Circles**					
8.05a	Circle nomenclature	Understand and use the terms centre, radius, chord, diameter and circumference.	Understand and use the terms tangent, arc, sector and segment.			
8.05b	Angles subtended at centre and circumference			Apply and prove: the angle subtended by an arc at the centre is twice the angle at the circumference.		
8.05c	Angle in a semicircle			Apply and prove: the angle on the circumference subtended by a diameter is a right angle.		
8.05d	Angles in the same segment			Apply and prove: two angles in the same segment are equal.		
8.05e	Angle between radius and chord			Apply and prove: a radius or diameter bisects a chord if and only if it is perpendicular to the chord.		

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8.05f	Angle between radius and tangent			Apply and prove: for a point P on the circumference, the radius or diameter through P is perpendicular to the tangent at P.		
8.05g	The alternate segment theorem			Apply and prove: for a point P on the circumference, the angle between the tangent and a chord through P equals the angle subtended by the chord in the opposite segment.		
8.05h	Cyclic quadrilaterals			Apply and prove: the opposite angles of a cyclic quadrilateral are supplementary.		
8.06	**Three-dimensional shapes**					
8.06a	3-dimensional solids	Recognise and know the properties of the cube, cuboid, prism, cylinder, pyramid, cone and sphere.				
8.06b	Plans and elevations	Interpret plans and elevations of simple 3D solids.	Construct plans and elevations of simple 3D solids, and representations (e.g. using isometric paper) of solids from plans and elevations.			

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OCR 9	**Congruence and Similarity**					
9.01	**Plane isometric transformations**					
9.01a	Reflection	Reflect a simple shape in a given mirror line and identify the mirror line from a shape and its image.	Identify a mirror line $x = a$, $y = b$ or $y = \pm x$ from a simple shape and its image under reflection.			
9.01b	Rotation	Rotate a simple shape clockwise or anti-clockwise through a multiple of 90° about a given centre of rotation.	Identify the centre, angle and sense of a rotation from a simple shape and its image under rotation.			
9.01c	Translation	Use a column vector to describe a translation of a simple shape and perform a specified translation.				
9.01d	Combinations of transformations			Perform a sequence of isometric transformations (reflections, rotations or translations), on a simple shape. Describe the resulting transformation and the changes and invariance achieved.		
9.02	**Congruence**					
9.02a	Congruent triangles	Identify congruent triangles.	Prove that two triangles are congruent using the cases: 3 sides (SSS) 2 angles, 1 side (ASA) 2 sides, included angle (SAS) Right angle, hypotenuse, side (RHS).			

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9.02b	Applying congruent triangles		Apply congruent triangles in calculations and simple proofs. e.g. The base angles of an isosceles triangle are equal.			
9.03	**Plane vector geometry**					
9.03a	Vector arithmetic		Understand addition, subtraction and scalar multiplication of vectors.	Use vectors in geometric arguments and proofs.		
9.03b	Column vectors		Represent a 2-dimensional vector as a column vector and draw column vectors on a square or coordinate grid.			
9.04	**Similarity**					
9.04a	Similar triangles	Identify similar triangles.	Prove that two triangles are similar.			
9.04b	Enlargement	Enlarge a simple shape from a given centre using a whole number scale factor and identify the scale factor of an enlargement.	Identify the centre and scale factor (including fractional scale factors) of an enlargement of a simple shape and perform such an enlargement on a simple shape.	Perform and recognise enlargements with negative scale factors.		
9.04c	Similar shapes	Compare lengths, areas and volumes using ratio notation and scale factors.	Apply similarity to calculate unknown lengths in similar figures. *[see also Direct proportion, 5.02a]*	Understand the relationship between lengths, areas and volumes of similar shapes. *[see also Direct proportion, 5.02a]*		

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OCR 10	**Mensuration**					
10.01	**Units and measurement**					
10.01a	Units of measurement	Use and convert standard units of measurement for length, area, volume/capacity, mass, time and money.	Use and convert standard units in algebraic contexts.			
10.01b	Compound units	Use and convert simple compound units (e.g. for speed, rates of pay, unit pricing). Know and apply in simple cases: speed = distance ÷ time	Use and convert other compound units (e.g. density, pressure). Know and apply: density = mass ÷ volume Use and convert compound units in algebraic contexts.			
10.01c	Maps and scale drawings	Use the scale of a map, and work with bearings. Construct and interpret scale drawings.				
10.02	**Perimeter calculations**					
10.02a	Perimeter of rectilinear shapes	Calculate the perimeter of rectilinear shapes.				
10.02b	Circumference of a circle	Know and apply the formula circumference $= 2\pi r = \pi d$ to calculate the circumference of a circle.	Calculate the arc length of a sector of a circle given its angle and radius.			
10.02c	Perimeter of composite shapes	Apply perimeter formulae in calculations involving the perimeter of composite 2D shapes.				

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10.03	**Area calculations**					
10.03a	Area of a triangle	Know and apply the formula: $\text{area} = \frac{1}{2}\text{base} \times \text{height}$.		Know and apply the formula: $\text{area} = \frac{1}{2}ab\sin C$.		
10.03b	Area of a parallelogram	Know and apply the formula: $\text{area} = \text{base} \times \text{height}$. [Includes area of a rectangle]				
10.03c	Area of a trapezium	Calculate the area of a trapezium.				
10.03d	Area of a circle	Know and apply the formula $\text{area} = \pi r^2$ to calculate the area of a circle.	Calculate the area of a sector of a circle given its angle and radius.			
10.03e	Area of composite shapes	Apply area formulae in calculations involving the area of composite 2D shapes.				
10.04	**Volume and surface area calculations**					
10.04a	Polyhedra	Calculate the surface area and volume of cuboids and other right prisms (including cylinders).				
10.04b	Cones and spheres		Calculate the surface area and volume of spheres, cones and simple composite solids (formulae will be given).			
10.04c	Pyramids		Calculate the surface area and volume of a pyramid (the formula $\frac{1}{3}$ area of base × height will be given).			

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10.05	**Triangle mensuration**					
10.05a	Pythagoras' theorem		Know, derive and apply Pythagoras' theorem $a^2 + b^2 = c^2$ to find lengths in right-angled triangles in 2D figures.	Apply Pythagoras' theorem in more complex figures, including 3D figures.		
10.05b	Trigonometry in right-angled triangles		Know and apply the trigonometric ratios, sinθ, cosθ and tanθ and apply them to find angles and lengths in right-angled triangles in 2D figures. *[see also Similar shapes, 9.04c]*	Apply the trigonometry of right-angled triangles in more complex figures, including 3D figures.		
10.05c	Exact trigonometric ratios		Know the exact values of sinθ and cosθ for θ = 0°, 30°, 45°, 60° and 90°. Know the exact value of tanθ for θ = 0°, 30°, 45° and 60°.			
10.05d	Sine rule			Know and apply the sine rule, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, to find lengths and angles.		
10.05e	Cosine rule			Know and apply the cosine rule, $a^2 = b^2 + c^2 - 2bc\cos A$, to find lengths and angles.		

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OCR 11	**Probability**					
11.01	**Basic probability and experiments**					
11.01a	The probability scale	Use the 0-1 probability scale as a measure of likelihood of random events, for example, 'impossible' with 0, 'evens' with 0.5, 'certain' with 1.				
11.01b	Relative frequency	Record, describe and analyse the relative frequency of outcomes of repeated experiments using tables and frequency trees.				
11.01c	Relative frequency and probability	Use relative frequency as an estimate of probability.	Understand that relative frequencies approach the theoretical probability as the number of trials increases.			

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11.01d	Equally likely outcomes and probability	Calculate probabilities, expressed as fractions or decimals, in simple experiments with equally likely outcomes, for example flipping coins, rolling dice, etc. Apply ideas of randomness and fairness in simple experiments. Calculate probabilities of simple combined events, for example rolling two dice and looking at the totals. Use probabilities to calculate the number of expected outcomes in repeated experiments.				
11.02	**Combined events and probability diagrams**					
11.02a	Sample spaces	Use tables and grids to list the outcomes of single events and simple combinations of events, and to calculate theoretical probabilities. e.g. Flipping two coins. Finding the number of orders in which the letters E, F and G can be written.	Use sample spaces for more complex combinations of events e.g. Recording the outcomes for sum of two dice. Problems with two spinners.	Recognise when a sample space is the most appropriate form to use when solving a complex probability problem. Use the most appropriate diagrams to solve unstructured questions where the route to the solution is less obvious.		
11.02b	Enumeration	Use systematic listing strategies.		Use the product rule for counting numbers of outcomes of combined events.		

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11.02c	Venn diagrams and sets	Use a two-circle Venn diagram to enumerate sets and use this to calculate related probabilities. Use simple set notation to describe simple sets of numbers or objects. e.g. A = {even numbers} B = {mathematics learners} C = {isosceles triangles}	Construct a Venn diagram to classify outcomes and calculate probabilities. Use set notation to describe a set of numbers or objects. e.g. D = $\{x : 1 < x < 3\}$ E = {x : x is a factor of 280}	Construct tree diagrams, two-way tables or Venn diagrams to solve more complex probability problems (including conditional probabilities; structure for diagrams may not be given).		
11.02d	Tree diagrams		Use tree diagrams to enumerate sets and to record the probabilities of successive events (tree frames may be given and in some cases will be partly completed).			
11.02e	The addition law of probability	Use the addition law for mutually exclusive events. Use p(A) + p(*not* A) = 1	Derive or informally understand and apply the formula p(A *or* B) = p(A) + p(B) − p(A *and* B)			

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11.02f	The multiplication law of probability and conditional probability		Use tree diagrams and other representations to calculate the probability of independent and dependent combined events.	Understand the concept of conditional probability and calculate it from first principles in known contexts. e.g. In a random cut of a pack of 52 cards, calculate the probability of drawing a diamond, given a red card is drawn. Derive or informally understand and apply the formula p(A *and* B) = p(A *given* B)p(B). Know that events A and B are independent if and only if p(A *given* B) = p(A).		
OCR 12	**Statistics**					
12.01	**Sampling**					
12.01a	Populations and samples		Define the population in a study and understand the difference between population and sample. Infer properties of populations or distributions from a sample. Understand what is meant by simple random sampling, and bias in sampling.			

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12.02	**Interpreting and representing data**					
12.02a	Categorical and numerical data	Interpret and construct charts appropriate to the data type; including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data. Interpret multiple and composite bar charts.	Design tables to classify data. Interpret and construct line graphs for time series data and identify trends (e.g. seasonal variations).			
12.02b	Grouped data			Interpret and construct diagrams for grouped data as appropriate, i.e. cumulative frequency graphs and histograms (with either equal or unequal class intervals).		

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12.03	**Analysing data**					
12.03a	Summary statistics	Calculate the mean, mode, median and range for ungrouped data. Find the modal class, and calculate estimates of the range, mean and median for grouped data, and understand why they are estimates. Describe a population using statistics. Make simple comparisons. Compare data sets using 'like for like' summary values. Understand the advantages and disadvantages of summary values.		Calculate estimates of mean, median, mode, range, quartiles and interquartile range from graphical representation of grouped data. Draw and interpret box plots. Use the median and interquartile range to compare distributions.		
12.03b	Misrepresenting data	Recognise graphical misrepresentation through incorrect scales, labels, etc.				

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12.03c	Bivariate data	Plot and interpret scatter diagrams for bivariate data. Recognise correlation.	Interpret correlation within the context of the variables and appreciate the distinction between correlation and causation. Draw a line of best fit by eye and use it to make predictions. Interpolate and extrapolate from data and be aware of the limitations of these techniques.			
12.03d	Outliers	Identify an outlier in simple cases.	Appreciate there may be errors in data from values (outliers) that do not 'fit'. Recognise outliers on a scatter graph.			

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