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The
EDEXCELCERTIFICATE
Mathematics

Scheme of work: Bridging to GCE

Teaching the Level 1/Level 2 Certificate in Mathematics alongside Core Mathematics 1

Edexcel Level 1/Level 2 Certificate in Mathematics (KMA0)
First examination 2012

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Acknowledgements

This document has been produced by Edexcel on the basis of consultation with teachers, examiners, consultants and other interested parties. Edexcel would like to thank all those who contributed their time and expertise to its development.

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Publications Code UG027243

Introduction

The Edexcel Level 1/Level 2 Certificate in Mathematics is designed for use in schools and colleges. It is part of a suite of qualifications offered by Edexcel.

About this scheme of work

It provides opportunities for you to extend and enrich the mathematical learning of your **Higher Tier** students. It is assumed that Higher Tier students have knowledge of all Foundation Tier content. This scheme of work should be used together with the higher tier course planner in the Level 1/Level 2 Certificate in Mathematics Teacher's Guide.

Through teaching the Edexcel GCE Core Mathematics 1 unit alongside the Higher Tier content, you will be able to prepare your Higher Tier students for the transition from Level 2 Mathematics to AS Mathematics, and beyond. It also enables you to extend several topic areas of the Mathematics Certificate Higher Tier content.

This scheme of work introduces the following topics from Edexcel GCE Unit Core Mathematics 1 in the **first year** of course:

- Algebra and functions
- Coordinate Geometry

The remaining topics from Edexcel GCE Unit Core Mathematics 1 could be taught during the **second year** of the course:

- Sequences and series
- Differentiation
- Integration.

This means that the scheme of work **extends** the following topic areas:

- 1.4 Powers and roots
- 2.2 Algebraic manipulation
- 2.7 Quadratic equations
- 2.8 Inequalities
- 3.3 Graphs.

It introduces **new concepts** within the following topic area:

- 3.4 Calculus – Differentiation.

It also introduces the following **topic areas not included in the Certificate**:

- Sequences and series
- Integration.

Contents

Mapping of Certificate in Mathematics Higher tier content to GCE Core Mathematics 1 unit content

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
1 Numbers and the number system	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
1.1 Integers	See Foundation Tier				
1.2 Fractions	See Foundation Tier				
1.3 Decimals	convert recurring decimals into fractions	$0.\dot{3} = \frac{1}{3}$, $0.2333\ldots = \frac{21}{90}$			
1.4 Powers and roots	understand the meaning of surds manipulate surds, including rationalising the denominator where the denominator is a pure surd use index laws to simplify and evaluate numerical expressions involving integer, fractional and negative powers	Express in the form $a\sqrt{2}$: $\frac{2}{\sqrt{8}}$, $\sqrt{18} + 3\sqrt{2}$ Express in the form $a + b\sqrt{2}$: $(3 + 5\sqrt{2})^2$ Evaluate: $\sqrt[3]{8^2}$, $625^{-\frac{1}{2}}$, $\left(\frac{1}{25}\right)^{\frac{3}{2}}$	***Extension topic*** ***Extension topic***	**Use and manipulation of surds** **Laws of indices for all rational exponents**	**Students should be able to rationalise denominators** **The equivalence of $a^{\frac{m}{n}}$ and $\sqrt[n]{a^m}$ should be known**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
1 Numbers and the number system	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
1.4 Powers and roots *continued*	evaluate Highest Common Factors (HCF) and Lowest Common Multiples (LCM)				
1.5 Set language and notation	understand sets defined in algebraic terms understand and use subsets understand and use the complement of a set	If A is a subset of B, then $A \subset B$ Use the notation A'			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra					
1 Numbers and the number system	**Students should be taught to:**	**Notes**			
1.5 Set language and notation ***continued***	use Venn diagrams to represent sets and the number of elements in sets use the notation $n(A)$ for the number of elements in the set A use sets in practical situations				
1.6 Percentages	use reverse percentages repeated percentage change	In a sale, prices were reduced by 30%. The sale price of an item was £17.50. Calculate the original price of the item Calculate the total percentage increase when an increase of 30% is followed by a decrease of 20%			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra					
1 Numbers and the number system	**Students should be taught to:**	**Notes**			
1.6 Percentages *continued*	solve compound interest problems	To include depreciation			
1.7 Ratio and proportion	See Foundation Tier.				
1.8 Degree of accuracy	solve problems using upper and lower bounds where values are given to a degree of accuracy	The dimensions of a rectangle are 12cm and 8cm to the nearest cm. Calculate, to 3 significant figures, the smallest possible area as a percentage of the largest possible area			
1.9 Standard form	express numbers in the form $a \times 10^n$ where n is an integer and $1 \leq a < 10$ solve problems involving standard form	$150\,000\,000 = 1.5 \times 10^8$			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
1 Numbers and the number system	**Students should be taught to:**	**Notes**			
1.10 Applying number	See Foundation Tier				
1.11 Electronic calculators	See Foundation Tier				
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
2.1 Use of symbols	use index notation involving fractional, negative and zero powers	Simplify: $\left(64t^3\right)^{\frac{2}{3}}$, $\frac{a^{\frac{1}{2}} \times a^{\frac{3}{4}}}{a^{\frac{1}{3}}}$	***Extension topic***	**laws of indices for all rational exponents**	**The equivalence of $a^{\frac{m}{n}}$ and $\sqrt[n]{a^m}$ should be known**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
2.2 Algebraic manipulation	expand the product of two linear expressions understand the concept of a quadratic expression and be able to factorise such expressions manipulate algebraic fractions where the numerator and/or the denominator can be numeric, linear or quadratic	$(2x+3)(3x-1)$ $(2x-y)(3x+y)$ Factorise: $x^2+12x-45$ $6x^2-5x-4$ Express as a single fraction: $\frac{x+1}{3}+\frac{x-3}{4}$ $\frac{3(4x-1)}{2}-\frac{2(5x+3)}{3}$ $\frac{3}{2x}-\frac{4}{3x}$, $\frac{3}{1-x}+\frac{2}{1+x}$ $\frac{x+1}{x+2}-\frac{x-2}{x-1}$ Factorise and simplify: $\frac{x^2-4x}{x^2-x-12}$	***Extension topic***	**Algebraic manipulation of polynomials, including expanding brackets and collecting like terms, factorisation**	**Students should be able to use brackets. Factorisation of polynomials of degree n, $n \leq 3$, eg x^3+4x^2+3x. The notation $f(x)$. *(Use of the factor theorem is not required)***

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**			
2.3 Expressions and formulae	understand the process of manipulating formulae to change the subject, to include cases where the subject may appear twice, or a power of the subject occurs	$v^2 = u^2 + 2gs$; make s the subject $m = \frac{1+at}{1-at}$; make t the subject $V = \frac{4}{3}\pi r^3$; make r the subject $T = 2\pi\sqrt{\frac{l}{g}}$; make l the subject			
2.4 Linear equations	See Foundation Tier.	$\frac{17-x}{4} = 2-x$, $\frac{(2x-3)}{6} + \frac{(x+2)}{3} = \frac{5}{2}$			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**			
2.5 Proportion	set up problems involving direct or inverse proportion and relate algebraic solutions to graphical representation of the equations	To include only the following: $y \propto x$, $y \propto \frac{1}{x}$, $y \propto x^2$, $y \propto \frac{1}{x^2}$, $y \propto x^3$, $y \propto \sqrt{x}$			
2.6 Simultaneous linear equations	calculate the exact solution of two simultaneous equations in two unknowns interpret the equations as lines and the common solution as the point of intersection	$3x - 4y = 7$ $2x - y = 8$ $2x + 3y = 17$ $3x - 5y = 35$			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
2.7 Quadratic equations	solve quadratic equations by factorisation	$2x^2 - 3x + 1 = 0$, $x(3x - 2) = 5$			
	solve quadratic equations by using the quadratic formula		***New topic***	**Completing the square. Solve quadratic equations**	**Solve quadratic equations by completing the square**
	form and solve quadratic equations from data given in a context				
	solve simultaneous equations in two unknowns, one equation being linear and the other being quadratic	$y = 2x - 11$ and $x^2 + y^2 = 25$ $y = 11x - 2$ and $y = 5x^2$	***New topic***	**Simultaneous equations: analytical solution by substitution**	**For example, where one equation is linear and one equation is quadratic**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
2 Equations, formulae and identities	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
2.8 Inequalities	solve quadratic inequalities in one unknown and represent the solution set on a number line identify harder examples of regions defined by linear inequalities	For example, $ax+b>cx+d$, $x^2 \leq 25, 4x^2 > 25$ Shade the region defined by the inequalities $x \leq 4$, $y \leq 2x+1$, $5x+2y \leq 20$	***New topic***	**Solution of linear and quadratic inequalities**	**For example,** $ax+b, cx+d,$ $px^2+qx+r \geq 0$, $px^2+qx+r < ax+b$

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Sequences and series**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**3 Sequences and series**	**What students need to learn**	**Notes**
3.1 Sequences	use linear expressions to describe the nth term of an arithmetic sequence	1, 3, 5, 7, 9, … nth term $= 2n - 1$	***New topic***	**Sequences, including those given by a formula for the nth term and those generated by a simple relation of the form** $x_{n+1} = \mathrm{f}(x_n)$	
			New topic	**Arithmetic series, including the formula for the sum of the first n natural numbers**	**The general term and the sum of n terms of the series are required. The proof of the sum formula should be known** **Understanding of Σ notation will be expected**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
3.2 Function notation	understand the concept that a function is a mapping between elements of two sets use function notations of the form $f(x) = \ldots$ and $f : x \mapsto \ldots$ understand the terms domain and range and which values may need to be excluded from the domain understand and find the composite function fg and the inverse function f^{-1}	$f(x) = \frac{1}{x}$, exclude $x = 0$ $f(x) = \sqrt{x+3}$, exclude $x < -3$ 'fg' will mean '*do* g *first, then* f'			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra					
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**			
3.3 Graphs	plot and draw graphs with equation: $y = Ax^3 + Bx^2 + Cx + D$ in which: (i) the constants are integers and some could be zero (ii) the letters x and y can be replaced with any other two letters	$y = x^3$, $y = 3x^3 - 2x^2 + 5x - 4$, $y = 2x^3 - 6x + 2$, $V = 60w(60 - w)$	***New topic***	**Quadratic functions and their graphs** **The discriminant of a quadratic function**	

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra					
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**			
3.3 Graphs ***continued***	or: $y = Ax^3 + Bx^2 + Cx + D + E/x + F/x^2$ in which: (i) the constants are numerical and at least three of them are zero (ii) the letters x and y can be replaced with any other two letters find the gradients of non-linear graphs	 $y = \frac{1}{x}$, $x \neq 0$, $y = 2x^2 + 3x + 1/x$, $x \neq 0$, $y = \frac{1}{x}(3x^2 - 5)$, $x \neq 0$, $W = \frac{5}{d^2}$, $d \neq 0$ By drawing a tangent			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Algebra and functions**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**1 Algebra and functions**	**What students need to learn**	**Notes**
3.3 Graphs ***continued***	find the intersection points of two graphs, one linear (y_1) and one non-linear (y_2), and recognise that the solutions correspond to the solutions of $y_2 - y_1 = 0$	The x-values of the intersection of the two graphs: $y = 2x + 1$ $y = x^2 + 3x - 2$ are the solutions of: $x^2 + x - 3 = 0$	***Extension topic***	**Graphs of functions; sketching curves defined by simple equations. Geometrical interpretation of algebraic solution of equations. Use intersection points of graphs of functions to solve equations**	**Functions to include simple cubic functions and the reciprocal function $y = \frac{k}{x}$, with $x \neq 0$ Knowledge of the term asymptote is expected**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra					
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**			
3.3 Graphs ***continued***	calculate the gradient of a straight line given the Cartesian coordinates of two points recognise that equations of the form $y = mx + c$ are straight line graphs with gradient m and intercept on the y axis at the point $(0, c)$ find the equation of a straight line parallel to a given line	Similarly, the x-values of the intersection of the two graphs: $y = 5$ $y = x^3 - 3x^2 + 7$ are the solutions of: $x^3 - 3x^2 + 2 = 0$ Find the equation of the straight line through (1, 7) and (2, 9)	***Extension topic***	**Equations of a straight line, including the forms** $y_1 - y_2 = m(x_1 - x_2)$ **and** $ax + by + c = 0$	**To include:** **1) the equation of a line through two given points** **2) the equation of a line parallel (or perpendicular) to a given line through a given point.**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Coordinate geometry in the (x, y)**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**2 Coordinate geometry in the (x, y)**	**What students need to learn**	**Notes**
			Extension topic	**Conditions for two straight lines to be parallel or perpendicular to each other**	**For example, the line perpendicular to the line $3x + 4y = 18$, through the point $(2, 3)$, has the equation $y - 3 = \frac{4}{3}(x - 2)$**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Coordinate geometry in the (x, y)**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**2 Coordinate geometry in the (x, y)**	**What students need to learn**	**Notes**
3.3 Graphs ***continued***			***Extension topic***	**Knowledge of the effect of simple transformations on the graph of $y = f(x)$ as represented by $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$**	**Students should be able to apply one of these transformations to any function (quadratics, cubics, reciprocal) and sketch the resulting graph.** **Given the graph of any function $y = f(x)$ students should be able to sketch the graph resulting from one of these transformations.**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Differentiation**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**4 Differentiation**	**What students need to learn**	**Notes**
3.4 Calculus Differentiation	understand the concept of a variable rate of change differentiate integer powers of x determine gradients, rates of change, turning points (maxima and minima) by differentiation and relate these to graphs distinguish between maxima and minima by considering the general shape of the graph	$y = x + \frac{9}{x}$ Find the Cartesian coordinates of the maximum and minimum points	***Extension topic***	**The derivative of $f(x)$ as the gradient of the tangent to the graph of $y = f(x)$ at a point; the gradient of the tangent as a limit; interpretation as a rate of change; second order derivatives**	**For example, knowledge that $\frac{dy}{dx}$ is the rate of change of y with respect to x**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Differentiation**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**4 Differentiation *continued***	**What students need to learn**	**Notes**
3.4 Calculus Differentiation *continued*	apply calculus to linear kinematics and to other simple practical problems	The displacement, s metres, of a particle from a fixed point 0 after t seconds is given by: $s = 24t^2 - t^3$, $0 \leq t \leq 20$ Find expressions for the velocity and the acceleration	***Extension topic***		**Knowledge of the chain rule is not required** **The notation** $f'(x)$ **may be used** **For example, for** $n \neq 1$, **the ability to differentiate expressions such as** $(2x+5)(x-1)$ **and** $\frac{x^2+5x-3}{3x^{\frac{1}{2}}}$ **is expected**

<table>
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<tr><td rowspan="4">3.4 Calculus Differentiation continued</td><td rowspan="4"></td><td rowspan="4"></td><td>New concepts</td><td>Applications of differentiation to gradients, tangents and normals</td><td>Use of differentiation to find equations of tangents and normals at specific points on a curve</td></tr>
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<tr><td>5 Integration</td><td>What students need to learn</td><td>Notes</td></tr>
<tr><td>New topic</td><td>Indefinite integration as the reverse of differentiation
integration of x^n</td><td>Students should know that a constant of integration is required.</td></tr>
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Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO1 Number and algebra			**Differentiation**		
3 Sequences, functions and graphs	**Students should be taught to:**	**Notes**	**5 Integration *continued***	**What students need to learn**	**Notes**
3.4 Calculus Differentiation *continued*			***New topic***		**For example, the ability to integrate expressions such as: $\frac{1}{2}x^2 - 3x^{-\frac{1}{2}}$ and $\frac{(x+2)^2}{x^{\frac{1}{2}}}$ is expected**

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
4 Geometry	**Students should be taught to:**	**Notes**			
4.1 Lines and triangles	See Foundation Tier.				
4.2 Polygons	See Foundation Tier.				
4.3 Symmetry	See Foundation Tier.				
4.4 Measures	See Foundation Tier.				
4.5 Construction	See Foundation Tier.				

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
4 Geometry	**Students should be taught to:**	**Notes**			
4.6 Circle properties	understand and use the internal and external intersecting chord properties recognise the term *cyclic quadrilateral* understand and use angle properties of the circle including: • angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the remaining part of the circumference • angle subtended at the circumference by a diameter is a right angle	Formal proof of these theorems is not required			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
4 Geometry	**Students should be taught to:**	**Notes**			
4.6 Circle properties *continued*	• angles in the same segment are equal • the sum of the opposite angles of a cyclic quadrilateral is 180° • the alternate segment theorem				
4.7 Geometrical reasoning	provide reasons, using standard geometrical statements, to support numerical values for angles obtained in any geometrical context involving lines, polygons and circles				

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
4 Geometry	**Students should be taught to:**	**Notes**			
4.8 Trigonometry and Pythagoras' Theorem	understand and use sine, cosine and tangent of obtuse angles understand and use angles of elevation and depression understand and use the sine and cosine rules for any triangle use Pythagoras' Theorem in 3 dimensions understand and use the formula $\frac{1}{2}ab\sin C$ for the area of a triangle apply trigonometrical methods to solve problems in 3 dimensions, including finding the angle between a line and a plane	The angle between two planes will not be required			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra			Algebra and functions		
4 Geometry	**Students should be taught to:**	**Notes**			
4.9 Mensuration	find perimeters and areas of sectors of circles	Radian measure is excluded			
4.10 3-D shapes and volume	find the surface area and volume of a sphere and a right circular cone using relevant formulae convert between volume measures	$m^3 \rightarrow cm^3$ and vice versa			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
4 Geometry	**Students should be taught to:**	**Notes**			
4.11 Similarity	understand that areas of similar figures are in the ratio of the square of corresponding sides understand that volumes of similar figures are in the ratio of the cube of corresponding sides use areas and volumes of similar figures in solving problems				

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Number and algebra					
5 Vectors and transformation geometry	**Students should be taught to:**	**Notes**			
5.1 Vectors	understand that a vector has both magnitude and direction understand and use vector notation multiply vectors by scalar quantities add and subtract vectors calculate the modulus (magnitude) of a vector find the resultant of two or more vectors apply vector methods for simple geometrical proofs	The notations $\overrightarrow{OA}$ and $\boldsymbol{a}$ will be used $\overrightarrow{OA} = 3a,\ \overrightarrow{AB} = 2b,$ $\overrightarrow{BC} = c$ so: $\overrightarrow{OC} = 3a + 2b + c$ $\overrightarrow{CA} = -c - 2b$			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO2 Shape, space and measures					
5 Vectors and transformation geometry	**Students should be taught to:**	**Notes**			
5.2 Transformation geometry	See Foundation Tier.	Column vectors may be used to define translations			
6 Statistics	**Students should be taught to:**	**Notes**			
6.1 Graphical representation of data	construct and interpret histograms construct cumulative frequency diagrams from tabulated data use cumulative frequency diagrams	For continuous variables with unequal class intervals			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO3 Handling data					
6.2 Statistical measures	estimate the median from a cumulative frequency diagram understand the concept of a measure of spread find the interquartile range from a discrete data set estimate the interquartile range from a cumulative frequency diagram	The terms 'upper quartile' and 'lower quartile' may be used			

Certificate in Mathematics (Higher tier)			GCE Core Mathematics 1 unit		
AO3 Handling data					
6 Statistics	**Students should be taught to:**	**Notes**			
6.3 Probability	draw and use tree diagrams determine the probability that two or more independent events will both occur use simple conditional probability when combining events apply probability to simple problems	Picking two balls out of a bag, one after the other, without replacement			

Higher tier Mathematics Certificate/GCE Core Mathematics 1 unit content summary

The table below is a summary of the Mathematics Certificate Higher tier content and GCE Core Mathematics 1 unit content that could be delivered/taught alongside each other, in the **first year** of the course. This scheme of work should be used together with the Higher tier course planner in the Mathematics Certificate Teacher's Guide. The module numbers in the table below refer to the module numbers in the course planner within the Mathematics Certificate Teacher's Guide. References to topic areas in GCE Core Mathematics 1 unit are in **bold**.

Year 1 content summary

Module number		**Module Title**	***Estimated teaching hours**
Number	2	Powers and roots ***C1: Use and manipulation of surds***	5
Algebra	1	Algebraic manipulation ***C1:Algebraic manipulation of polynomials, including expanding brackets and collecting like terms, factorisation***	5
	3	Linear equations and simultaneous linear equations ***C1: Simultaneous equations: analytical solution by substitution***	7
	5	Linear graphs ***C1: Equation of a straight line, including the forms*** $y - y_1 = m(x - x_1)$ ***and*** $ax + by + c = 0$***. Conditions for two straight lines to be parallel or perpendicular to each other***	7
	6	Integer sequences ***C1: Sequences, including those given by a formula for the nth term and those generated by a simple relation of the form*** $x_{n+1} = \mathrm{f}(x_n)$ ***This could be done in the first year as an extension of integer sequences***	5
	8	Inequalities ***C1: Solution of linear and quadratic inequalities***	6
	9	Indices ***C1: Laws of indices for all rational exponents.***	5

*Teachers should be aware that the estimated teaching hours are approximate and should only be used as a guideline.

The table below is a summary of the Mathematics Certificate Higher tier content and GCE Core Mathematics 1 unit content that could be delivered/taught alongside each other, in the **second year** of the course. This scheme of work should be used together with the Higher tier course planner in the Mathematics Certificate Teacher's Guide. The module numbers in the table below refer to the module numbers in the course planner within the Mathematics Certificate Teacher's Guide. References to topic areas in GCE Core Mathematics 1 unit are in **bold**.

Year 2 content summary

Module number		Module Title	*Estimated teaching hours
Algebra	7	Quadratic equations ***C1: Completing the square. Solution of quadratic graphs***	10
	11	Function notation ***C1: Quadratic functions and their graphs. The discriminant of the quadratic function.***	10
	12	Harder graphs ***C1: Graphs of functions; sketching curves defined by simple equations. Geometrical interpretation of algebraic solution of equations. Use intersection points of graphs of functions to solve equations. Knowledge of the effect of simple transformations on the graphs of*** $y = \mathrm{f}(x)$ ***as represented by*** $y = a\mathrm{f}(x)$, $y = \mathrm{f}(x) + a$, $y = \mathrm{f}(x + a)$, $y = \mathrm{f}(ax)$	10
	13	Calculus – Differentiation ***C1: The derivative of*** $\mathrm{f}(x)$ ***as the gradient of the tangent to the graph of*** $\mathrm{f}(x)$ ***at a point; the gradient of the tangent as a limit; interpretation as a rate of change; second order derivatives. Applications of differentiation to gradients, tangents and normals***	15
C1 topic	**1**	***C1: Sequences and Series*** ***Sequences could either be covered in Year 10 as an extension of IGCSE/Certificate in Mathematics topic: Integer sequence, or together with Arithmetic series in the second year.*** ***Arithmetic series, including the formula for the sum of the first*** n ***natural numbers***	10
C1 topic	**2**	***C1: Calculus – Integration*** ***Indefinite integration as the reverse of differentiation*** ***integration of*** x^n	15

*Teachers should be aware that the estimated teaching hours are approximate and should only be used as a guideline.

Higher tier Mathematics Certificate/GCE Core Mathematics 1 unit scheme of work

This scheme of work only contains the modules that could be extended through teaching the Edexcel GCE Core Mathematics 1 unit alongside the Mathematics Certificate. It should be used alongside the Mathematics Certificate course planner in the Teacher's Guide.

Number

Module 2 – Powers and roots [Year 1] Time: 4 – 6 hours

Target grades: A*/A/B/C

Content	Area of specification
Squares and square roots	1.4
Cubes and cube roots	1.4
Using a calculator effectively to evaluate powers and roots	1.1
Powers of numbers – using index notation	1.4
Order of operations including powers (BIDMAS*)	1.1
Expressing a number as the product of powers of its prime factors	1.4
Using prime factors to evaluate Highest Common Factors (HCF) and Lowest Common Multiples (LCM)	1.4
Understanding and using powers which are zero, negative or fractions	1.4
Recognising the relationship between fractional powers and roots	1.4
Using laws of indices to simplify and evaluate numerical expressions involving integer, fractional and negative powers	1.4
Understanding the meaning of surds	1.4
Manipulating surds, including rationalising the denominator	1.4

*__BIDMAS__ = __B__rackets, __I__ndices, __D__ivision, __M__ultiplication, __A__ddition, __S__ubtraction

A/A* notes/tips

- In order for students to aspire to the top grades, it is essential that they are able to use algebraic manipulation and index notation confidently
- Remind students that when writing fractions, it is not usual to write surds in the denominator, because without a calculator, it is not always easy to work out the value of the fraction, eg $\frac{1}{\sqrt{2}}$, but 'rationalising' the denominator will help clear the surds from the denominator

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 3: Number 3 page 117 Unit 3: Number 3 page 114 – 116
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 66 – 70

GCE Core Mathematics 1

Content	Textbook reference
Write a number exactly as a surd	1.7
Rationalise the denominator of a fraction when it is a surd	1.8

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 10 – 13

ALGEBRA

Module 1 – Algebraic manipulation [Year 1] Time: 4 – 6 hours

Target grades: A*/A/B/C/D

Content	Area of specification
Multiplying a single term over a bracket	2.2
Factorising by taking out a single common factor	2.2
Finding and simplifying the product of two linear expressions, eg $(2x + 3)(3x - 1)$, $(3x - 2y)(5x + 3y)$	2.2
Factorising quadratic expressions, including the difference of two squares	2.2
Adding and subtracting algebraic fractions, including simplifying algebraic fractions by cancelling common factors	2.2
Numerator and/or the denominator may be numeric, linear or quadratic	2.2

Notes

Emphasise importance of using the correct symbolic notation, for example $3a$ rather than $3 \times a$ or $a3$. Students should be aware that there may be a need to remove the numerical HCF of a quadratic expression before factorising it in order to make factorisation more obvious

A/A* notes/tips for Higher tier

- Students need to be reminded that they should always factorise algebraic expressions completely, setting their work out clearly
- In order for students to work towards to the top grades, it is essential that they are confidently able to manipulate algebraic expressions in a variety of situations
- When simplifying algebraic fractions, students should be encouraged to fully factorise both the numerator and the denominator, where possible
- A typical common error is for students to 'cancel out' the terms in x
- Simplifying algebraic fractions is usually a challenging topic for many students. A key point is that algebraic fractions are actually generalised arithmetic, and that the same rules apply

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Algebra 1 page 11 – 12 Unit 2: Algebra 2 page 65 – 67 Unit 3: Algebra 3 page 121 – 123
Edexcel IGCSE Mathematics A Student Book 2	Unit 5: Algebra 5 (Revision) page 346 – 347

GCE Core Mathematics 1

Content	Textbook reference
Simplify expressions by collecting like terms	1.1
Expand an expression by multiplying each term inside the bracket by the term outside	1.3

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 2, 4 – 6

Module 3 – Linear equations and simultaneous linear equations [Year 1]

Time: 6 – 8 hours

Target grades: B/C/D

Content	Area of specification
Inverse operations	2.4
Understanding and use of 'balancing' methods	2.4
Solving simple linear equations	2.4
Solving linear equations:	
• with two or more operations	2.4
• with the unknown on both sides	2.4
• with brackets	2.4
• with negative or fractional coefficients	2.4
• with combinations of these	2.4
Setting up and solving simple linear equations to solve problems, including finding the value of a variable which is not the subject of the formula	2.4
Solving simple simultaneous linear equations, including cases where one or both of the equations must be multiplied	2.6
Interpreting the equations as lines and their common solution as the point of intersection	2.6

Prior knowledge

Algebra: Modules 1 and 2

The idea that some operations are 'opposite' to each other

Notes

Students need to realise that not all linear equations can be solved easily by either observation or trial and improvement; a formal method is often needed

Students should leave their answers in fractional form where appropriate

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Algebra 1 page 12 – 17 Unit 2: Graphs 2 page 79 – 80 Unit 3: Algebra 3 page 126 – 130

GCE Core Mathematics 1

Content	Textbook reference
Solve simultaneous linear equations by elimination	3.1
Solve simultaneous linear equations by substitution	3.2
Use the substitution method to solve simultaneous equations whereone equation is linear and the other is quadratic	3.3

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 28 – 31

Module 5 – Linear graphs [Year 1] **Time: 6 – 8 hours**

Target grades: A/B/C/D

Content	**Area of specification**
Recognising that equations of the form $x = a$ and $y = b$ correspond to straight line graphs parallel to the y-axis and to the x-axis respectively	3.3
Completing tables of values and drawing graphs with equations of the form $y = mx + c$ where the values of m and c are given and m may be an integer or a fraction	3.3
Drawing straight line graphs with equations in which y is given implicitly in terms of x, for example $x + y = 7$	3.3
Calculating the gradient of a straight line given its equation of the coordinates of two points on the line	3.3
Recognising that graphs with equations of the form $y = mx + c$ are straight line graphs with gradient m and intercept $(0, c)$ on the y-axis	3.3
Finding the equation of a straight line given the coordinates of two points on the line	3.3
Finding the equation of a straight line parallel to a given line	3.3

Prior knowledge

Algebra: Modules 1, 2, 3 and 4

Notes

Axes should be labelled on graphs and a ruler should be used to draw linear graphs

Science experiments/work could provide results which give linear graphs

Resources

Textbook	**References**
Edexcel IGCSE Mathematics A Student Book 1	Unit 1: Graphs 1 page 19 – 27

GCE Core Mathematics 1

Content	Textbook reference
Write the equation of a straight line in the form of $y = mx + c$ or $ax + by + c = 0$	5.1
Work out the gradient m of the line joining the point with coordinates (x_1, y_1) to the point with the coordinates (x_2, y_2) by using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$	5.2
Find the equation of a line with gradient m that passes through the point with coordinates (x_1, y_1) by using the formula $y - y_1 = m(x - x_1)$	5.3
Find the equation of the line that passes through the points with the coordinates (x_1, y_1) and (x_2, y_2) by using the formula $\frac{y - y_1}{y_2 - y_1} = \frac{x - x_1}{x_2 - x_1}$	5.4
Work out the gradient of a line that is perpendicular to the line $y = mx + c$	5.5

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 74 – 90

Module 6 – Integer sequences [Year 1] **Time: 4 – 6 hours**

Target grades: B/C/D

Content	**Area of specification**
Using term-to-term and position-to-term definitions to generate the terms of a sequence	3.1
Finding and using linear expressions to describe the nth term of an arithmetic sequence	3.1

Resources

Textbook	**References**
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Sequences 5 page 254 – 264

GCE Core Mathematics 1

Content	**Textbook reference**
A series of numbers following a set rule is called a sequence	6.1
Know a formula for the nth term of a sequence (eg $U_n = 3n - 1$) to find any term in the sequence	6.2
Know the rule to get from one term to the next, and use this information to produce a recurrence relationship (or recurrence formula)	6.3
A sequence that increases by a constant amount each time is called an arithmetic sequence	6.4

Resources

Textbook	**References**
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 92 – 100

Module 7 – Quadratic equations [Year 2] Time: 9 – 11 hours

Target grade: A*/A/B/C

Content	Area of specification
Solving quadratic equations by factorisation	2.7
Solving quadratic equations by using the quadratic formula	2.7
Setting up and solving quadratic equations from data given in a context	2.7
Solving exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear in each unknown and the other is linear in one unknown and quadratic in the other	2.7
Solving exactly, by elimination of an unknown, two simultaneous equations in two unknowns, one of which is linear in each unknown and the other is linear in one unknown and the other is of the form $x^2 + y^2 = r^2$	2.7

Prior knowledge

Algebra: Modules 1 and 3

Notes

Remind students that they should factorise a quadratic before using the formula

A/A* notes/tips

- Remind students that it is important to always factorise completely before resorting to using the quadratic formula
- When applying the quadratic formula, students must substitute the correct values into the formula. They should be reminded that rounding or truncating during the process leads to inaccurate solutions
- Often solving equations with algebraic fractions is a challenge for most students, however they should be encouraged to show their working out through using a few lines of correct algebra. Remind students of the value of retaining the structure of the equation throughout their working, rather than merely treating the algebra as an expression to be simplified

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 5: Algebra 5 page 248 – 251
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Algebra 2 page 71 – 80 Unit 3: Algebra 3 page 176 – 182

GCE Core Mathematics 1

Content	Textbook reference
Plot graphs of quadratic equations	2.1
Solve quadratic equations using factorising	2.2
Write quadratic expressions in another form by completing the square	2.3
Solve quadratic equations by completing the square	2.4
Solve quadratic equations by using the formula	2.5

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 17 – 23

Module 8 – Inequalities [Year 1] Time: 5 – 7 hours

Target grades: A/B/C

Content	Area of specification
Understanding and using the symbols $>$, $<$, $\geq$ and $\leq$	2.8
Understanding and using the convention for open and closed intervals on a number line	2.8
Solving simple linear inequalities in one variable, including 'double-ended' inequalities	2.8
Representing on a number line the solution set of simple linear inequalities	2.8
Finding the integer solutions of simple linear inequalities	2.8
Using regions to represent simple linear inequalities in one variable	2.8
Using regions to represent the solution set to several linear inequalities in one or two variables	2.8
Solving quadratic inequalities in one unknown and representing the solution set on a number line	2.8

Prior knowledge

Algebra: Modules 3, 5 and 7

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Algebra 2 page 74 – 78, 81 – 86
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Algebra 2 page 81 – 84 Unit 5: Algebra 5 page 356

GCE Core Mathematics 1

Content	Textbook reference
Solve linear inequalities using similar methods to those for solvinglinear equations	3.4
Solve quadratic inequalities	3.5

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 31 – 39

Module 9 – Indices [Year 1] **Time: 4 – 6 hours**

Target grades: A/B/C/D

Content	Area of specification
Using index notation for positive integer powers	2.1
Substituting positive and negative numbers into expressions and formulae with quadratic and/or cubic terms	2.1
Completing tables of values and drawing graphs of quadratic functions	3.3
Using index notation with positive, negative and fractional powers to simplify expressions	2.1

Prior knowledge

Algebra: Modules 2 and 4

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 1	Unit 2: Number 2 page 60, 73 – 74 Unit 4: Graphs 4 page 185 – 190
Edexcel IGCSE Mathematics A Student Book 2	Unit 2: Number 2 page 66 – 70

GCE Core Mathematics 1

Content	Textbook reference
Simplify expressions and functions by using rules of indices (powers)	1.2
Extend rules of indices to all rational exponents	1.6

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 3,4 and 8,9

Module 11 – Function notation [Year 2] Time: 9 – 11 hours

Target grades: A*/A/B

Content	Area of specification
Understanding the concept that a function is a mapping between elements of two sets	3.2
Using function notation of the form $f(x) = \ldots$ and $f : x \mapsto \ldots$	3.2
Understanding the terms domain and range	3.2
Understanding which parts of the domain may need to be excluded	3.2
Understanding and using composite function fg and inverse function f^{-1}	3.2

Prior knowledge

Algebra: Modules 1, 2 and 3

A/A* notes/tips

- This tends to be demanding topic for students and in order to deepen their understanding of how to apply their knowledge of functions in different types of questions, they should be given plenty of practice
- Students may need to be reminded that $f(x) = y$
- When solving $f(x) = g(x)$, given the graphs of both functions, remind students that they should give their answers as solutions of x
- Remind students that when one function is followed by another, the result is a composite function, eg $fg(x)$ means do f first followed by g, where the domain of f is the range of g
- Students need to understand, and be able to, use the concepts of domain and range, as this will enable them to develop an appropriate working knowledge of functions. In particular, students must be familiar with the concept that division by zero is undefined,
  eg for $g(x) = \dfrac{1}{x-2}$, $x - 2 \neq 0$, which means
  $x = 2$ must be excluded from the domain of g
- For inverse functions, remind students that the inverse of $f(x)$ is the function that 'undoes' whatever $f(x)$ has done, and that the notation $f^{-1}(x)$ is used
- It is helpful to remind students that if the inverse function is not obvious then:
  - Step 1: write the function as $y = \ldots$
  - Step 2: change any x to y, and any y to x
  - Step 3: make y the subject, giving the inverse function

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 3: Algebra 3 page 183 – 197

GCE Core Mathematics 1

Content	Textbook reference
Transform the curve of a function $f(x)$ by simple translations	4.5
Transform the curve of a function $f(x)$ by simple stretches	4.6
Perform simple transformations on a given sketch of a function	4.7

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 55 – 65

Module 12 – Harder graphs [Year 2] Time: 9 – 11 hours

Target grades: A*/A/B

Content	Area of specification
Plotting and drawing graphs with equation $y = Ax^3 + Bx^2 + Cx + D$ in which (i) the constants are integers and some could be zero (ii) the letters *x* and *y* can be replaced with any other two letters	3.3
Plotting and drawing graphs with equation $y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2}$ in which (i) the constants are integers and at least three of them are zero (ii) the letters x and y can be replaced with any other two letters	3.3
Finding the gradients of non-linear graphs by drawing a tangent	3.3
Finding the intersection points of two graphs, one linear (y_1) and one non-linear (y_2) and recognising that the solutions correspond to $y_2 - y_1 = 0$	3.3

Prior knowledge

Algebra: Modules 1, 2, 3, 5 and 9

Notes

Students should be made aware that they should not use rulers to join plotted points on non-linear graphs

When plotting points or reading off values from a graph, the scales on the axes should be checked carefully

A/A* notes/tips

- Remind students that when finding an estimate for the gradient of a graph $y = \mathrm{f}(x)$ at given point, a tangent drawn at this point is helpful, although a related, correct division, to find the gradient, is required to gain top marks in a question
- Students should recognise that cubic graphs have distinctive shapes that depend on the coefficient of x^3
- Students should recognise that reciprocal graphs have x as the denominator, and that they produce a type of curve called a hyperbola. An awareness of the concept of the smallest (minimum) value of y, and the value of x where this happens on the graph, is helpful
- Students should appreciate that an accurately drawn graph can be used to solve equations that may prove difficult to solve by other methods. They should also appreciate that most graphs of real-life situations are curves rather than straight lines. Information on rates of change can still be found by drawing a tangent to a curve, and using this to estimate the gradient of the curve at this point

- Students should recognise that the algebraic method is more accurate than the graphical method of solving simultaneous equations, in particular when one equation is linear and the other equation is nonlinear

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 1: Graphs 1 page 19 – 27 Unit 3: Graphs 3 page 198 – 209

GCE Core Mathematics 1

Content	Textbook reference
Sketch graphs of quadratic equations and solve problems using the discriminant	2.6
Sketch cubic curve of the form $y = Ax^3 + Bx^2 + Cx + D$	4.1
Sketch and interpret graphs of the cubic form $y = x^3$	4.2
Sketch the reciprocal function $y = \frac{k}{x}$, where k is a constant	4.3
Sketch curves of functions to show points of intersection and solutions to equations	4.4

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 23 – 25, 42 – 55

Module 13 – Calculus [Year 2] Time: 14 – 16 hours

Target grades: A*/A/B

Content	Area of specification
Understanding the concept of a variable rate of change	3.4
Differentiating integer powers of x	3.4
Determining gradients, rates of change, maxima and minima by differentiation and relating these to graphs	3.4
Applying calculus to linear kinematics and to other simple practical problems	3.4

Prior knowledge

Algebra; Modules 1, 2, 5, 9 and 12

Notes

When applying calculus to linear kinematics, the reverse of differentiation will not be required

A/A* notes/tips

- Student should understand that the process of finding the gradient of a curve is called differentiation, where the result is the derivative or the gradient function, and that the gradient of a curve can also be represented by $\frac{dy}{dx}$
- Students should be encouraged to set their work out appropriately, maintaining the structure of their solution, as this will aid their understanding, and revision, of the topic, particularly as it increases in complexity
- Students need to understand the turning points are points on the curve where the gradient is zero. They should also be able to distinguish between a minimum turning point and a maximum turning point
- Students need to be able to apply their knowledge of differentiation to the motion of a particle in a straight line, including speed and acceleration

Resources

Textbook	References
Edexcel IGCSE Mathematics A Student Book 2	Unit 4: Graphs 4 page 268 – 287

GCE Core Mathematics 1

Differentiation

Content	Textbook reference
Estimate the gradient of the tangent	7.1
Find the formula for the gradient of the function $f(x) = x^n$	7.2
Find the gradient formula for a function such as $f(x) = 4x^2 - 8x + 3$	7.3
Find the gradient formula for a function such as $f(x) = x^3 + x^2 - x^{\frac{1}{2}}$	7.4
Expand or simplify polynomial functions so they are easier to differentiate	7.5
Repeat the process of differentiation to give a second derivative	7.6
Find the rate of change of a function f at a particular points using $f'(x)$ and substituting in the value of x	7.7
Use differentiation to find the gradient of a tangent to a curve and then find the equation of the tangent and the normal to the curve at a specified point	7.8

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 113 – 131

C1 topic

Module 1 – Sequences and Series [Year 2] Time: 9 – 11 hours

GCE Core Mathematics 1

Content	Textbook reference
Arithmetic series are formed by adding together the terms of an arithmetic sequence	6.5
Find the sum of an arithmetic series	6.6
Use Σ to signify 'the sum of'	6.7

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 100 – 110

C1 topic

Module 2 – Integration [Year 2] Time: 14 – 16 hours

GCE unit Core Mathematics 1

Content	Textbook reference
Integrate functions of the form $f(x) = ax^n$ where $n \in \mathbb{R}$ and a is a constant	8.1
Apply the principle of integration separately to each term of $\frac{dy}{dx}$	8.2
Use the integral sign	8.3
Simplify an expression into separate terms of the form x^n	8.4
Find the constant of integration, c, when given any point (x, y) that the curve of the function passes through	8.5

Resources

Textbook	References
Edexcel AS and A Level Modular Mathematics Core Mathematics 1	page 134 – 142

Publications Code UG027243 July 2011

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