Outline schemes of work

A-level Mathematics 6360

Version 2.0, Autumn 2013

Introduction

These outline schemes of work are intended to help teachers plan and implement the teaching of the AQA A-level Mathematics specification. The purpose of these outline schemes is to provide advice and guidance to teachers, not to prescribe and restrict their approach to the specification. Each scheme has been produced by a practising A-level Maths teacher. There are obviously many other ways of organising the work, and there is absolutely no requirement to use these schemes.

Scheme 1, A-level Maths with two teachers

It is assumed that there are a total for 4 to 4.5 hours per week of contact time and around 36 weeks in the academic year available for teaching. It is also assumed that there is some teaching time after the AS exams in year 12, though it is acknowledged that not all centres have this luxury. The scheme assumes equal contact time for the two teachers.

Date	Teacher A	Teacher B	Notes
Autumn term Year 12 First half term	**Core 1** Algebraic manipulation of polynomials (12.1) Factorisation of quadratic polynomials (12.1) Completing the square (12.1) Solution of quadratic equations (12.1) Graphs of quadratic functions (12.1) Effect of translations on quadratic graphs (12.1) Discriminant of quadratic function (12.1) Linear and quadratic inequalities (12.1) Simultaneous equations (12.1)	**Core 1** Surds (12.1) Algebraic division (12.1) Equation of a straight line (12.2) Graphs of linear functions (12.1) Parallel and perpendicular lines (12.2) Coordinate geometry of the circle (12.2) Equation of a circle (12.2) Effect of translations on circles (12.1) Equation of the tangent and normal (12.2) Geometrical interpretation of algebraic solutions (12.1) Intersection of a straight line and a curve (12.2)	Surds: at the start of the course, focus on questions of the type illustrated in the first two examples only.

Date	Teacher A	Teacher B	Notes
Second half term	Remainder theorem (12.1) Factor theorem (12.1) Graphs of quadratic and cubic functions (12.1) Geometrical interpretation of solutions of equations (12.1) Factorisation of quadratics (12.1) Integration (12.4) Surds (12.1)	Differentiation (12.3) Start on applied maths module (Statistics 1, Mechanics 1 or Decision 1)	Surds: examples of the type in example 3.
Spring term	**Core 2** Sine and cosine rules (13.3) Area of a triangle (13.3) Degree and radian measure (13.3) Arc length , area of sector (13.3) Sequences and series (13.2) Laws of indices (13.1) $y = a^x$ and its graph (13.4) Logs and laws of logs (13.4) Solution of equations of the form $a^x = b$ (13.4) Sine, cosine and tangent functions (13.3) Use of $\tan\theta = \frac{\sin\theta}{\cos\theta}$, $\sin^2\theta + \cos^2\theta = 1$ (13.3) Solution of trig equations (13.3) Effect of transformations on the graph of $y = \mathrm{f}(x)$ (13.1) Differentiation (13.5) Integration (13.6)	Continue with applied maths module	Binomial expansion: for weaker students, just focus on the use of Pascal's triangle as a method of expansion. Teachers who intend to enter students for the Statistics coursework option, should start collecting the data as soon as practicable in order to allow plenty of time for the interpretation and validation.
Summer term	Revision and working through AS papers	Revision and working through AS papers	

Date	Teacher A	Teacher B	Notes
After the AS exams are finished	**Core 3** Numerical methods (14.6) sec, cosec and cot (14.2)	**Core 3** Definition of a function (14.1) Domain and range (14.1) Composition of functions (14.1) Inverse functions and their graphs (14.1) Modulus (14.1) e^x and $\ln x$ (14.3)	Maximise the use of graphical packages in these areas.
Autumn term Year 13 First half term	Knowledge of $\sin^{-1}$, $\cos^{-1}$ and $\tan^{-1}$ functions (14.2) Understanding of their domains and graphs (14.2) Integration (14.5)	Differentiation (14.4) Combinations of transformations (14.1) **Core 4** Algebra and functions (15.1)	
Second half term	**Core 4** Sequences and series (15.3) Use of formulae for $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$ (15.4) Coordinate geometry in the x–y plane (15.2) Double angle formulae (15.4)	Second applied maths module (Statistics 1 or 2, Mechanics 1 or 2, Decision 1 or 2)	
Spring term	Exponentials and logs (15.5) Differentiation and Integration (15.6) Vectors (15.7) Start revision for June entry	Continue with the second applied maths module	It is worth considering bringing in Vectors (15.7) into the Autumn term for those students who will be taking Mechanics 2 as their second application module. Suggest that in this situation Vectors would be taught by Teacher 2.
Summer term	Continue with revision programme	Revision for examinations in June	

Scheme 2, for MPC1 with two teachers

Teacher A

The number of hours is only a general indication. The specification gives more detail about the topics.

Topic	Notes	Hours
Use and manipulation of surds.	See specification for level of difficulty	2
Equation of a straight line. Conditions for lines to be parallel or perpendicular to each other. Midpoint of a line. Distance between two points.	$y = mx + c$, $y - y_1 = m(x - x_1)$, $ax + by + c = 0$ and graph of a straight line. Knowledge that the product of the gradients of perpendicular lines is -1. Problems using this knowledge. Graphical illustration.	3
Graphs of quadratic functions. Include use of $f(x)$ notation. Factorisation of quadratic polynomials – use in solving quadratic equations. Completing the square. Use in solving quadratic equations and in finding maximum and minimum values of a quadratic polynomial. The graph of $y = (x - a)^2 + b$ as a translation of the graph of $y = x^2$. Solving quadratic equations by formula. The discriminant of a quadratic function.	As the other techniques in this section are covered, they can be illustrated by reference to the graph. Note terms 'vertex' and 'line of symmetry' need to be known. See specification for level of difficulty. Include negative coefficients of x^2 and rearrangement of equations. See specification for level of difficulty. Include surd manipulation in solving equations. Formula needs to be learnt. Use in determining the number of real roots.	7
Solution of linear and quadratic inequalities.	Include surds in linear inequalities and in associated roots of the quadratic. Graphical illustration. Cover applications involving the discriminant eg determine the range of values of k for which $x^2 + (k+2)x + (2k+1) = 0$ has distinct real or non-real or equal roots.	3
Simultaneous equations including one linear and one quadratic. Intersection of two straight lines and of a straight line and the graph of a quadratic function.	Revise two linear equations by elimination and by substitution. Linear and quadratic mostly by substitution but cover cases when elimination is possible. Including the cases when the straight line is a tangent to the quadratic, intersects it at two distinct points and does not intersect it. Links with quadratic functions and quadratic inequalities.	3

Topic	Notes	Hours
Coordinate geometry of the circle. $(x-a)^2+(y-b)^2=r^2$ as a translation of $x^2+y^2=r^2$. Graphs of circles. The equation of the tangent and normal at a given point to a circle. The intersection of a straight line and a circle.	Including the form $(x-a)^2+(y-b)^2=r^2$ using the distance formula and using completing the square to put the equation in this form to determine the coordinates of the centre and the radius. Calculus not required. Use of the coordinates of appropriate points to find gradients. Problems involving the use of: (i) the angle in a semicircle is a right angle; (ii) The perpendicular from the centre to a chord bisects the chord (iii) The tangent to a circle is perpendicular to the radius at the point of contact. Algebraic methods. Geometrical interpretation of equal roots, distinct real roots and no real roots. Links with quadratic functions and quadratic inequalities.	4
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Teacher B

The number of hours is only a general indication. The specification gives more detail about the topics.

Topic	Notes	Hours
Algebraic manipulation of polynomials, including expanding brackets and collecting like terms.	Include use of $\mathrm{f}(x)$ notation.	1
Simple algebraic division. Use of the factor theorem. Use of the remainder theorem	See specification for level of difficulty. See specification for level of difficulty. Use in solving cubic equations. See specification for level of difficulty. Including questions such as eg find the values of p and q in $\mathrm{f}(x)=x^3+px^2+qx-8$ given $(x-1)$ is a factor and the remainder when $\mathrm{f}(x)$ is divided by 2 is 24.	4
Graphs of cubic functions.	Using the factor theorem.	1
Differentiation – general introduction to gradient of a curve. Differentiation of polynomials. Gradient of a curve.	Introduction to $\frac{\mathrm{d}y}{\mathrm{d}x}$ and $\mathrm{f}'(x)$ notation. Use graphics calculator, zooming to illustrate linearity of graphs. $\lim_{h\to 0}\left(\frac{(x+h)^2-x^2}{h}\right)=\lim_{h\to 0}(2x+h)=2x$ although not tested on specification. Formula needs to be learnt.	3
Equations of tangents and normal.	Problems based on these and on coordinate geometry of a straight line.	2

Topic	Notes	Hours
Stationary points, maxima and minima. Use of second order derivatives.	Related to graphs and to optimising a single variable in a practical problem, eg maximizing volume of a cuboid etc. Refer back to sketching quadratics and extend sketching cubics to include max and min points. $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = \frac{\mathrm{d}g}{\mathrm{d}x}$ where g is gradient function. Graphical illustration.	4
Increasing and decreasing functions.	Might be more logically covered before stationary points but need to be sure inequalities securely covered. Including general discussion of derivative as a rate of change and graphical illustration. Finding ranges of values for which a function is increasing/decreasing including for a cubic leading to a quadratic inequality.	2
Integration as the reverse of differentiation. Integration of polynomials.	Indefinite integration. Formula needs to be learnt. Include finding the equation of a curve given the gradient function and a point on the curve.	1
Area under a curve. Definite integration.	Including areas below the x-axis. Problems including composite areas and intersection of a straight line and a quadratic curve.	4
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Schemes 3 and 4, sections of content not divided between teachers

The schemes shown above divides some of the sections within modules between two teachers. The following two possibilities are based on a more straightforward division of the content, with each section of the specification, eg 12.2 Coordinate geometry, wholly taught by one of the teachers. Both schemes assume equal contact time for teachers A and B.

In the first outline scheme, both teachers would complete their section of MPC1 at about the same time.

In the second outline scheme, the start of MPC2 teaching would be staggered.

Unit	Teacher A	Teacher B
MPC1	12.1 Algebra	12.2 Coordinate geometry
		12.3 Differentiation
		12.4 Integration
MPC2	13.1 Algebra	13.3 Trigonometry
	13.2 Sequences and series	13.5 Differentiation
	13.4 Exponentials and logs	13.6 Integration
MPC1 and MPC2	12.1 Algebra	12.3 Differentiation
		12.4 Integration
		13.5 Differentiation
		13.6 Integration
	12.2 Coordinate geometry	13.3 Trigonometry
	13.1 Algebra	
	13.2 Sequences and series	13.4 Exponentials and logs

Scheme 5, AS Further Maths

The following suggestion is based on a 1:2 contact time split between Teacher A and Teacher B. It is designed to allow AS Further Maths to be taught alongside AS Maths, using the course in Scheme 1.

Date	Teacher A	Teacher B	Notes
Autumn Term Year 12	Matrices (excl transformations) (16.8) Roots and coefficients of a quadratic equation (16.3) Complex numbers (16.2) Series (16.4) Graphs of parabolas, ellipses and hyperbolas (16.1) Finding roots of equations (16.6)	First applied maths module	
Spring Term	Solving differential equations (16.6) Transformations in x–y plane using matrices (16.8) Reducing a relation to a linear law (16.6) Trigonometry (16.7) Graphs of rational functions (16.1) Calculus (16.5)	Second applied maths module	
Summer Term	Revision and preparation for MFP1	Revision and preparation for the applied maths units	Students taught in this way will be taking MPC1, MPC2 and an application unit for AS Maths and MFP1 and two more applications units for AS Further Maths.