

ASSESSMENT and
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ALLIANCE

## GCE MATHEMATICS

## Specification 6360

## Outline Schemes of Work

Version 1.0
Autumn 2005
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## Introduction

These Outline Schemes of Work are intended to help teachers plan and implement the teaching of the new AQA GCE 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 GCE Maths teacher. There are obviously many other ways of organising the work, and there is absolutely no requirement to use these schemes.

## Scheme $1 \quad$ For A Level Maths with 2 Teachers

It is assumed that there are a total of $4-4.5$ 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 Y12, 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 |
| :---: | :---: | :---: | :---: |
| AutumnTerm <br> Year 12 <br> First half term | Core 1 <br> Algebraic manipulation of polynomials (12.1) <br> Factorisation of quadratic polynomials (12.1) <br> Completing the square (12.1) <br> Solution of quadratic equations (12.1) <br> Graphs of quadratic functions (12.1) Effect of translations on quadratic graphs (12.1) Discriminant of quadratic function (12.1) <br> Linear and quadratic inequalities (12.1) Simultaneous equations (12.1) | Core 1 <br> Surds (12.1) <br> Algebraic division (12.1) <br> Eqn of a straight line <br> (12.2) <br> Graphs of linear functions (12.1) <br> Parallel and perpendicular lines (12.2) <br> Co-ordinate geometry of the circle (12.2) <br> Eqn of a circle (12.2) <br> Effect of translations on circles (12.1) <br> Eqn of the tangent and normal (12.2) <br> Geometrical interpretation of algebraic solutions (12.1) <br> 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. |
| Second half term | Remainder theorem (12.1) <br> Factor theorem (12.1) <br> Graphs of quadratic and cubic functions (12.1) <br> Geometrical interpretation of solutions of eqns (12.1) Factorisation of quadratics (12.1) <br> Integration (12.4) <br> Surds (12.1) | Differentiation (12.3) <br> Start on Applied Maths module (Statistics 1, Mechanics 1, Decision 1) | Surds: Examples of the type in example 3. |


| Spring Term | Revision for MPC1 exam in January <br> Core 2 <br> Sine and cosine rules (13.3) <br> Area of a triangle (13.3) <br> Degree and radian measure (13.3) <br> Arc length, area of sector (13.3) <br> Sequences and series (13.2) <br> Laws of indices (13.1) <br> $y=a^{x}$ and its graph (13.4) <br> Logs, and laws of logs (13.4) <br> Solution of eqns of form $a^{x}=b$ (13.4) <br> Sine, cosine and tangent functions (13.3) <br> Use of $\tan \theta=\frac{\sin \theta}{\cos \theta}$, $\sin ^{2} \theta+\cos ^{2} \theta=1(13.3)$ <br> Solution of trig eqns (13.3) Effect of transformations on the graph of $y=\mathrm{f}(x)$ (13.1) <br> Differentiation (13.5) <br> Integration (13.6) | Revision for MPC1 exam in January <br> Continue with Applied Maths module | January: Students sit MPC1 (if centre policy allows). <br> Make full use of past questions from AQA Specifications A and B papers in revision. <br> Binomial expansion: For weaker candidates just focus on the use of Pascal's triangles as a method of expansion. <br> Teachers who intend to enter students for the 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 | If no January unit taken revision could start at the end of the Spring Term. Make full use of past questions from AQA Specifications A and B papers in revision. <br> June: Students sit MPC2 and Applied Maths unit. |


| After the AS <br> exams are <br> finished | Core 3 <br> Numerical Methods (14.6) <br> sec, cosec and cot (14.2) | Core 3 <br> Definition of a function <br> $(14.1)$ <br> Domain and range (14.1) <br> Composition of functions <br> $(14.1)$ <br> Inverse functions and their <br> graphs (14.1) <br> Modulus(14.1) <br> $\mathrm{e}^{x}$ and ln $x(14.3)$ | Maximise the use of <br> graphical packages in <br> these areas. |
| :--- | :--- | :--- | :--- |
| Autumn Term <br> Year 13 <br> First half term | Knowledge of sin ${ }^{-1}$,cos ${ }^{-1}$ <br> and tan ${ }^{-1}$ functions (14.2) | Differentiation (14.4) <br> Combinations of <br> Understanding of their <br> domains and graphs (14.2) | transformations (14.1) <br> Core 4 <br> Integration (14.5) <br> (15.1) and functions |

## Scheme $2 \quad$ For MPC1 with 2 Teachers

## Work Scheme - 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. <br> Conditions for lines to be parallel or perpendicular to each other. Mid-point of a line. Distance between two points. | $y=m x+c \quad y-y_{1}=m\left(x-x_{1}\right) a x+b y+c=0 \text { and }$ <br> graph of a straight line. <br> Knowledge that the product of the gradients of perpendicular lines is -1 . <br> Problems using this knowledge. Graphical illustration. | 3 |
| Graphs of quadratic functions. Include use of $\mathrm{f}(x)$ notation. <br> Factorisation of quadratic polynomials - use in solving quadratic equations. <br> Completing the square. Use in solving quadratic equations and in finding maximum and minimum values of a quadratic polynomial. <br> The graph of $y=(x-a)^{2}+b$ as a translation of the graph of $y=x^{2}$. Solving quadratic equations by formula. <br> 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. <br> See specification for level of difficulty. Include negative coefficients of $x^{2}$ and rearrangement of equations. <br> See specification for level of difficulty. Include surd manipulation in solving equations. <br> Formula needs to be learnt. <br> Use in determining no. 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 e.g. determine the range of values of $k$ for which $x^{2}+(k+2) x+(2 k+1)=0$ has distinct real or non-real or equal roots. | 3 |
| Simultaneous equations including one linear and one quadratic. <br> 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. <br> Including the cases when the straight line is a tangent to the quadratic, intersects it two distinct points and does not intersect it. Links with quadratic functions and quadratic inequalities. | 3 |


| Coordinate geometry of the | Including the form $(x-a)^{2}+(y-b)^{2}=r^{2}$ using the | 4 |
| :--- | :--- | :--- |

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.

## Work Scheme - Teacher B

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

| Topic |  | Hours |
| :--- | :--- | :---: |
| Algebraic manipulation of <br> polynomials, including expanding <br> brackets and collecting like <br> terms. | Include use of $\mathrm{f}(x)$ notation. | 1 |
| Simple algebraic division. <br> Use of the Factor Theorem. <br> Use of the Remainder Theorem | See specification for level of difficulty. <br> See specification for level of difficulty. Use in solving <br> cubic equations. <br> See specification for level of difficulty. Including <br> questions such as e.g. find the values of $p$ and $q$ in <br> $\mathrm{f}(x)=x^{3}+p x^{2}+q x-8$ given $(x-1)$ is a factor and the <br> remainder when $\mathrm{f}(x)$ is divided by 2 is 24. | 4 |
| Graphs of cubic functions. | Using the factor theorem. |  |
| Differentiation - general <br> introduction to gradient of a <br> curve. | Introduction to $\frac{\mathrm{d} y}{\mathrm{~d} x}$ and $\mathrm{f}^{\prime}(x)$ notation. Use graphics <br> calculator, zooming to illustrate linearity of graphs. <br> Perhaps look at | 3 |
| Differentiation of polynomials. <br> Gradient of a curve. | $L t\left(\frac{(x+h)^{2}-x^{2}}{h}\right)=L_{h \rightarrow 0}(2 x+h)=2 x$ although not <br> $h \rightarrow 0$ <br> tested on specification | 1 |
| Fquations of tangents and <br> normals. | Problems based on these and on coordinate geometry of <br> a straight line. | 2 |


| Stationary points. Maxima and minima. <br> Use of second order derivatives. | Related to graphs and to optimising a single variable in a practical problem e.g. maximizing volume of a cuboid etc. Refer back to sketching quadratics and extend sketching cubics to include max. and min. points. $\frac{\mathrm{d}^{2} y}{\mathrm{~d} x^{2}}=\frac{\mathrm{d} g}{\mathrm{~d} x}$ 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. <br> Integration of polynomials. | Indefinite integration. <br> Formula needs to be learnt. <br> 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 |

## 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 e.g.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 sections of MPC1 at about the same time, so this would work well where students take MPC1 in January.

In the second outline scheme, the start of MPC2 teaching would be staggered, and this might be suitable where students do not take a unit in January.

|  | 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 |


| Teacher A | Teacher B |  |  |
| :--- | :--- | :--- | :--- |
| $12.1 \quad$ 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 <br> Yr 12 | Matrices (excl. <br> transformations) (16.8) <br> Roots and coefficients of a <br> quadratic equation (16.3) <br> Complex Numbers (16.2) <br> Series (16.4) <br> Graphs of parabolas, <br> ellipses and hyperbolas <br> (16.1) <br> Finding roots of <br> equations(16.6) | First Applied Maths <br> module (suggest MD01) | If MD01 is taught, there is <br> a strong case to enter for <br> assessment in January. |
| Spring Term | Solving differential <br> equations (16.6) <br> Transformations in $x-y$ <br> plane (16.8) <br> Reducing a relation to a <br> linear law (16.6) <br> Trigonometry (16.7) <br> Graphs of rational <br> functions (16.1) <br> Calculus (16.5) | Second Applied Maths <br> module |  |
| Summer Term | Revision and Preparation <br> for MFP1 | Revision and preparation <br> for Applied Maths units |  |

