Making the most of maths

Get your plan for the Maths mocks together, get the exam done, and then get on with your study for the real thing

Making the most of the mocks
It is important for students to have a strategy for dealing with the mock exams.

Since very few will have the complete course covered, it is essential to decide which questions to attempt. Choose topics which you feel you are good at. Make sure that you prepare at least four questions on each paper (I know that you are required to do six but if you do four questions well it will do for the time being).

For the option on paper two, make sure you are able to make a reasonable attempt at this, as this is the only compulsory question on the exam .

Practise these questions use past exam papers .When using exam papers, only use the last four to five years' papers, as the people setting the mock are inclined to base the mock questions on recent exam papers.

Choosing questions – Paper One
My advice would be to prepare the algebra questions one, two and five (logs/induction/binomial) and six and seven, the differential calculus questions. There are effectively only two topics being examined over five questions. Many of the topics in one, two and five are related and by using past papers you will find no surprises on the mock.

Choosing questions – paper two
There is a greater variety of topics on paper two, and choice of topics is very important. I would advise you to prepare question two (the line), question three (vectors) and questions four and five (trigonometry).

Again we are picking questions that confine us to just studying three topics . It is important that you also make a good attempt at question eight as it is compulsory. The fact that you have studied differential calculus for paper one will help you with the Maclaurin series and the max/min parts of question eight. I tend to advise students to avoid questions six and seven on the mocks as they are often badly phrased and confusing.

During the exam
Stick to the plan. Focus on the questions you have decided to do. Do not try to do questions you have not prepared (unless you know what you are doing). If you try to attempts topics not already covered in class, you will be putting too much pressure on yourself and end up not getting the result you are capable of. Remember, if you are getting bogged down in a question, assess how many marks are allocated for the question and if you reckon you have 50 per cent of the marks available move on!

Note also that it is often very good students who are so determined to solve a problem that even when they are on their fourth page of foolscap and have introduced half the alphabet into the solution, they still persist – do not do this.

Accept the fact that this is a mock exam and you're just trying to get a result .The real exam is four months away.

After the exam
After the exam, forget about the mock and try and get back into a good study regime. Too many students waste valuable time putting their studies on hold while they wait for the mock results. Get on with your life. When the mock papers are returned, make sure that you thoroughly examine each question to see where marks were lost. Look out for silly mistakes (errors in signs/errors in formula/misreadings). This will be of great benefit in the

2007 Question 2 – Higher Level Paper 1 Question

2. (a) Solve the simultaneous equations

$$x+y+z=2$$
$$2x+y+z=3$$
$$x-2y+2z=15.$$

(b) α and β are the roots of the equation $x^2-4x+6=0$.

(i) Find the value of $\frac{1}{\alpha}+\frac{1}{\beta}$.

(ii) Find the quadratic equation whose roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$.

(c) (i) Prove that $x+\frac{9}{x+2}\geq 4$, where $x+2>0$.

(ii) Prove that $x+\frac{9}{x+a}\geq 6-a$, where $x+a>0$.

2007 Question 4 – Higher Level Paper 2 Question

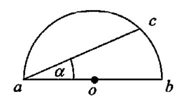
4. (a) Show that $(\cos A+\sin A)^2=1+\sin 2A$.

(b) Find all the solutions of the equation
$6\cos^2 x+\sin x-5=0$, where $0^\circ\leq x\leq 360^\circ$.
Give the solutions correct to the nearest degree.

(c) $[ab]$ is the diameter of a semicircle of centre o and radius-length r.
$[ac]$ is a chord such that $|\angle cab|=\alpha$, where α is in radian measure.

(i) Find $|ac|$ in terms of r and α.

(ii) $[ac]$ bisects the area of the semicircular region.
Show that $2\alpha+\sin 2\alpha=\frac{\pi}{2}$.



Top tips for studying Higher Maths

Algebra, algebra, algebra

If your algebra is good you will have no trouble with higher maths.
You must be solve the following types of equations
(i) Linear
(ii) Simultaneous equations
(iii) Quadratic equations. Remember the degree of the equation tells you how many solutions you must get.

Common mistakes which will cost you marks include:
(i) Solve $x^2-2x=0\Rightarrow x-2=0\Rightarrow x=2$ (this is incorrect as all quadratics have two solutions). You should have done the following: $x^2-2x=0\Rightarrow x(x-2)=0\Rightarrow x=0, x=2$

(ii) Solve $x^2=4\Rightarrow x=2$ (incorrect for the same reason)
You should have solved as follows:
$x^2=4\Rightarrow x^2-4=0\Rightarrow (x-2)(x=2)=0\Rightarrow x=2, x=-2$
Another common mistake is $x=\sqrt{4}\Rightarrow x=\pm 2$. This is incorrect; the $\sqrt{4}$ is 2 (the positive root, check it on your calculator).

(iii) Cubic equations
This question is based entirely on the factor theorem, so practise your long division.
An interesting fact which was on the old course is:

If $ax^3+bx^2+cx+d=0$ has roots α,β,γ then
$(i).\alpha+\beta+\gamma=\frac{-b}{a}$ (ii) $\alpha\beta\gamma=\frac{c}{a}$.
This can be very useful in verifying solutions of cubic equations
Remember algebra-based questions occur on paper one in questions one, two, three, four, five and on paper two in questions six and eight.

Surds $\frac{\sqrt{3}+1}{\sqrt{3}-1}$
It will be interesting to see the examinations commission's attitude to surds as both the new Casio and Sharp calculators will give your answers in surd form and will simplify expressions such as. $\frac{\sqrt{3}+1}{\sqrt{3}-1}$
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Trigonometry

This is not everybody's favourite topic, but questions involving some form of trigonometry occur in all of the following questions:
Paper 1: Question three – Complex numbers, Question six and seven – Differential calculus, Question 8 – Integral calculus.
Paper 2: Question 1 – the circle, question three – vectors, questions four and five – the main trigonometry questions .
You must be able to deal with all of the following :

(i) Limits of the form $\lim_{x\to 0}\frac{Sinx}{x}=1$

(ii) Find A if $\sin A=\frac{-\sqrt{3}}{2}, 0\leq A\leq 360$

(iii) Length of an arc /area of a sector $L=r\theta, A=\frac{1}{2}r^2\theta$. ($\theta$ in radians)

(iv) Trigonometric Identities such as

$$Sin2A=\frac{2\tan A}{1+\tan^2 A}:Cos2A=\frac{1-\tan^2 A}{1+\tan^2 A};Tan2A=\frac{2\tan A}{1-\tan^2 A}$$

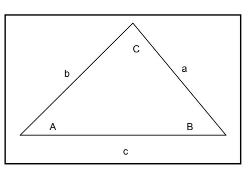
Students often express concern about the trig identities but the reality is that all the information is on page 9 of the maths tables

(v) Trigonometric equations, such as

$$Sin4A+Sin2A=0:2Sin^2A+5CosA-4=0.$$

These are great and are often worth 20 marks.

Triangle-based problems



Use the following formulae

(i) The area of a triangle $A=\frac{1}{2}ab\sin C$

(ii) The sine rule $\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$

(iii) The cosine rule $a^2=b^2+c^2-2bc\cos A$.

Problems involving three dimensions seem to be in vogue at the moment .You could also expect a trig identity in this question.

Differential Calculus

You must be able to differentiate functions using:
(i) The product rule.
(ii) The quotient rule
(iii) The chain rule
(iv) You must be able to differentiate implicit functions ie functions of the form
$xy+y^2=4$
(v) You must be able to differentiate functions which are in parametric form
$x=t\sin t, y=2\cos t$
(vi) You must be able to use calculus to find the turning points on a curve.
(vii) You must be able to find the Asymptotes of the graphs of functions such as: $y=\frac{x+3}{x-2}$.
(viii) You must be able to apply your knowledge of differential calculus to sketching graphs of functions, in particular to finding the turning points on the curve and where the graph of the function is increasing and decreasing.
(ix) You must be able to differentiate specific functions from first principals (this can appear in question six or question seven) .There is a very nice way of proving the product y = uv and the quotient $y=\frac{u}{v}$ rules from first principles using δx.
(x) You must be able to use calculus to solve problems involving distance, speed, time and rate of change problems in general.
(xi) Finding approximates for the roots of equations using the Newton Rapson method has been a particular favourite in this question in recent years. Practise using past papers from 2007, 2006 and 2005.