GCE

Examiner's Report

# Edexcel AEA Mathematics (9801)

## June 2002

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**June 2002**

**ADVANCED EXTENSION AWARD**
**SYLLABUS 9801**

(Maximum mark: 75)
(Mean Mark: 46.7 Standard Deviation 21.9)

## Introduction

Most candidates found the paper accessible and they could tackle some of the questions, but there were only a few candidates who tackled all the questions successfully. Disappointingly there were still a number of candidates who seemed ill prepared for the demands of this paper; their algebraic processing was often inaccurate and their grasp of some A level techniques and formulae was poor.

Questions 2, 3 and 4 were popular with most students and they were usually tackled using well-rehearsed techniques. Questions 5, 6 and 7 required a little more thought and imagination and proved to be good discriminators.

## Comments on individual questions

### Question 1

It was not uncommon to see 2 or 3 pages of trigonometry here with the candidates applying every formula they could think of, but failing to make any progress in answering the question. An expansion of sin $(4x + x)$ was a popular unproductive start to this question and others used deMoivre's theorem to expand sin $5x$ and cos $5x$. Those who did rearrange the equation to $\sin 5x + \sin x = \cos 5x + \cos x$ and then use the formulae for $\sin A + \sin B$ and $\cos A + \cos B$, made quick progress. Unfortunately a number who got this far cancelled the cos $2x$ terms and therefore lost the $\cos 2x = 0$ part of the solution. Other successful solutions used the $R \cos (x \pm 0)$ formulae, but sometimes they got as far as $\cos (5x + \alpha) = \sin (x + \beta)$, but were unable to progress further. Some candidates chose to square both sides of the equation and this led to the simpler equation $\sin 2x = \sin 10x$, however it was very rare to see a check that the solutions obtained were valid.

### Question 2

Most candidates could write down a correct binomial expansion and obtain the correct equation. Some made heavy weather of removing the $p(p - 1)$ factor; the advantage of working with factorised expressions was often not appreciated. The two values of $p$ were usually checked in the $x^3$ coefficient, but there were a number of sign errors here and the wrong value was sometimes chosen. It was rare to see a clear explanation of why $p$ could not take the values of 1 or 0, most solutions just cancelled the $p(p - 1)$ factor without considering these cases.

**Question 3**

This was answered well by most candidates. Almost all found the equation of the normal, although not all explained why $t = 1$; many seemed to assume that if $t^2 = 1$ then $t$ must be 1. Generally the candidates applied the correct method to form a cubic equation in $t$ and also realised that $t - 1$ was a factor. Long division was the favoured method of obtaining the quadratic in $t$ and many completely correct solutions were seen. Some candidates attempted to find the intersection of the normal with the curve in Cartesian form. This inevitably led to some very unpleasant algebra and little chance of success although one or two did obtain the correct values this way, but they wasted a great deal of time and energy in doing so.

**Question 4**

Most correctly differentiated the equation although there were the inevitable problems with the $xy$ product and the 48 term. It was usual to see the gradient set to zero and many obtained $y = x^2$ . Many good answers were seen to the next part too. Some failed to recognise that $x^6 - 2x^3 = 48$ was a quadratic equation in $x^3$ and made no further progress. Others spotted the $x - 2$ factor, carried out the long division, but then could make no headway with the very unpleasant quintic equation, however many obtained $x = 2$ and $-6^{1/3}$ though a significant number failed to use $y = x^2$ to find their $y$ values and they usually got in a tangle by trying to use the original equation.

There were assorted efforts to find the second derivative, but many failed to set $\frac{\mathrm{d}y}{\mathrm{d}x}$ and $(y - x^2)$ to 0 and did not reap the benefits of eliminating most terms.

**Question 5**

Part (a) was answered well and there were many correct expressions for $\frac{\mathrm{d}y}{\mathrm{d}x}$ in part (b), although sometimes the use of sin (0) to establish the stationary point was not clear. Part (c) was perhaps the most demanding part of the paper. Few candidates quoted the $\sin\theta < \theta$

inequality and those who used this did not always appreciate the significance of $0 \le x \le -\frac{\pi}{2}$. There were better attempts at the second result; candidates recognised the straight line and then some realised the relevance of the convexity of *OCB*. Part (d) by contrast was answered very well and many students left out the difficult parts (b) and (c), but knew how to use the inequalities in (c) to establish the result here.

**Question 6**

Students needed to make two key observations here: that $n_2 > n_1$ and that both values of $n$ are even. Those who did this usually continued to the remaining parts successfully. In part (b), nearly all knew that the integral of $C_2 - C_1$ was needed and the integration was carried out accurately. Many used $n_1 = 4$, $n_2 = 8$, though frequently with no or poor explanations for this choice. The arithmetic proved too much for many candidates though the examiners saw some simplified answers such as $\frac{712}{5}3^5$. In part (c), without calculators, the

relative sizes of $\left(\frac{1}{2}\right)^{\frac{1}{4}}$ and $\left(\frac{1}{5}\right)^{\frac{1}{8}}$ was not obvious and only the best students were convincing with their answers.

**Question 7**

There were some very good responses to this lengthy question. It was encouraging to see that many candidates had the perseverance to make a good attempt here, despite an indifferent performance elsewhere on the paper. The great majority knew where the error occurred, but their explanations were often poor. Several referred to $x$ *and* $x^2 + \frac{3}{4}$, but most compared the statement with the situation where $pq = 0$. Division by $(x - \frac{1}{2})$ followed by an examination of the discriminant of the resulting quadratic factor was the common approach in part (b), although some did use an argument based on the gradient. In part (c), most obtained $\beta^2 = 1 - \alpha^2$, but some then tried to examine the discriminant before dividing by $(x - \alpha)$ and some seemed uncertain of the step from $\alpha^2 < 4$ to $|\alpha| < 2$ and statements such as $\alpha < \pm 2$ were occasionally seen. In the final part most correctly interpreted the "students method" though the $x = \alpha$ case was sometimes missed, however the correct quadratic inequality in $\alpha$ was often seen. Many went on to find the correct critical values, but they did not always combine these values with the $|\alpha| < 2$ result to give the final answer.

## Grade Boundaries/Pass Rate Statistics:

| | Distinction | Merit |
|---|---|---|
| Advanced Extension | 74 | 51 |
| | (13.7%) | (42.3%) |