Examiners' Report Summer 2007

GCE

AEA Mathematics (9801)

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Introduction

This paper was a very good discriminator, leading to a wide spread of marks. At the same time all the questions contained parts that were accessible to competent A- level mathematics candidates, but also contained parts enabling the more able candidates to shine. Q3(b), Q4(a), Q5(f) and Q7(e) and (f) were particularly effective discriminators whilst Q2(a) and (c), Q3(a), Q4(b) and much of Q5 and Q6 were accessible to most candidates.

The general standard of entry was slightly better than in previous years but there are still too many candidates who have had little, if any, preparation for more searching questions on the core material and a small minority whose scripts suggested they would struggle with standard questions in C1 – C4.

Comments on individual questions

Question 1

Part (a) was usually answered correctly. In part (b) some worked from their expansion in (a) and let $y = \cos\theta$ and then worked from $(1-\cos\theta)^{-2}$ to $\frac{1}{4}\text{cosec}^4\left(\frac{\theta}{2}\right)$. Others chose to work the other way around and sometimes went via $\cos\left(\frac{\theta}{2}\right)$ which made their solution rather long winded. Given that the question was a "show that" we expected some explicit use of $2\sin^2\left(\frac{\theta}{2}\right)=1-\cos\theta$ (or equivalent) at some stage in the working. Few candidates stated the values of θ for which the result was not valid; $2n\theta$ was quite common (often coming from considering $\sin\left(\frac{\theta}{2}\right)=0$) but others realised that the condition was $|\cos\theta|=1$ but could not proceed from here.
Having written down a correct expansion in part (a) it was disappointing that so few candidates spotted the connection with parts (c) and (d). Those who did usually scored the 4 marks very easily but others floundered around with various expressions largely unrelated to the problem.

Question 2

Part (a) was answered well although a number of candidates sketched both $y=\sqrt{x}$ and $y=-\sqrt{x}$. In part (b) most interpreted the integrals in terms of area and there were some very thorough explanations usually accompanied by some shading on their diagram. The integration in part (c) was usually correct and many obtained $a=\frac{16}{9}$ but it was surprising how many candidates simplified as far as $\sqrt{a}=\frac{4}{3}$ and then failed to obtain the correct answer. Part (d) gave the candidates an excellent opportunity to shine by understanding rather than effort. Many tried to integrate a general f(x) and got no where. Some simply translated as in the mark scheme and others identified f(x) = $|x|$ with $b = \frac{16}{9}$. A few persistent candidates tried various powers of x and realized that they needed both f(x) and $\sqrt{\text{f}(x)}$ to be even functions and this led to $\text{f}(x) = x^4$ and $b = \sqrt{\frac{5}{3}}$ which was seen from time to time.

Question 3

Part (a) was straight forward and usually answered very well. Most reduced the equation to a quadratic in cos$x$ although some used the factor formulae. Part (b) though was much more difficult and many candidates made no progress. Some simply assumed that cos was a linear function and wrote x + 2x = 0 (or sometimes 1) and $\frac{1}{\cos x} + \frac{1}{\cos 2x} = \frac{\pi}{2}$ was often seen. Some did start by letting cosα= x and cosβ = 2x and then using the cos(A + B) formula but often they were unable to find sinα and sinβ in terms of x. Those who spotted that α and β were two angles in a right angled triangle often obtained a correct solution quickly and neatly.

Question 4

There were very few correct attempts at part (a). Many scored the first mark for making the substitution and integrating the right hand side although a large number forgot the +c. Some realised that they needed to square both sides to remove the square root on the left hand side but few spotted that they then needed to differentiate to obtain the printed result. There were many poor attempts at dealing with $\int \left(\frac{\text{d}y}{\text{d}x}\right)^2 \text{d}x$ often involving integrating by parts. Some good solutions simplified $\int \left(\frac{\text{d}y}{\text{d}x}\right)^2 \text{d}x = \int \left(\frac{\text{d}y}{\text{d}x}\right) \text{d}y$ and then proceeded to the required result after differentiating with respect to y.

The answers to part (b) were usually more successful but plenty of basic errors were seen here. Some could not separate the variables properly and we saw $\int \frac{1}{2y} \text{d}y = \int 2c \, \text{d}x$. Others forgot to include a constant when integrating and there were errors when removing logs so that $\ln(y + c) = 2x + \alpha$ became $y + c = \text{e}^{2x} + \text{e}^{\alpha}$. There were some correct solutions to part (c) but those without an arbitrary constant in (b) stood no chance and many simply took y(0)=1.

Question 5

Almost all the candidates understood how the sequence was developing and scored full marks in parts (a) and (b). In part (c) they often did not identify that the perimeters formed an arithmetic sequence but merely spotted the pattern and wrote down an expression for the general term. In (d) most stated that the perimeter increased but few stated that $p_n \longrightarrow \infty$ as $n \longrightarrow \infty$. Part (e) was straightforward and gave the first 3 terms of the sequence of areas required in part (f). Few identified the correct geometric series here and some failed to add the a^2.

Question 6

Part (a) was nearly always correct and most used the product rule correctly in part (b) and usually proceeded to the printed result although sometimes the identity work was rather protracted. Most candidates knew what they were trying to do in part (c) but some made heavy weather of the algebra. The most successful approaches considered f(x)= $\pi - 2x - 2\sin x$ and then considered $f(\frac{\pi}{4})$ and $f(\frac{\pi}{3})$. Justification for $f(\frac{\pi}{4}) > 0$ and $f(\frac{\pi}{3}) < 0$ were often blurred (although some candidates gave excellent arguments here and also justified $\sec^2\left(\frac{x}{2}\right) \neq 0$) but candidates were able to explain that a change of sign meant a turning point existed in the given range. Very few showed that this turning point was a maximum and some attempted $A''(x)$ to try and show this. There were a variety of methods employed to answer part (d) and the surd manipulation was usually carried out correctly. Most used a formula for tan2A but other approaches used the identity $\tan\left(\frac{\pi}{8}\right) = \frac{\sin\left(\frac{\pi}{4}\right)}{1+\cos\left(\frac{\pi}{4}\right)}$. Even those who failed to complete part (d) were often able to form a correct argument to establish the result in part (e).

Question 7

In part (a) most realised that angle $OPQ = 90^o$ but few gave any justification for this. They were often able to use this though to establish the given result although the use of vector notation was poor. Most had a correct method for finding λ in part (b) but arithmetic slips often meant that the correct answer was not obtained. There were fewer good attempts at part (c) with many candidates concentrating on finding lengths rather than a vector route for $\overrightarrow{OR}$. There were many possible ways of finding the area of the kite and many candidates were successful here.

Attempts at parts (e) and (f) were few and far between. A clear diagram with the centre of C_1 on OQ and the radii drawn to meet OP and PQ at right angles usually meant that they could identify a square and use similar triangles to obtain the required result. Those who achieved a result in part (e) were often able to tackle part (f) too and several fully correct solutions were seen.

Grade Boundaries:

June 2007 GCE Mathematics Examinations

	Distinction	Merit
Advanced Extension	68	49

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