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Examiners' Report Summer 2008

AEA

AEA Mathematics (9801)

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Introduction

The general standard of work was better than in previous years with most students making some progress with nearly all the questions. Algebraic processing was often much more confident and the calculus questions were handled well. Logarithms are still causing problems for many students and the geometrical demands of Q6 and Q7 proved too much for all except the best.

Although the quality of the work had improved the overall presentation was often still very poor. Candidates who intend to pursue their mathematical studies would benefit from spending a little more time in presenting their arguments clearly and remembering to explain the steps in their working. As the problems get harder the need for clear working becomes more important.

Report on individual questions

Question 1

Apart from the handful of candidates who thought the question was about a geometric series most candidates were able to obtain a value for n. Many simply divided 200 by 2.5 and obtained n = 80 without really appreciating that the 80^{th} term was the last positive term and the 81^{st} term was zero. This soon became apparent when they tried to use $S_n = \frac{n}{2}(a+l)$ with the wrong value for l. Differentiating a general expression for S_n was another popular approach yielding n = 80.5 but many candidates then tried to substitute this value back in S_n failing to realise that n should be an integer.

A very common error was to have d = +2.5 and a few candidates tried to solve $S_n = 0$ rather than $u_n = 0$.

Question 2

Part (a) was usually answered well although some failed to substitute for both y and $\frac{\mathrm{d}y}{\mathrm{d}x}$. The arithmetic was accurate here too and most found the correct coordinates of P.

In part (b) most separated the variables, used partial fractions and integrated correctly but then problems arose. Some forgot to include an arbitrary constant before removing the logs and others made errors in the application of the log rules. A number of candidates failed to see the link with part (a) and did not find the particular solution. A few candidates did not use partial fractions in part (b) but tried to split the integral in the form

$$\frac{1}{2}\left(\frac{2x+3}{x^2+3x+2}\right)-\frac{3}{2}\left(\frac{1}{\left(x+\frac{3}{2}\right)^2-\left(\frac{1}{2}\right)^2}\right).$$

Although the second integral is essentially "standard" and in the formula booklet this route proved quite demanding and it was rarely completed successfully.

Question 3

Most candidates completed part (a) successfully using tan30 (and double angles) or tan(60 - 45) or tan (45 - 30) and simplifying surds.

In part (b) the use of sin ($A \pm B$) formulae was the most common approach but some used $\frac{1}{2}(\cos 120 - \cos 2\theta)$. The equation was usually simplified to a correct expression for $\cos^2\theta$ but at this point most candidates were stuck. Those who rearranged to $\tan^2\theta$ were sometimes able to see the connection with part (a) and, provided they remembered the $\pm$ when square rooting, were able to complete the question as were those who worked towards cos2□ .

Question 4

Part (a) was generally completed successfully although a few candidates did not simplify their y coordinate to $\frac{1}{e}$.

In part (b) there were two stages where the candidates got stuck. The first stage of integration by parts was fine but some couldn't manage to integrate sin$x$ tan$x$. The final hurdle was the substitution and simplification of the limits with complicated inverse trigonometric functions as the limits and an expression in terms of "e" required for the final answer.

It was encouraging to see some using the symmetry of the function, and they had a much simpler lower limit of 0, and also to see several helpful triangles drawn to aid in the substitution of the limits. Despite its appearance though this was a fairly accessible question and there were many good solutions.

Question 5

In part (a) many candidates were able to find p= 9 and often q = 9/8 as well but their solutions were often rather jumbled and it was rare for $\log_3 p = 0$ to be considered and clear arguments as to why p = 1 was not valid were few and far between.

Most realised that $\log_3 9 = 2$ and often they were able to use the rules of logarithms to simplify the given equation. The usual approach though was to multiply everything out and obtain a cubic equation which often did not factorise due to poor algebra in reaching this stage. Those who had worked accurately frequently found (x - 2) as a factor and went on to present three answers of 2, 8/3 and 12. It was very unusual to see candidates checking the suitability of these answers in the original equation and only the best candidates gave a clear reason for x = 12 as the only solution.

Very few candidates factorised $3x^3 - 23x^2 + 40x$ early on but those who did had a much less complicated path through this question.

Question 6

Apart from those who tried to find $f'(x)$ or $\frac{1}{f(x)}$ the first part was usually answered successfully.

Most candidates made a start on part (b) but the more complicated approach of finding ff(x) and then comparing coefficients often led to some very complicated algebra and associated errors. Those who realised that $f(x) = f^{-1}(x)$ found a = -2 much more readily.

The sketches in part (c) were quite varied. The basic shape was often correct but common errors were to omit the y = -2 asymptote and the (b/2, 0) intercept. The transformations were understood quite well and even those with an incorrect graph in part (i) were able to translate their graph correctly in part (ii).

Part (d) proved very challenging. Very few spotted the symmetries about the intersection of the asymptotes but there a few very impressive solutions seen.

Question 7

Most began part (a) correctly but some of those trying the scalar product approach used **AB.BC** rather than **BA.BC** to find the cosine and lost the final accuracy mark.

Part (c) was often answered next and this too was usually answered very well. The rest of the question though proved beyond most candidates.

The few who used a rhombus approach in part (b) were able to complete this part easily but the preferred method usually involved half angles. Some showed that there were two equal angles between L and BA and BC (without showing that these angles were both equal to $\frac{1}{2}A\hat{B}C$),

others showed that the angle between L and BA was $\frac{1}{2}A\hat{B}C$ but failed to consider the angle made with BC.

Those who realised that triangle ABC was isosceles and that the centre would lie on the line from A to the mid-point of BC, often made good progress with the remainder of the question but there were far too many candidates who were trying to use the mid-points of AB or AC.

It is important for students to appreciate the need to explain one's working in mathematics. The examiners are often presented with pages of column vectors and occasionally vector equations of lines but if, as is often the case, these are incorrect and there is no indication of where they come from then credit for using an appropriate method can not be given.

Grade Boundaries:
Summer 2008 AEA Mathematics Examinations

	Distinction	Merit
Advanced Extension	72	54

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