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Examiners' Report/ Principal Examiner Feedback

Summer 2010

GCE O Level

Pure Mathematics (7362/01) Paper 1

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Pure Mathematics
Specification 7362

Paper 1

Introduction

Candidates across the full target range of ability found questions that enabled them to demonstrate their knowledge, but there was also plenty to challenge those at the higher end of the scale. The presentation of work was good on most scripts, with few candidates failing to show the methods used to obtain their answers.

There were many instances where candidates spent a considerable amount of time on one part of a question, often restarting the answer repeatedly using the same method when it might have been wiser to consider an alternative approach. This happened especially with Q9. There was also a tendency to leave a question completely following a difficulty with one part, particularly when the working failed to verify a given result. Candidates should be aware that method marks remain available after a mistake, and accuracy is also followed through in some questions.

Report on Individual Questions

Question 1

Most candidates understood that they needed to eliminate y between the equation of the line and the equation of the curve. The algebra was usually completed accurately, showing sufficient detail to confirm the given result.

The graph caused greater difficulty with many candidates failing to see the link between the graph and $\sqrt[3]{3}$. Some made no attempt to draw the line $y = 5x - 4$. Others drew lines that did not resemble the correct one, though some did intersect the curve in the right place. More frequently, the line $x = 1.4$ was drawn from the x axis to the curve. The correct answer was usually given when the line $y = 5x - 4$ was drawn accurately, though scales were sometimes read wrongly, giving values such as $x = 1.9$, and some gave the y value at the point of intersection instead. Too many candidates failed to round their answer to 1 decimal place. Answers found by calculation, without a correct graph, received no marks.

Question 2

Nearly all candidates knew that they had to differentiate the expression for velocity in order to find the acceleration and this process was completed well. Part (b) was also done reliably.

A few candidates found $t = 3$ but failed to use it to evaluate v. Some tried to solve $v = 0$.

Question 3

Candidates were generally familiar with the procedure for eliminating a variable by substitution. Ultimately, the standard of algebra was good, but it was often after one or more failed attempts which soon exhausted the answer space available. Those who chose to eliminate y had difficulty achieving a correct quadratic equation. Most used factorisation successfully to solve the quadratic equation.

Question 4

Relatively few candidates realised that the smallest angle was opposite to the shortest side so they resorted to finding all angles. This introduced an additional problem for those who used the cosine rule to find one angle and then the sine rule to find the next, without considering that the largest angle could be obtuse. These candidates usually used angles in a triangle to find the third angle, leading to an incorrect result if this was the smallest angle. Just a few attempts treated the triangle as isosceles, claiming that $\cos\theta = \frac{4}{6}$, or as right-angled, giving $\tan\theta = \frac{5}{6}$. In both of these cases the area formula $\frac{1}{2}bh$ was likely to be used incorrectly. Otherwise, part (b) was done well using $\frac{1}{2}ab\sin\theta$. Some preferred to use Heron's formula, which was usually applied correctly.

Question 5

The first term posed no difficulty for the many candidates who realised that it was equal to S_1. Others launched into more complicated working with a lower rate of success. The best of these alternative approaches started with $\frac{n}{2}\left(2a + \left(n-1\right)d\right) = n\left(2n+1\right)$. Mistakes in the simplification were common but some managed to compare coefficients of n and n^2 to find values for the first term and the common difference.

Part (b) was more challenging. S_2 was frequently evaluated as a starting point. A significant number of answers then claimed that the common difference was S_2 minus the first term.

The most common mistake in part (c) was to find S_{25} instead of the 25th term. Correct answers usually used $3 + 24 \times 4$. S_{25} - S_{24} was used by some, possibly realising that this did not depend on the accuracy of previous results.

Question 6

Most candidates knew that integration would be needed to find the volume but they had great difficulty in identifying a strategy that would produce the required result. Some focussed on areas, attempting integrals such as $\int_0^3 (9 - x^2)\,\mathrm{d}x$, and others tried to rotate about the y axis. Amongst those who headed in the right direction, common mistakes were $\pi\int\left(9-x\right)^2\mathrm{d}x$ and $\pi\int_0^3\left(4-x^2\right)^2\mathrm{d}x$. Incorrect limits were also common, such as -2 to 2 or 0 to 5, and π was occasionally omitted. Those who split the volume into a cylinder and an integral from $x = 2$ to $x = 3$ usually managed to complete the integration and obtain a correct result.

Question 7

The Binomial expansion was applied well but mistakes did occur in simplifying the terms. Very few candidates were able to write down the range of values of x for which the expansion is valid. Some did not know where to start with this. Others got as far as $x^2 < \frac{1}{3}$ and either left this as the answer or proceeded incorrectly. $\sqrt{-\frac{1}{3}}$ was seen all too frequently and a partial range was often given, such as $x < \frac{1}{\sqrt{3}}$.

Other common answers were $-\sqrt{3} < x < \sqrt{3}$, $-\frac{1}{3} < x < \frac{1}{3}$, and $-\frac{1}{3} < x^2 < \frac{1}{3}$.

Part (c) seemed to be too complicated for many and they abandoned the question at this stage. A few tried to expand $\left(1+3x^2\right)^{\frac{1}{2}}$ and then gave up their attempt to divide 2 + kx^2 by the result. Those who understood that they needed to multiply their answer to part (a) by 2 + kx^2 made good progress and usually went on to give a convincing verification that k = 5, though mistakes were made with signs and in simplifying terms.

It was mainly the stronger candidates who survived to attempt part (e). Many had lost accuracy by this stage, with $\int_0^{0.3}(2-2x^2-\frac{3}{4}x^4)\mathrm{d}x$ being especially common, but they were still able to gain some credit for the integration and substituting limits. A term in x^6 was sometimes included, even though the question stated that this was zero, and other extra terms were also seen. Mistakes were also made in evaluating correct integrals, so relatively few candidates gave an accurate result to 4 decimal places.

Question 8

The first equation was usually written as $5^x = 625$. This tended to be followed immediately by $x = 4$, with just a few candidates giving an intermediate step of $x = \frac{\log 625}{\log 5}$. $x^5 = 625$ featured amongst a variety of incorrect methods. Mistakes were even fewer in part (b), but statements such as $\log_3(5y+3) = \log_3 5y + \log_3 3$ were seen.

The factorisation in part (c) completely defeated some candidates and others thought that they could simplify the expression by putting x = ln x. Most got as far as $\ln x(5x+3) - 10x - 6$ but a significant proportion of these were unable to complete the factorisation. $\ln x = 2$ usually followed from correct factors. This was sometimes left as an answer. Some correctly identified the exact value of x and others wrote x = ln 2. The value $x = -\frac{3}{5}$ was nearly always included but candidates were expected to understand that the root of this equation could not be negative.

A minority of candidates had insufficient understanding of logarithms to tackle part (d) but it was familiar territory for the rest. Methods varied considerably. The most popular approach was to express all of the logarithms in either base p or in base q. This was followed through well to produce a simple quadratic equation. Many candidates were able to solve this and use their answers with pq = 81 to produce the values p = 3 and q = 27. Candidates were not penalised for including values that arose from their working but could not be roots of the equation.

Another common approach to part (d) was to eliminate one variable immediately, giving logarithms with a base of $\frac{81}{p}$ or $\frac{81}{q}$. This tended to lead to many more mistakes though some achieved success in this way. A less frequent method was to change all of the logarithms to base 10. It was possible to complete the solution quite concisely by doing this but very few managed to do so.

Question 9

This question depended heavily on part (a). Some candidates made no attempt to find the values of *a*, *b* and *d*, and others gave up very quickly. A few wrote f(x) as a product of factors, multiplied the brackets and quickly obtained the required values. The majority used the factor theorem to produce three equations. Attempts to solve these frequently spilled over on to continuation pages. Correct values were obtained using this method, but mistakes were common and many candidates gave up after their lengthy calculations failed.

It was possible to score 4 of the 5 marks in part (b) using incorrect values from part (a) and many of the candidates who persevered managed to do this. Those with correct values from part (a) frequently scored full marks in part (b). The most common mistakes were to write down the equation of a line through (-2, 0), (-2, f(2)) or (2, f(2)). The minority of candidates who found a correct equation for the tangent at *S* were usually able to confirm that it passed through the point *R*. Those with incorrect equations for the tangent generally realised that *R* was not on their line and this often meant that no attempt was made in part (d).

The area in part (d) was most easily obtained using the integral $\int_{-2}^{2}\left(\left(2-x\right)-\left(x^3+2x^2-5x-6\right)\right)\mathrm{d}x$, but few did this. Instead, there were various attempts to split the area, usually at x = -1 but sometimes at various other points as well. Many of these attempts used the line, or the curve, or both across only part of the range of the area. Some ignored the line completely. Others struggled to sort out the signs that their integrals produced and more mistakes occurred in evaluating the integrals, especially with negative limits. Consequently, few correct answers were seen.

Question 10

Candidates who had struggled with question 9 were probably relieved to find marks easier to gain in the final question. There were very few incorrect gradients in part (a) and most candidates showed that the product of their answers was -1, but they must remember to state their conclusion. The length in part (c) was also calculated reliably, though some gave only a decimal value rather than the exact surd. A few more mistakes were made in finding an equation for the perpendicular bisector of *PR*, though many gained full marks for this. The most common mistake was not to use the coordinates for the mid-point of *PR*, making the line go through *P* or *R* instead, or sometimes looking forward in the question and making it go through the point *Q*. Those who found a correct equation were nearly always able to show that it passed through the point *Q*.

The candidates who attempted part (f) usually started by finding the coordinates of *S* correctly. Some found the length of one more side of *PQRS* and decided that this was enough to show that it was a square. Establishing that all 4 sides have the same length gained credit but some reference to the right angle at *Q* was necessary for full marks. Any other complete method of showing that the quadrilateral is a square would have received full marks, but most attempts were insufficient. Some showed that opposite sides were equal and parallel, for instance, or that the diagonals were perpendicular. A few even thought that it could be done by drawing a graph.

The final part was popular and well done. The determinant method was the most common approach, with some inevitable mistakes in the evaluation. It was probably easier to calculate $\frac{1}{2}\sqrt{13}\times\sqrt{13}$.

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	80	60	41	36	29	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	80	60	40	35	30	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	79	60	42	37	28	0

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