Examiners' Report/ Principal Examiner Feedback

January 2010

GCE O Level

Pure Mathematics (7362/01) Paper 1

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Pure Mathematics

Specification 7362

Introduction

Candidates found paper 1 to be slightly more difficult than paper 2 although both papers contained some questions where the weaker candidates could gain marks and also questions to challenge the most able. There was no evidence that candidates were prevented from showing what they could achieve due to lack of time.

There were the usual problems of failure to round answers as instructed and failure to carry sufficient significant figures through the working to enable accurate final answers to be obtained. Several of the questions demanded exact answers. Candidates should be advised that whenever that is the case use of a calculator to obtain decimal approximations on the way to the answer causes loss of exactness and the final mark is already lost. Also, candidates at this level should be aware of the two units of angle measurement and take care to set their calculators to the correct mode in any trigonometric question.

Whenever a formula is used it is advisable to quote that formula first. That way if an error is made when numbers are substituted the examiner can see clearly that the candidate knows the correct method (so method marks are available) but has made a slip (and so accuracy marks are lost). Without the formula shown, incorrect substitution will be assumed to be an incorrect formula. Examiners can only mark what the candidate has written on the examination paper – they cannot read candidates' minds.

Paper 1

Report on Individual Questions

Question 1

There were many good, clear answers. A few failed to round their answers or made mistakes in doing so. Some omitted the second value in spite of the question asking for the two possible sizes of the angle or thought it was 180 – 80.4 – 42. The cosine rule was used occasionally, with just a few instances of success.

Question 2

Part (a) defeated many candidates. Some did not attempt it; others made laborious attempts, often using the factor theorem, which tended to end in an unproductive muddle. There was much more success with part (b). The most common approach was to use the factor theorem twice and solve the resulting simultaneous equations. Some candidates then used their answers from (b) to factorise the expression and show that 3 was a repeated root. As this had been assumed in the solution of (b), this approach to (a) was invalid.

Question 3

Most candidates understood the need for calculus and were able to demonstrate some understanding of the chain rule. Many solutions were clear and complete, showing good notation. Labels sometimes went wrong, showing the initial differentiations with respect to r as $\dfrac{dV}{dt}$ or $\dfrac{dA}{dV}$ for example. A few candidates did not give correct formulae for the area and volume. $A = \pi r^2$ and $A = 2\pi r^2$ were amongst the more common mistakes. A significant number of candidates resorted to decimal evaluation throughout their working. Since an exact answer was not demanded here this did not result in a loss of marks but did make more work for the candidate.

Question 4

Nearly all candidates made a reasonable attempt at the simultaneous equations, often presenting neat and accurate solutions. Most proceeded by substituting $y = \frac{6}{x}$ or $x = \frac{6}{y}$ in the second equation. The resulting quadratic was usually solved accurately, normally by factorisation. Just occasionally this went wrong, with versions like $(x - 6)(x + 1) = 0$. A few candidates failed to find the values of the second variable and some did not read the question carefully enough, using 1 instead of 11.

Question 5

It was good to see a few excellent solutions, demonstrating a sound knowledge of vectors and accurate notation. These were very much the minority. Most candidates seemed to struggle with the concepts of vectors and were unable to construct a meaningful solution, especially in part (b). It was not unusual, for instance, to see candidates equating vectors that were not equal or even not parallel, and some used vectors as coordinates or components of other vectors, possibly including the odd scalar amongst the vectors.

In part (a) correct expressions for $\overrightarrow{AB}$ often earned a mark but the ratios associated with the position of *C* were not used well. $\overrightarrow{AC} = \overrightarrow{CB}$ was not uncommon. Those who made any real progress generally knew that they could compare coefficients but accuracy was often lost.

In part (b) very few candidates realised that $\overrightarrow{OD}$ was $\tfrac{1}{3}\overrightarrow{OB}$. Stronger candidates tended to go through the motions of establishing this from first principles, starting with equations like $\overrightarrow{OD} = h\overrightarrow{OB}$ and $\overrightarrow{DC} = k\overrightarrow{OA}$ and then solving simultaneous equations to find the values of *h* and *k*. Just occasionally, this was done successfully. Weaker candidates said $\overrightarrow{DC} = \begin{pmatrix} 3 \\ 8 \end{pmatrix}$ so $\overrightarrow{OM} = \begin{pmatrix} 1.5 \\ 4 \end{pmatrix}$. It would have helped candidates to draw a clear diagram. This might even have alerted them to the useful properties of similar triangles.

Question 6

Most candidates gained at least the method mark in part (a), and many solved successfully to find the *x* value. There were plenty of correct *y* values too, but some forgot the square root and others resorted to decimal approximation in spite of the request for exact answers.

The intercepts in part (b) were usually found correctly and most candidates were able to associate integration with the area. It was relatively unusual to see integrations involving either the square or square root of the correct expressions. Rather more candidates integrated using just one of the equations. Others used both equations, but with the same limits from -½ to 2. A reasonable number of solutions were correct.

Question 7

Most candidates salvaged something from this question but few achieved all of the marks. The first term was usually correct but there were some lengthy methods used. Some candidates compared the given sum with the general sum of an arithmetic series, comparing the coefficients of n and n^2 to find a and d. This approach did achieve success in many cases but those who did not simplify the general sum tended to write $13 = 2a$, just looking at the first term of the brackets.

Part (b) caused difficulty. Only a minority of candidates subtracted the sum of $r-1$ terms from the sum of r terms. About half of those that did managed to obtain an accurate result whilst the others made mistakes with the algebra. A more common approach was to do part (c) first. This was achieved with reasonable success, though $d = S_2 - a$ was not uncommon. Candidates who had not previously attempted part (b) usually used their value of d to find an expression for the rth term, but others were less likely to go back to correct or complete part (b). The final part was often omitted. Some attempts were completely muddled; others worked with the expression for the sum; and many treated it as an inequality. Those who did equate the rth term to a multiple of 5 usually used specific values, most commonly 5 or 10. Many ended up with fractional or negative values for p. Correct solutions were rare.

Question 8

The expansion was usually done well. A surprising minority wrote the first term as a and the last term was occasionally given as bx^6. Some candidates did not simplify beyond terms like $(bx)^6$. Those who preferred to use the expansion in the form $(1+y)^6$ often lost powers of a after starting with $a\left(1+\frac{b}{a}x\right)^6$.

In part (b), the fourth term was sometimes put equal to twice the third term and mistakes in the simplification were not uncommon, but many did achieve a correct equation linking a and b. Solutions became less reliable after this. There was a tendency to substitute $x = 3$ into the expansion and then put $a = 1.5b$ into this expression, equating it all to 46656. A few candidates managed to follow the heavy working through to a correct solution, but most made mistakes. Those who did simply put $a + 3b = \sqrt[6]{46656}$ rarely included -6 when taking the root.

Question 9

Parts (a) and (b) were both done very well.

A majority of candidates realised the need to change base in part (c). Many of them did this successfully and continued to complete a correct solution. In a few cases, $p^{\frac{1}{2}} = 3$ led to $p = \sqrt{3}$, $\log_p 9$ sometimes became $\frac{1}{2\log_3 p}$ and there were instances where the quadratic was lost because $(\log_3 p)(\log_3 p)$ became $\log_3 2p$ or $\log_3 p^2$.

Question 10

The coordinates of A were usually found correctly. One of the more common mistakes was to conclude that $x^2(x-1) = x^2$ implies $x = 1$. In part (b) a few candidates used $\frac{4-0}{2-0}$ as the gradient of the tangent at A, but most understood that differentiation was needed and they usually found a correct gradient. The general equation of a straight line was known and used well.

In part (c) the quotient rule was applied well by most candidates though a few made mistakes in simplifying or evaluating their derivative. The final part was omitted by a significant minority. Others attempted it but were confused about the coordinates of the vertices of the triangle. Those who drew clear sketches were the most successful. In this example it was probably quicker to use $\frac{1}{2}bh$ for the area, but the matrix method was more popular. Both methods were successful when correct coordinates were used.

Question 11

Many candidates attempted to complete the question without drawing any sketches, often showing little or no annotation of the given diagram. This did not help them to see what they were doing, nor did it make their working easy to follow when new labels were introduced without any indication of the points they referred to. Those who were able to show clearly the triangles that they were using at each stage generally completed the question very well.

Part (a) produced some lengthy methods in an attempt to find *AE*. Both these and the more direct methods achieved a good rate of success, though the final answer was frequently 10.9.

In part (b), *VA* was also done well although $13 \div 2 = 7.5$ was seen numerous times.
A few candidates gave up after trying to find *AE* and *VA*. Most of the remainder identified the correct angle in part (c). Those who did were generally able to find a value, often with rounding errors.

Candidates had greater difficulty identifying the angle required in part (d). *VAH* was a common mistake. Those who worked in two separate triangles were often more successful with the 42.4^{o} angle than with 59.0^{o}. Accuracy tended to be lost with both results but many then gained the final mark for adding them. It was quite common to see attempts to use a single triangle. Even where the method was entirely correct, accuracy was usually lost. Those who used the rounded values $AV = 11.9$, $AH = 16.3$ and $HV = 22$ in triangle *VAH* calculated a numerically correct value of 101.4^{o} with these incorrect values.

A few candidates showed a clear vision of what was needed in part (e) and they completed a concise solution accurately, possibly wondering why the final item on the paper was so easy. This was not the case for most candidates. Many simply did not know which angle was involved. Others thought that it was *AVD*. Those who appeared to identify the correct angle did not always realise that it was in an isosceles triangle. Even those who did often opted to use the length Ö136, nearly always rounded as a decimal value, rather than the lengths 6 and 10, which were given exactly. Inevitably, the final answer was rarely accurate.

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	72	55	39	34	29	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	70	54	39	34	29	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	73	56	39	34	29	0

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