Examiners' Report/ Principal Examiner Feedback

Summer 2010

GCE O Level

Pure Mathematics (7362/02) Paper 2

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Pure Mathematics
Specification 7362

Paper 2

Introduction

Again in this paper some candidates spent an excessive length of time on parts of questions that caused them problems. In cases where the answer had been given they would have been better advised to continue with the printed answer and return later, if they had time, to correct the troublesome part. Candidates should always keep an eye on the marks awarded for each part of a question as these give them an idea of how long they should be spending on the separate parts.

When answers were provided, as in Q3 and Q7(b), candidates often tried to gain the marks by writing down the given answer at the end of their work with little regard for whether it could be obtained from their working. Examiners do look at the working supplied and little credit will be given in such cases.

As always, there were cases where marks were lost through failing to follow rounding instructions and using the wrong units for angle measurement.

Report on Individual Questions

Question 1

Most candidates drew lines in part (a) with gradients that were acceptable. The problems arose with the intercepts. Many did not indicate these with numbers on the axes; some made small marks instead leaving examiners to assume that these marks occurred at unit intervals along the axes, which was unacceptable, and others gave no indication at all. The shading was frequently correct, providing correct lines had been drawn, although sometimes the region described by $y...2x+1$, $y+3x$, 9 and $x...0$ was shaded.

Question 2

Obtaining the factorisation of the quadratic was successfully achieved by the majority of candidates. Part (b) was most commonly done by dividing the cubic by either the quadratic expression or by each of the two linear factors in turn. Factor theorem solutions were relatively rare. Many candidates failed to give a final statement to answer the question asked.

Question 3

Many candidates did not realise that the number of terms in the given sum was not *n*, but $n-4$. There were also errors in the common difference used. Unsurprisingly, many candidates with either of these errors still tried to convince the examiners that their answer was n^2-16.

A common alternative to the mark scheme method was to evaluate and add the first four terms of $\sum_{1}^{n}(2r-1)$ and then subtract this number from the algebraic expression for the sum.

Question 4

Candidates who could apply the method of finding the coordinates of the mid-point of a line to a vector question obtained the values of *a* and *b* efficiently. However, many candidates thought that $\frac{1}{2}\overrightarrow{AB} = 9\mathbf{i} + 40\mathbf{j}$ $\left(\overrightarrow{OM}\right)$ and consequently lost both marks in (a) and were working with an incorrect vector in part (b) also.

The work in part (b) showed there was considerable misunderstanding of the meaning of a "unit vector". Many candidates found the magnitude and then stopped. It was not uncommon to see $\frac{\left|\overrightarrow{OM}\right|}{\overrightarrow{OM}}$.

Question 5

Candidates in general either knew exactly how to answer this question, and did so very well, or made no attempt at all. Many attempts scored 4/5, losing the final mark because the answer was given to 3 decimal places rather than 3 significant figures. Apart from the final accuracy, it was the radius, rather than $\frac{\mathrm{d}A}{\mathrm{d}r}$, that candidates did not obtain correctly.

Question 6

Most candidates knew that, in part (a), they had to differentiate the given identity using the quotient rule. A few, however, seemed to think that quoting the learned result $\frac{\mathrm{d}(\tan x)}{\mathrm{d}x} = \sec^2 x$ and changing the $\sec^2 x$ to $\frac{1}{\cos^2 x}$ was a suitable response; the sec function is not even included in this specification.

Part (b) was generally well done, although there were a number of candidates who tried to use the answer to (a) to re-write the expression before differentiating and so attempted the quotient rule on $\frac{\mathrm{e}^{3x}}{\cos^2 x}$. Most candidates obtained $\tan\theta = 2$ in part (c) but far too many then gave their answer in degrees instead of radians.

Question 7

Many candidates thought that the volume of the box was $2x^2h$ and so were unsuccessful with part (b) also, although the printed answer often appeared at the end of their working in (b). However, these candidates could continue with parts (c) and (d) using the printed result.

The differentiation in (c) was usually good and led to a correct value for *x* (13.4). Some candidates did not go on to obtain the corresponding value of *S*, simply giving 13.4 as their minimum.

In part (d), the majority knew the method required but many omitted the 1 in the second derivative and hence lost the accuracy mark. A small minority used a method other than investigating the sign of the second derivative for this part. Some of these were acceptable but too often those considering the change of sign in the region of the minimum point simply quoted the rule and failed to produce numerical evidence to justify the turning point being a minimum.

Question 8

Only a few failed to earn both marks in part (a); some lost the accuracy mark due to careless algebra and some did not realise that all that was needed was to multiply out the brackets on the left hand side and collect the terms. The majority could identify the sum and product of the roots of the given equation correctly and only the occasional algebraic error occurred in parts (b) and (c).

Not all candidates realised the advantage of utilising the original identities in parts (d) and (e) and some made errors when working without them. Part (e) was the least successful part of the question. Many failed to appreciate that having found a value of $(\alpha-\beta)^2$ in (c), they could use it to obtain a value of $(\alpha-\beta)$ to use here. The answer for part (e) was not always given in the required form; $-9\sqrt{24}$ appeared quite often.

Part (f) should have been brief, with previous working being used to obtain the sum of the roots of the new equation. However, some candidates ignored their previous work and so took far longer than was necessary here. As always, some omitted the $=0$ from their "equation" and so lost the final mark.

Question 9

The majority of candidates could do parts (a) and (b) but part (c) was more problematic. Here candidates often offered results containing a mixture of *A*, *B*, *P* and *Q*. Even those whose work suggested that they knew the essentials of the method required often failed to set their work out in a convincing "proof" form. The work presented improved again in part (d) where many candidates were able to use the result from (c) to establish the identity correctly. Most candidates then used the result from (d) to obtain an integrable expression in (e) and then made good progress with their integration. However, often the correct multiple was omitted. Some candidates seemed to think that $\int \cos 6x \cos^2 x \, dx$ was $\frac{1}{6}\sin 6x \cos^3 x$ or some similar expression.

Question 10

Part (a) was, in general, correct although some candidates seemed to think that $y=4$ is a line parallel to the *y*-axis. Many candidates were unable to identify the steps required to establish the existence of maximum and minimum points. They knew they needed to obtain the first differential but then omitted to show it was zero at the given points, which could be done either by equating to zero and solving or by substitution of the given values. Many candidates thought that simply obtaining the second differential and checking its sign at the given points was sufficient without having established that these points were turning points of the curve. The differentiation was often made more complicated by re-writing the equation as a single fraction. Candidates who worked on to part (c) found this a welcome relief and usually produced correct coordinates. The sketches in (d) were, however, frequently disappointing. The coordinates of the turning points were often placed on the curve at points that were clearly not turning points and although the question referred to "**the** point where the curve crossed the *y*-axis", many curves crossed this axis at two or more points. Many sketches consisted of the line $x=1$ and no more. Candidates need to be aware that until at least one part of the curve is drawn, this line is just a line, and not an asymptote.

Question 11

Most candidates made a good attempt to obtain an equation from the given information as required in part (a); unfortunately this was not always the correct equation. Sometimes candidates were confused between, for example, the fifth term and the sum of five terms. Others used lengthy methods and obtained equations with powers higher than two which, even if correct, they were unable to solve. Those who obtained two values of x could usually gain both marks for parts (b) and (d) as follow through was allowed. The final mark of part (c) was possibly the hardest mark on the paper to gain. Very few candidates gave a complete solution for the equation $r^2 = 9$ and so did not need to rule out the negative value. Many candidates also forgot that they were working with the first and third terms and so gave $r = 9$ as their common ratio; the same error in part (e) caused the omission of the square root. Some candidates used the value of $x \left(-\frac{1}{2}\right)$ as the common ratio in (e) and it was not uncommon to see the sum to infinity calculated with a value of r which was greater than one.

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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