Examiners' Report Summer 2007

GCE

GCE AO Level Pure Mathematics (7362)

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Introduction

These two papers seem to have been found slightly more difficult than some recent papers but the work has been of its usual high standard. The usual problems arose with failure to round answers as instructed and using previously rounded answers in subsequent calculations, thereby arriving at an incorrect final answer. Some candidates seem reluctant to write down the formula they are using before substitution. This can lose them marks if an error arises on substitution. An example of this is Q1 on paper 2. Examiners need to be sure that the quotient rule is being applied with a difference of terms in the numerator before awarding any marks.

Most candidates are now writing their answer to each question in the space allowed for that question. When that space proves to be insufficient (due probably to restarting a question on failure of the initial attempt), additional sheets are usually used. Continuing the work on another page of the booklet is risky (especially on a page labelled as a blank page) as the markers may not see the work. Sketch graphs were drawn in the space provided rather than on separate sheets of graph paper as in January.

Paper 1

Report on Individual Questions

Question 1

It was not uncommon here to see candidates square root the expression given for y^2 and then square their result ready for integration. Some made errors whilst doing this and so lost marks; others forgot to square before integrating. Most included π with their integral, although some forgot it in spite of being asked to give their answer as a multiple of π.

Question 2

Most candidates realised that the product rule was needed in order to differentiate correctly. The most frequently seen answer was 7.68, resulting from substituting $t = 3$ with the calculator in degree mode.

Question 3

As usual, some candidates produced a lot of working in order to "write down" the equations of the asymptotes. Some sketches were totally wrong, quite a few omitted the lower branch of the curve, the curves often were not asymptotic to the "asymptotes" and the points of intersection with the axes were frequently not shown. Some curves even acquired extra intersection points between their calculation and the sketch!

Question 4

The requirement for integer coefficients in (a) was often ignored and some candidates seemed to be looking for a "normal" with a gradient of $-\frac{24}{7}$. Some candidates could not remember the formula for the length of a line joining two points; they knew that squaring, square rooting, adding and subtracting were involved but performed the operations in an incorrect order.

Question 5

Most candidates could complete the table of values correctly although the usual problems about rounding and/or truncating occurred. Those who made serious errors in the table rarely were alerted to them by their graphs, some of which were a very peculiar shape. Many did not attempt to re-arrange the equations in part (c) and of those who did re-arrange successfully and obtained answers from their graphs, some then forgot to observe the rounding instructions.

Question 6

The majority knew, and could correctly apply, the binomial expansion. There were occasional errors in simplifying the resulting fractions. Many correct solutions were seen for part (b) but a significant minority substituted $\frac{1}{32}$ and compared their result to the value they obtained from their calculator. Too many candidates simply wrote down a value from their calculator in (c), rather than substituting $\frac{1}{32}$ into their expansion. There were further difficulties in (d) where some did not know the formula for calculating a percentage error, others used a rounded value from their calculator instead of the exact $\sqrt[5]{37}$ and some had forgotten to double the result of their substitution in (b) and so claimed a 50% error.

Question 7

There were many candidates who gave answers in degrees in this question and others who gave multiples (correct to 3 significant figures) of π. In part (a) quite a few candidates began by multiplying out the brackets, in many cases proceeding with a totally erroneous solution and in others factorising once more, but not always getting back to the given equation. In part (b) the 2θ proved troublesome; candidates divided by 2 at the wrong point in the solution. Those who worked in degrees frequently mixed their units and subtracted $\frac{\pi}{6}$ instead of $30°$. In part (c) the majority used the identity $\sin^2\theta + \cos^2\theta = 1$ and obtained a correct quadratic equation which they could then solve satisfactorily, apart from, in many cases, giving the answer in degrees once more.

Question 8

Providing candidates knew their formulae correctly, parts (a) and (b) were usually completely correct. Some interchanged the *n* th term and sum of *n* terms formulae, with disastrous results. In part (c), the most common error was a failure to move from the solution of the quadratic $(n = 25)$ to the least value of 26. In part (d), many candidates found the sum of the last 11 terms rather than the last 10.

Question 9

Most could use Pythagoras' theorem in 3 dimensions successfully in part (a) but in some cases this was as far as they could proceed with this question. Those who went further usually succeeded with parts (b), (c) and (e). Part (d) was clearly found to be significantly harder, with only a minority identifying the correct angle. In part (e) many found the obtuse angle between the two lines and did not proceed to the acute angle. Several marks were lost in this question by premature rounding. Computation needs to avoid the use of rounded results from earlier parts instead of accurate values. It is better to work with the surd forms throughout and only round when giving a required answer.

Question 10

Here parts (a) to (d) were usually well done. Errors included not being able to factorise a cubic where one root is known. In part (c), quite a few found the equation of a tangent instead of the line *PS*. Part (e) was a difficult end to the paper for many. Many thought that the curve *QS* was a straight line. The actual integration was frequently correct but obtaining the necessary areas and combining them correctly was more problematic. Students who integrated line – curve were more likely to be successful.

Paper 2

Report on Individual Questions

Question 1

The majority of candidates knew, and could correctly apply, the quotient rule. Errors seen included integrating terms rather than differentiating them and forgetting the 2 when differentiating sin 2x.

Question 2

Some candidates did not know the formula for the area of a circle and others could not apply the chain rule correctly but many produced a completely correct solution. Rounding, as always, cost some candidates marks either for using a previously rounded answer in their working or by failing to round the final answer as instructed.

Question 3

Most candidates recognised that the cosine rule had to be applied in part (a) and then used either the sine or cosine rule in (b). Those who made errors in part (a) were able to gain some marks in (b). Some again, failed to round as instructed.

Question 4

Part (a) was done well, though a few stopped at values of *x* instead of proceeding to the coordinates of the points of intersection. Some candidates then made no attempt at part (b). The method used for choosing the set of values of *x* was rarely shown, resulting in no marks for an incorrect answer. There were a number who attempted to combine the two outside intervals into the one statement $-3 \ldots x \ldots 5$, thus implying that $-3 \ldots 5$, which is clearly incorrect. Many did not make the connection with (a) and repeated that section of the work.

Question 5

In parts (a) and (b) candidates seemed to find roundabout ways to score achieve the required results, spending a lot of time gaining relatively few marks. In part (c) many candidates arrived at the given answer by totally erroneous methods; in questions such as this it is important that every step is written down in order to convince the examiner that the result could have been achieved even if it wasn't stated in the question. Part (b) had been intended to help towards (c) but many either did a complete change of base once more which was not always the same as their answer to (b) or omitted to change base at all. Very few candidates obtained both answers in (d). Some obtained $\frac{2}{5}$ from incorrect working.

Question 6

Some candidates made no attempt at part (a) but then completed the rest of the question correctly. There were very few "fudged" answers here. In part (b), a significant number of candidates scored the first three marks and then stopped. There are still candidates who consider that stating the sign of the derivative on either side of the turning point (without giving numerical evidence) is sufficient to establish the nature of that turning point. Part (d) was rarely incorrect providing the first stage of (b) had been completed correctly.

Question 7

Most could obtain the required vectors correctly provided they could handle the ratios correctly. For part (b), most realised that they needed to compare two vectors in each case. Some then divided the vectors rather than simply deducing that one was a scalar multiple of the other; others failed to draw a suitable conclusion from their work.

Question 8

A significant number of candidates could not begin this question. Part (a) created problems for those who were unable to solve the equations they had obtained. For those who were successful in (a), part (b) followed easily. Some candidates did not know the formula required in (c) and others failed to realise that to satisfy the given condition the value of *r* had to be negative. In (d), sorting out the signs after substitution caused many errors in the final answer.

Question 9

Part (a) caused few problems. In part (b) most errors arose due to incorrect algebra. Too many thought that $\alpha^2 + \beta^2 = (\alpha + \beta)^2$ and made similar mistakes with the algebra in the following parts. There seemed to be a lack of understanding of the words "rational" and "prime" in part (d) and some candidates did not attempt this part at all in spite of achieving full marks on the rest of the question. In (e), many restarted the algebra necessary to find $\alpha^3 + \beta^3$ instead of using their answer to (c). Others were unable to construct the equation correctly or omitted the $= 0$.

Question 10

Most could write down an expression for $\sin 2\theta$; the mark was gained whether or not this was done from memory or using the given formula. In part (b), however, it was necessary to use the given formula together with $\sin^2\theta + \cos^2\theta = 1$ to gain any marks. Quoting and re-arranging $\cos 2\theta = 1 - 2\sin^2\theta$ is not adequate as the quoted formula is simply a re-arrangement of the required result. Part (c) was found difficult by many. Some tried, usually unsuccessfully, to simultaneously expand and square $\sin(A + B)$. In part (d), (ii) was more often correct than was part (i). Some used the results from (d) to change the integrand in part (e) but many tried to integrate the product as it stood. Even when the integration was correct, some substituted 120° instead of $\frac{2\pi}{3}$. Whilst this is never correct, the error disappears with correct evaluation of the trigonometric functions but not for the 2θ.

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	78	62	47	42	33	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	77	60	44	38	32	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	79	64	49	41	34	0

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