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Examiners' Report January 2008

GCE

GCE AO Level Pure Mathematics (7362)

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Specification 7362

Paper 1

Introduction

Although the intention is that the two papers are of similar standard, it was clear that candidates found paper 1 to be significantly more difficult than paper 2. There were questions on both papers that weaker candidates did not attempt. However, most candidates did attempt some if not all of most of the questions and there was no evidence that they 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. 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.

Sketch graphs are now almost always done in the examination booklet instead of on graph paper as frequently occurred in the past and candidates appeared to be better advised about using extra sheets if the space provided in the booklet was not sufficient for a particular question and not using blank pages or surplus space intended for a different question.

Report on Individual Questions

Question 1

Most candidates applied the cosine rule to find the required angle in one operation; for these the most common way to lose a mark was by failing to round as demanded. Some candidates found another angle first (by the cosine rule) and then used the sine rule to find $\angle LMN$. As $\angle LMN$ was obtuse this was an ambiguous case and invariably the answer given was acute.

Question 2

Many fully correct answers were provided here although a few candidates thought they were adding 43 terms instead of 44. Some candidates overlooked the starting point of 7 and summed 50 terms. Most knew and could apply the formula for the sum of an arithmetic series but a few thought the series was geometric. Weaker candidates who wrote down the first few terms before moving to a summation had been advised well as they frequently gained full marks.

Question 3

Part (a) was usually correct but part (b) was more problematical. Candidates usually knew that integration was required but did not always know how to use the result. Indefinite integrals appeared often, usually without any sign of a constant. Candidates then substituted $t = 1, 2, 3, 4$ in turn and added the results together to obtain the final answer.

Question 4

Many good solutions were seen for part (a), failures arose from an inability to use the product rule correctly and/or to differentiate the exponential term. There was no requirement to simplify the result of differentiating in (a) but those who did so had not wasted their time as they were well set up to complete an elegant demonstration in part (b). Many candidates could complete part (a) correctly but had no idea of how to approach part (b); others made relatively minor errors in (a) and tried to make part (b) work successfully by very dubious means.

Question 5

Most candidates knew the formulae for volume and surface area needed for part (a) and could successfully use them and the given numerical value for the volume to obtain the required result. Some gave their cylinder a lid and then dropped the resulting 2 part-way through their solution. (Solutions where the 2 was crossed out throughout were accepted as being correct.) It was rare to see candidates using their own expression in part (b) instead of the one given in (a) though it did occur sometimes. Both differentiations required in part (b) were usually correct but a significant number of candidates omitted the π in $\frac{\mathrm{d}^2A}{\mathrm{d}r^2}$; this is an incorrect differential and can only be accepted for a fully correct solution if the A has been replaced by another letter. Other errors in this question arose from rounding the value of r too soon and using this rounded value to calculate $A_{\min}$, omitting to verify that the obtained value of A was a minimum and forgetting to calculate a value for $A_{\min}$.

Question 6

It appeared that some candidates may not have been taught this part of the syllabus as there were some blank and "no idea" responses to this question. There were also many excellent responses. Some of the algebra was weak, involving lengthy methods which could have been avoided by substituting the numerical values of $(\alpha+\beta)$ and $\alpha\beta$ at the earliest possible moments. Some candidates forgot that "– sum of roots" was needed in forming the equations in spite of obtaining a correct value for $\alpha+\beta$ initially. Some "equations" lacked = 0. Only the stronger candidates were successful with both (c) and (d); many candidates returned to the original given equation here instead of using their equation from part (b), others had no valid method at all.

Question 7

Many excellent solutions were seen to this question, scoring full or almost full marks. The quadratic required to solve part (a) was usually correct and solved correctly either by factorising or using the formula. Unfortunately in part (c) some candidates, having found a correct value for the common ratio, then found the third term instead of the first term. Use of this in a correct sum formula in part (d) gained the M mark but the associated A mark was lost. Candidates who failed to obtain correct values of x in part (a) were generally unaware of this and continued through the question picking up some marks as they went.

Question 8

This was found to be the most difficult question on the two papers. Some candidates had no idea how to start and so passed on to the next question immediately. Many candidates who knew to integrate in part (a) omitted the constant of integration with a potentially disastrous effect on the rest of the question. This omission only affected the second A mark in part (b). In part (c), the instruction "write down" together with the allocation of only 2 marks for the two equations should have told candidates that no working was needed. Some candidates produced a lot of work and obtained equations of lines which were parallel to neither axis. Referring to the diagram once more should have told them that all was required in order to form correct equations was the y-coordinate of P and the x-coordinate of Q. Marks were awarded for a correct "follow through" from their answers to part (b). Few candidates added these lines to their diagram in order to facilitate finding the area in part (d). The "line – curve" method was the most efficient one for obtaining this area but numerous ways of dividing it into parts were seen. Those who omitted the constant, or obtained an incorrect value for it, in part (a) could still gain up to 5 of the 7 marks in part (d).

Question 9

Parts (a) and (b) were generally well attempted, the principal error being a failure to eliminate the $\sin^2\theta$ in (a). In part (c) it was not uncommon to see candidates use the given formula, sometimes then proceeding to use their results from (a) and (b) but failing to make further progress or fudging the rest. This type of question is set on a regular basis so it is disappointing to see that many candidates fail to realise that the final parts depend on the use of the result from (c). Many "solutions" for the equation in (d) factorised the left-hand side, keeping 2 on the right. Many of those who solved the equation correctly spoiled their results by giving answers in degrees instead of radians. In part (e) integrals including $\int \cos^3\theta \, d\theta = \frac{1}{4}\sin^4\theta$ were far too common.

Question 10

Good attempts were seen for parts (a), (b) and (c) although some candidates used rounded answers from earlier calculations in later ones, thereby obtaining incorrect final answers. Writing down the surd forms before rounding will leave exact results available for use later if required. Parts (d) and (e) however were found challenging by all candidates and only attempted by stronger ones. In (d), candidates seemed to assume that the perpendicular needed was the perpendicular bisector of VA. Good solutions to this part were seen using two calculations of the area of triangle VAB. Few candidates realised that the perpendicular in (d) was needed to find the angle in part (e).

Paper 2

Report on Individual Questions

Question 1

Most candidates knew the formula for the volume of revolution but unfortunately a few forgot to square y before integrating whilst others made errors when squaring, omitting the "middle term" or squaring e^{2x} incorrectly. Substitution of both limits was usually seen but some did not use $e^0 = 1$ when simplifying.

Question 2

In part (a), many candidates found $\overrightarrow{PR}$ instead of $\overrightarrow{OR}$. Fortunately this did not seem to cause a problem in part (b). There were, however in part (b) , many candidates who claimed the two vectors were parallel when theirs quite clearly weren't!

Question 3

For those who were familiar with these questions, this was a straightforward example and posed few problems. Some candidates overlooked the crucial statement $h = 3r$ and attempted to differentiate r^2h by treating h as a constant; others used $h = \frac{1}{3}r$ and so lost accuracy. Most could apply the chain rule correctly.

Question 4

Part (a) was generally well done by those who recognised the need for the quotient rule although some errors such as applying the rule the wrong way round, or adding in the numerator instead of subtracting were seen. A few quoted the known result that $\frac{d}{d\theta}(\tan\theta) = \sec^2\theta$, which was not allowed because of the instructions in the question (and not because it is outside the syllabus). In part (b) a few either omitted $234.5°$, included an extra value or failed to round as instructed and some gave $\tan\theta = \frac{5}{7}$ initially. It was surprising how many candidates did not attempt one or other of the parts of this question; each part seemed to be omitted in approximately the same number of cases.

Question 5

Most candidates could make a reasonable attempt at parts (a) and (b) although some set up the first equation incorrectly by making the eighth term four times the fourth term. Part (c) was more of a problem. Some candidates could use the sum formula but did not know what to do with it. Others used $S_n > 1$ instead of $S_n > 0$, others thought that when the product of two brackets was greater than zero, each bracket was greater than zero. Many worked with an equation instead of an inequality.

Question 6

The table (part (a)) and graph were usually completed and drawn accurately. Some candidates did not round correctly as instructed in the table, most used the correct scale for the graph. Graph errors included plotting (1, 0) instead of (1, 1), (0, -3) instead of (0.5, -3) and using a ruler to join points which was particularly obvious in the region from $x = 0.5$ to $x = 1$. Weaker candidates often stopped after completing the graph. Many candidates could form the single fraction as requested in part (c) but could not apply the result to obtain $\sqrt[3]{0.5}$; some gave an answer that had clearly come from their calculator as it did not match their graph. Part (d) was more successful, with many candidates being able to re-arrange the equation to read "graph = line" and then draw the necessary line to obtain a solution for the given equation.

Question 7

Most candidates could calculate the length of a line joining two points but not all followed the instruction to give exact answers. Very few recognised that the triangle was right-angled but a greater number did observe that it was isosceles and so only calculated one angle by trigonometry. Even those who knew there was a right angle at *A* often missed the significance of this in part (c). Candidates must be aware that the syllabus for this subject also assumes knowledge of the syllabus for the O level paper 7361, in this instance the circle theorems. Many candidates did successfully find the coordinates of the points where the perpendicular bisectors of the sides met, but this was a very long method for 2 marks! It was surprising how many assumed that one of the arms of the right angle was the diameter, rather than the hypotenuse. Even among those who found the correct coordinates of the centre, many then used the Pythagoras' formula to obtain the length of the radius rather than simply halve the length of *BC*.

Question 8

The binomial expansion is generally well known but there were some errors in simplifying the terms, especially in the part (b) where more minus signs were involved. It was disappointing to see how many candidates did not know the validity conditions for their expansions (part (c)). A reasonable proportion of candidates were aware that they needed to multiply their two previous expansions in part (d) but extra factors of 4 or 16 crept in from time to time. In part (e), most knew they needed to integrate their answers from part (d) but in some cases this meant integrating a quotient of quadratic expressions to obtain a quotient of cubics!

Question 9

Parts (a) and (b) were a good introduction to a question on logarithmic equations and almost all candidates achieved full marks. In part (c), most could change the base of one of the logarithms to obtain an equation which, after multiplying to remove the fraction, was a quadratic in a logarithm. However, some failed to realise that the fraction could be removed in this way and so made little progress. A variety of methods were seen for the solution of part (d). Most included dividing by $\left(2-3x\right)$ or changing $x^{2x-3} = 3^{2(2-3x)}$ to $x = 3^2$ and so losing the solution $x = \frac{2}{3}$. There were several who substituted a letter for $\log_3 x$; unfortunately they frequently chose *x*, resulting in a very muddled solution!

Question 10

Apart from the few candidates who needed to do a lot of work to "write down" the equations of the asymptotes, responses to parts (a) and (b) were good. Some, however, could not transfer their information to the sketch in (c). The sketch often only showed one branch of the curve and some crossed the axes in more points than had been obtained in (b). Most started part (d) by differentiating the curve equation accurately but many then made mistakes in the subsequent algebra. Some then substituted $x = \frac{1}{2}$ instead of $x = 0$ in order to find the gradient of the tangent at P and some forgot to proceed to the gradient of the normal. There were also cases where the gradient of the line joining $\left(0, -\frac{1}{2}\right)$ and $\left(\frac{1}{2}, 0\right)$ was found and used for the gradient of the normal. The method for part (e) was generally correct, but if the equation for the normal was not correct it was impossible to obtain correct coordinates for Q.

Statistics

Overall Subject Grade Boundaries

Grade	Max. Mark	A	B	C	D	E	U
Overall subject grade boundaries	100	78	60	43	38	30	0

Paper 1

Grade	Max. Mark	A	B	C	D	E	U
Paper 1 grade boundaries	100	72	56	40	33	27	0

Paper 2

Grade	Max. Mark	A	B	C	D	E	U
Paper 2 grade boundaries	100	84	64	45	39	34	0

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