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Summer 2012

GCE Further Pure Mathematics FP2
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Introduction

The responses given by candidates indicated that the questions were well understood by the majority. The questions enabled candidates in the lower ability range to respond to most parts of the paper. It was rare that candidates felt unable to access at least some part of the paper.

The paper discriminated at the higher grades, especially question 7.

Report on individual questions

Question 1

This was a straightforward start to the paper with the majority of candidates making a good attempt to solve the inequality. The most successful approach involved the algebraic method being supported with a sketch and these were most likely to achieve full marks. Those who chose to square both sides subsequently ran into difficulty as they had extra values and did not know which ones to use.

Question 2

Almost all candidates gained the first two marks for this question with a small minority, however, using $r\cos\theta$ instead of $r\sin\theta$. Differentiation using the chain or product rule was usually successful and a correct quadratic in $\cos\theta$ was often obtained. The majority made a valid attempt at solving their quadratic and gave a correct value for $\cos\theta$. Unfortunately, some candidates thought that their answer was a value for θ and then could not gain the method mark for finding a value for r. Again, some did not realise that their value for r was, in fact, the length *OP*. Of these, many found x and y and went on to use Pythagoras to obtain the same answer they had started with. However, a number of candidates resorted to decimals and lost the last accuracy mark.

Question 3

This question was well done by the majority of candidates who showed a good understanding of De Moivre's Theorem. In part (a) r was usually evaluated accurately, the most common error being to give an incorrect value for θ. In part (b) $\sqrt{2}$ or $4^{1/4}$ was usually seen and the next method mark for dividing their θ by 4 was awarded. A majority of responses indicated an understanding that they had to add a multiple of 2π to their θ and then divide by 4 to generate more values, but some unfortunately carried out this process the wrong way around, losing the last three marks. Unfortunately sometimes marks were lost by not giving the final answers in the required form.

Question 4

Candidates were usually very successful in solving this second order differential equation. Almost all obtained the correct complementary function, with only a very few making an error in solving the auxiliary equation. A number of candidates used x as their variable instead of t although this was not penalised initially and candidates could go on to gain full mark as they recovered in their final answer. The particular integral was usually in the correct form although a few candidates used the same coefficient and lost several marks overall. Almost all candidates gained the marks for $f'(1)$ and $f''(1)$. Unfortunately arithmetic errors often led to an inaccurate value for $f'''(1)$. The majority of candidates continued to find the general solution as the sum of their expressions but the last mark was often not awarded as candidates either gave their answers in terms of x, used an incorrect variable, or wrote down an expression as opposed to an equation for their final answer.

Question 5

Part (a) was very well done with almost all candidates differentiating the product and using implicit differentiation to gain full marks. However, a minority did take a very lengthy approach although they too were usually successful. In part (b) many lost the method mark for incorrect differentiation, but then could go on to gain the majority of the remaining marks. The correct form of the expansion was seen often, although again the last mark was often withheld as an expression was given as their series solution. A few candidates gave the solution as powers of x, losing the marks. Generally candidates seemed to have a good understanding of this topic and there were many pleasing fully accurate solutions.

Question 6

Almost all got full marks in part (a) and went on to use the method of differences in part (b). The majority of solutions offered listed sufficient terms to show cancellation and usually went on to express their summation as a single fraction. Those candidates who got this far invariably went on to gain full marks. Some candidates showed minimal working, however, and should be encouraged to show all necessary steps. Part (c) was not so well done, with a number of candidates starting again from scratch. Those who did use the result from part (a) often made the simplifying process much more complicated than necessary by failing to use the lowest common denominator of their two algebraic fractions.

Question 7

The first part of this question was very well done with most candidates differentiating $y = vx$ accurately and substituting it to obtain the correct differential equation in terms of v and x. The problems began in part (b) where many attempted an integrating factor approach even though it meant they were trying to integrate a function of x and v. These candidates were penalised heavily in part (b) although they could still gain marks in part (c). The more standard method of separating the variables was well attempted with some pleasing attempts at integration and correct removal of logarithms, also dealing correctly with the constant. Slips in the working were quite frequent, however, when substituting for v and rearranging to $y=\mathrm{f}(x)$. Some candidates identified that the left hand side could be expressed as an exact derivative by rearranging the original differential equation and multiplying through by x and these usually gained full marks. Part (c) was disappointing with many students not reading the question and understanding what was required.

Question 8

The majority of candidates substituted $z = x + \mathrm{i}y$ and then found the modulus of both sides and squared. Unfortunately, some forgot to square the 2, but still gained credit for their method. A few candidates tried to square the terms in i, showing little understanding of the method required. Most candidates attempted to find the centre and radius of the circle although there were many mistakes in this straightforward algebra and many obtained the wrong centre. In part (b) the sketches were often poor. Those who had found the correct coordinates of the centre usually failed to realise that the circle should pass through the origin. The half line was often drawn with no indication of the point of contact with the x-axis. Unfortunately very few candidates got full marks in part (c) as they did not look at their diagram in part (b) for guidance. Some candidates tried the very simple geometric approach, usually successfully, but the majority floundered with the algebraic solution of the two equations and often gave up.

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