Examiners' Report/
Principal Examiner Feedback

Summer 2013

GCE Further Pure Mathematics FP1 (6667)
Paper 01

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Introduction

Generally this paper proved to be accessible to most and discriminated well between candidates. Candidates do need to make sure they show all stages in their working however, as many seem to rely heavily on using a graphic calculator. Unfortunately, some candidates just wrote down solutions with no method shown, which will lose a significant number of marks, especially if incorrect answers are given. Questions involving standard bookwork were attempted well and formal statements were often used correctly and in the right context.

Report on individual questions

Question 1

The majority of candidates understood what was meant by a singular matrix and gained full marks for this question. The usual sign errors caused some to lose marks and some factorised incorrectly. There were a significant number of candidates who wrote down the solutions to their quadratic with no working shown, possibly using a graphic calculator. Some put the determinant equal to 1 and some went on to find the inverse matrix.

Question 2

Most candidates realised that a conclusion was required to part (a) and gained full marks here. Some had used degrees instead of radians and were confused by the lack of sign change. These candidates rarely continued to attempt part (b) although they could have gained the method and follow through mark had they done so.

In part (b) there were often problems with the sign of 0.911 and the fraction was often inverted and both of these errors resulted in no marks being awarded for this part of the question. Some candidates attempted to use interval bisection instead of linear interpolation. Occasionally, candidates went back to first principles and found the equation of the line, then putting $y = 0$ to find the intercept on the x-axis. A long method, but often successful.

Question 3

A variety of methods were used to find k including evaluating f(0.5), long division and inspection. Generally all were quite successful, but those who attempted long division or tried to find the quadratic factor by inspection often made errors. A small number of candidates substituted $x = -\frac{1}{2}$ instead of $x = \frac{1}{2}$ and gained no marks in part (a).

Once $k = 30$ had been successfully achieved, part (b) proved very accessible for most candidates. Once again, the quadratic factor was obtained from a variety of methods, with long division being the most popular but there were often a few sign errors here. Once the quadratic factor had been obtained, candidates went on to find the two complex solutions either by completing the square or by using the formula.

Question 4

There were many good answers to part (a). Candidates were able to find the gradient of the tangent using calculus and realised that they had to take the negative reciprocal to find the gradient of the normal. Very few candidates left these gradients in terms of x and most realised that a substitution was needed. As a piece of bookwork, this had been well understood and there were many fully correct solutions.

Part (b) proved to be more challenging. A few candidates substituted t as $\frac{1}{2}$ instead of $-\frac{1}{2}$ into their equation of the normal and many did not realise that they also needed to use the equation of the hyperbola. Those that did use the equation of the hyperbola were generally successful in obtaining a quadratic, which they solved to get the correct coordinates. Those who drew a sketch generally showed a better understanding of what was required in this part of the question.

Question 5

There were some good answers to part (a). The correct formulae were used and the term 6n was achieved by the majority of candidates. Factorising went ahead correctly, possibly because there was a given answer to achieve. A few candidates tried to use mathematical induction to prove the result and they gained no marks.

In part (b) most realised that they needed to find the difference of two sums. Marks were lost here when $3\mathrm{f}(n)$ was used in place of $\mathrm{f}(3n)$. Also $3n^2$ instead of $(3n)^2$ was a common error. Overall this question was very well answered this year.

Question 6

The mathematics required here had been learnt well and many candidates achieved the required result successfully. Only a few candidates just quoted the gradient of the tangent and again, few left the gradient as a function of x, which was encouraging.
The equation in part (b) was usually quoted accurately although there were a few candidates who tried to start from scratch for 1 mark.

In part (c) most attempted to eliminate either x or y to find the coordinates of the point of intersection but simplifying the result proved to be more of a challenge. Often poor algebraic skills meant the loss of the last three marks for this question. The equation of the directrix was not generally known and only the more able candidates achieved the final two marks for this question. Use of $x = -4a$ and $x = a$ as the directrix were common errors.

Question 7

Part a proved a challenge to some candidates and common errors seen were finding the modulus of z_1 and z_2, then adding. Unfortunately some candidates just added z_1 and z_2 and made no attempt to find the modulus and a few left i in the square root. Most candidates knew what they were supposed to do to achieve the answer but the amount of simplification required defeated them. Many ended up, after many lines of working, with only one variable in either the real or complex part of their answer. Few failed to spot that multiplying the two numerical terms, $(2 + 3i)$ and $(3 – 2i)$ before multiplying by the algebraic term simplified the working.

In part (c) the algebra involved in achieving an answer, following an earlier error, proved to be a challenge.

The mark for the use of tan was usually achieved in part (d) and common errors in the final answer were omitting the negative sign or inverting the fraction.

Question 8

Generally the standard of responses to this question were high for the first and the last parts. Part (a) was very well done. Almost all candidates were able to square a matrix and were able to quote the identity matrix.

In part (b) however, most candidates did not realise what was expected. Many tried a numerical approach, as in part (a) and gained no marks for their effort. Of those who did attempt an algebraic solution, some wrote that $7\mathbf{A}\mathbf{A}^{-1} = 7$, and some attempted to divide by $\mathbf{A}$. There were, however, some excellent solutions.

In part (c) there were some good attempts and only a very few candidates attempted to multiply matrices in the wrong order. The most successful solutions used the inverse matrix $\mathbf{A}^{-1}$. Many candidates chose a method involving simultaneous equations instead and were usually successful.

Question 9

In general, the methods required for mathematical induction were well understood, but the specific requirements of this question were missed by many candidates. Statements were often ones that had been learned, rather than being used in the appropriate context. The conclusions were often ill-conceived, particularly when defining the values for which the proof was valid.

In part (a) some candidates validated the result for $n = 2$ rather than $n = 1$. Some candidates used $u_{k+1} = 4u_k – 9(k + 1)$ and a few wrote that $4(4^k) = 16^k$, but the most common error here was not taking the expression $4^{k+1} + 3k + 4$ any further and not formally proving that it is true for $n = k + 1$.

Part (b) was more successful than part (a), although a few candidates did not show sufficient working when multiplying out their matrices to justify being awarded full marks for their solution.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
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