Examiners' Report/
Principal Examiner Feedback

January 2014

Pearson Edexcel International A Level in Further Mathematics F1 (WFM01) Paper 01

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Further Pure Mathematics F1 (WFM01)

General Introduction

Candidates found the paper accessible and standard methods were known. Presentation was generally very good. This paper afforded a typical grade E candidate plenty of opportunity to gain some marks across all of the questions. At the other end of the scale, there were some testing questions involving coordinate geometry and series that allowed the paper to discriminate well across the higher ability levels. Question 2 was a new topic and candidates seemed well prepared for this new material although a significant number of candidates resorted to find the two roots explicitly. Part of the method for question 4 (division of a quartic by a quadratic) was also was also a new topic but candidates performed well.

Report on individual questions

Question 1

In part (a) the majority of candidates correctly found f(3) and f(4) but a surprising number failed to give a conclusion or concluded there was a root without referring to the change of sign.

In part (b) the first 2 terms were generally differentiated correctly, but the constant $\frac{1}{2}$ caused problems in the third term. Newton-Raphson was generally applied well although lack of working did mean that it was sometimes difficult to tell if the procedure was being applied correctly. There were some examples of some poor rounding.

There were many good attempts in part (c) at linear interpolation especially if a diagram was used, but negative lengths appeared fairly often. Some candidates used interval bisection.

Question 2

Most candidates were successful in part (a), although a few ignored the coefficient of x^2, obtaining 4 and 2 for the sum and product and a small minority used the sum of the roots as $\frac{b}{a}$. Quite a few candidates solved the original quadratic equation to find the roots explicitly and tackled the whole question in this way.

The correct identity was used by the majority of candidates in part (b).

In part (c) many knew the method although x^2 + (sum)x + product = 0 was seen occasionally and some candidates failed to give the coefficients as integers.

Question 3

Part (a) was well done with only a very small minority of candidates not knowing what non-singular meant in the context of matrices. A significant number of candidates thought that the determinant of **A** is $\frac{1}{\det \mathbf{A}}$.

In part (b), the majority knew the determinant property for area but some divided by det **A** instead of multiplying.

In part (c) some used 2×4 instead of 2^4 and some resorted to finding $\mathbf{A}^4$, despite the instruction not to do so.

Question 4

The most popular approach in part (a) was to find the quadratic root $x^2 + x - 12$ and divide by it to obtain $x^2 + 2x + 5$. Some divided by $(x + 4)$ and $(x - 3)$ in turn, and a few factorised by inspection. Some slips occurred in solving $x^2 + 2x + 5 = 0$ usually not dealing correctly with $\sqrt{-16}$ or $\sqrt{-4}$ leading to $-1 \pm 16\text{i}$ and $-1 \pm 4\text{i}$.

Part (b) was often well done and was an improvement on previous series but a small number of candidates still did not take enough care over labelling in order to make clear what their points represented.

Question 5

The majority of candidates knew the approach to take in part (a) and took out common factors as early as possible. This approach should be encouraged if it is appropriate to the question. Some candidates multiplied out fully and then factorised the resulting cubic expression.

Usually sufficient work was shown but candidates should be encouraged to show all the steps in their working in 'show that' questions.

Part (b) was not done well in many cases. The common errors included a failure to sum the power terms. The answers ranged from 2 to 2^{12}. A number of candidates actually wrote down all the terms of the geometric progression and added them. This was usually successful. Errors often occurred in using the sum from part (a) due to slips in substitution or arithmetic.

Question 6

Part (i)(a) was very well done with only sign errors although there were some examples where the adjoint matrix was incorrect.

In part (i)(b) the majority used their matrix from part (i)(a) and most multiplied in the correct order. A significant number of candidates multiplied the wrong way round. A few let **A** be an unknown matrix and multiplied by **B** to produce simultaneous equations and were usually successful.

In part (ii)(a) the majority of candidates used the determinant correctly for the scale factor of the enlargement although some did not take the square root.

Part (ii)(b) was less successful than the enlargement scale factor and some candidates just used sin $\theta = \frac{1}{2}$ to give an angle of 30º without noticing that both cosine and tangent were negative for the angle of rotation. A significant number of candidates opted to multiply a general enlargement by a general rotation and then compare the matrices and were usually successful although again some identified an incorrect angle of rotation.

Question 7

In part (i) a variety of approaches was seen. Some multiplied top and bottom by the correct complex conjugate straight away while others made some attempt at rearrangement before doing so. There were a surprising number of basic errors when expanding the numerator.

The first step in part (ii) was well done with the majority being able to expand $(2 + \lambda\text{i})(5 + \text{i})$ correctly. The next step was less successful with some candidates setting their expansion equal to $\frac{\pi}{4}$. A surprising number of candidates who managed to reach $2 + 5\lambda = 10 - \lambda$ failed to solve this equation correctly.

Question 8

The standard work was almost always very well done in part (a). Implicit differentiation was the most popular approach. Quite a number used explicit differentiation and a few used parametric differentiation. The vast majority of candidates did obtain a gradient of $\frac{1}{p}$ and then used it correctly to obtain the equation of the tangent.

Success in part (b) was varied and those who did not appreciate that the equation of the directix was required, made little progress.

In part (c) there were many correct solutions but a significant number of candidates appeared to work with triangle *OPB* or triangle *OBD*. Candidates should be encouraged to draw diagrams to help identify the correct triangle.

Question 9

Of its kind, this induction question was more straightforward than others as the demand required for the algebra was less. Many candidates went straight for the $f(k + 1) – f(k)$ approach. In most cases they went on to obtain a correct expression but failed to then make $f(k + 1)$ the subject, thus losing the final 2 marks.

Some started with $f(k + 1)$ and as a consequence did make $f(k + 1)$ the subject and often successfully completed the proof. Some opted to start with $f(k + 1) – nf(k)$ with a suitable value for n and again success with the final 2 marks depended on them making $f(k + 1)$ the subject. Candidates should be encouraged to make a full conclusion at the end to bring all of the parts of the proof together to score the final mark.

Grade Boundaries

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