FURTHER MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

FURTHER PURE MATHEMATICS A – AS UNIT 1

Overview of the Unit

The candidates performed very well on a high number of occasions and there were some excellent scripts, including some scoring all 70 marks. However, as in previous series, poor algebraic skills were apparent and often proved costly. Candidates often performed well on the beginning and middle sections of the paper, finding the final three questions more challenging.

Comments on individual questions/sections

Q.1 This question was well answered by many candidates. However, some candidates incorrectly dealt with $(\lambda i)^2$ leading to a linear equation to solve, whilst others failed to note the information in the question that λ was a positive constant.

Q.2 Part (a) was answered well by the majority of candidates, with the most common errors being sign errors. Part (b) was answered well by many candidates, particularly those candidates who heeded the 'hence' in the question to use the inverse matrix from part (a). However, some candidates did not heed the 'hence' and found three pairs of simultaneous equations to solve. This method, if used correctly, enabled candidates to gain full credit.

Q.3 Part (a) was answered very well by candidates, with the vast majority noting the complex conjugate as another root of the equation. Part (b) was answered in a variety of ways by candidates. Some candidates used the two known roots to form a quadratic factor, to rewrite the quartic into two quadratic factors, and then solved the second quadratic equation – these candidates usually scored full marks, but careless sign errors were seen on occasions, leading to incorrect complex roots for this second quadratic equation. Some candidates used the expressions for roots of polynomials and usually scored full marks. However, some candidates decided to expand $(x-\alpha)(x-\beta)(x-\gamma)(x-\delta)$, to equate the coefficients with those given in the question – this method could lead to full credit, but errors in the expansion were seen regularly.

Q.4 Part (a) was well answered by the majority of candidates, although some candidates made errors by multiplying the matrices in the wrong order. In part (b), although candidates were able to formulate two linear equations, they were often unable to articulate how many invariant points existed under the transformation, but instead gave a description of the points.

Q.5 Overall, a well-answered question.

Q.6 Candidates seemed very familiar with the method required to answer this question, but the coefficient of 2 on the right-hand side caused some issues, e.g. if candidates chose to square both sides of the equation, they would forget to square the '2'. Whilst this error would still lead to the equation of a circle, accuracy marks were lost.

Q.7 Most candidates were able to gain at least the first three marks of this question by working out the result for $n = 1$, and then considering $n = k$ and $n = k + 1$. When calculating the entries of the $n = k + 1$ matrix, the top-right entry proved problematic. Some candidates simply noted the $(k + 1)$ form, as they knew the form of the target matrix. Others had poor algebraic skills and, through a series of errors, arrived at the required entry, such as $2 \times 2^k = 4^k$ and $5 \times 2^k = 10^k$ only to factorise 2 and 5 to return to 2^k.

Q.8 Candidates often started this question well, but were frequently unable to correctly manipulate their algebraic expressions, e.g. multiplying and simplifying fractions, for the coefficients of the new cubic equation, into a form that would allow them to make use of the results obtained earlier in the question.

Q.9 Parts (a) and (b) were generally well answered by many candidates. However, part (c) proved challenging for many candidates. Of those who made use of the formula in the Formula Booklet, many used the (x, y)-coordinates, rather than the corresponding coordinates in the (u, v)-plane.

Q.10 This was the most difficult question on the paper for many candidates. Few candidates correctly interpreted the information given in the question that the series ended with an odd number. Many candidates simply noted $\sum r^3 - \sum (r + 1)^3$ with identical ranges, or something similar, and very few marks, if any, could be awarded. However, it was pleasing to see some excellent responses to the question, with the three methods noted in the mark scheme all seen in responses.