

FURTHER MATHEMATICS

General Certificate of Education (New)

Summer 2019

Advanced Subsidiary/Advanced

FURTHER PURE MATHEMATICS A - AS UNIT 1

General Comments

The candidates performed very well on a high number of occasions and there were some excellent scripts. Many candidates began well, before struggling with some elements of the middle section of the paper, but then successfully earned marks towards the end of the paper.

Comments on individual questions/sections

- Q.1 This question was answered well by many candidates. There was little difference in the numbers of candidates using the inverse matrix method and those using simultaneous equations. However, more than a few candidates using the inverse matrix method multiplied the matrices in the wrong order, resulting in a possible maximum of only 3 marks.
- Q.2 This question was also answered well by the majority of candidates. However, poor notation resulted in the deduction of marks for numerous candidates. This poor notation mainly involved the omission of " $\mathbf{r} =$ " at the beginning of the vector equation, or multiplying both direction vectors by the same coefficient. Some candidates found correct direction vectors, but did not write full vector equations. In part (b), whilst the majority of candidates knew the correct method to use, some candidates used the full vector equations to find points of intersection, making no comment on perpendicularity.
- Q.3 Candidates did not perform as well as expected on this question. Whilst many candidates found z correctly, few candidates found w correctly. Many candidates plotted z on an Argand diagram, but many also believed that w was a reflection in the real axis. In part (b), many candidates gained follow-through marks and the majority used the rationalising surds method. However, those using the rules of modulus and argument for dividing complex numbers were almost always awarded full marks.
- Q.4 Questions on proof by induction have appeared in the legacy qualification and also in the Summer 2018 Unit 1 paper, so it was disappointing that rarely were full marks awarded for this question. Many candidates were aware of the steps involved in mathematical induction, but it seemed they were unaware of the subtlety of some of the steps and were simply repeating taught processes. Candidates needed to include the element of doubt e.g. "Assume it is true for $n = k$ ", followed by a conclusion detailing "If it is true for $n = k...$ "

- Q.5 The vast majority of candidates followed Method 1 in the mark scheme, realising that a quadratic factor could be derived. Some candidates did not multiply through by 2 to remove fractions and consequently encountered more problems. Poor algebraic manipulation sometimes resulted in candidates arriving at the incorrect quadratic equation to solve, whilst others substituted values incorrectly into the quadratic formula. It was disappointing to see some candidates reaching the conclusion that the quadratic equation had no roots, rather than solving for complex roots. Some candidates used the roots-of-polynomials method and were generally successful in reaching a quadratic equation, but similar errors occurred to those seen in the factorising method.
- Q.6 This question was answered very well by the majority of candidates. However, some candidates were unable to substitute $x + iy$ correctly, or square correctly after substitution, leading to errors.
- Q.7 In part (a), many candidates were able to square the expression and gain the first mark. Most candidates were able to substitute expressions for $\sum r^2$ and $\sum 4r$, but only some were able to substitute an expression for $\sum 4$. Fewer candidates were able to deal with the $2m$ in the limit, but those who realised, and substituted subsequently, were able to gain full marks. In part (b), few candidates heeded the 'hence' and simply calculated the sum of 13^2 to 22^2 . On other occasions, candidates did not take note of the lower limit of 11, and whilst they calculated $\sum_{r=1}^{20} (r+2)^2$ correctly, no marks could be awarded.
- Q.8 This was the most poorly-answered question on the paper. Often, candidates seemed to state various vectors without a clear idea of the direction in which their solution was heading. Some candidates had elements of both methods detailed in the mark scheme; however, their workings were often left incomplete.
- Q.9 Although part (a) was very well-answered, some candidates were unable to square $x + iy$ correctly, whilst other candidates did not take account of the '-1'. Part (b) often began well, with the majority of candidates finding expressions for u and v correctly; however, when eliminating x or y from their expressions, they often encountered difficulties.
- Q.10 The majority of candidates were able to begin the question by stating expressions for the sum of roots and the product of roots of the quadratic equation given in the question. However, some had sign errors in their initial equations, which often made the question more difficult. The majority of candidates were able to find expressions for the sum of roots and the product of roots of the cubic equation; however, many errors were encountered with the sum of pairs of products of roots. Fewer candidates than expected were able to spot $\alpha\beta + \alpha(\alpha + \beta) + \beta(\alpha + \beta) = \alpha\beta + (\alpha + \beta)^2$. Furthermore, when forming the cubic equation, candidates often substituted their new expressions with sign errors, and '= 0' was often missing.

Summary of key points

- Most candidates worked through the paper in question number order. Candidates are reminded that this is not essential and working to their strengths may lead to higher marks.
- Poor algebraic skills were apparent in many questions, particularly on squaring expressions and using the correct form for equations (such as vector equations).
- Problem-solving skills were not always apparent, leading candidates to omitting some parts of questions.
- Not all candidates made good use of the Formula Booklet – candidates are reminded of the assistance provided within the Formula Booklet.
- Most candidates showed all their working; however, all candidates are reminded to show sufficient working for their solutions.