

## FURTHER MATHEMATICS

### General Certificate of Education (New)

Summer 2022

#### 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. However, poor algebraic skills were apparent throughout the performance range. There was little pattern in the scripts as to the comparative ease of questions.

#### Comments on individual questions/sections

- Q.1 Part (a) was answered well by many candidates, with the majority deciding to multiply the complex numbers before finding the modulus and argument. Part (b) was answered far poorer than expected. Many candidates found  $\frac{1}{v}$  correctly and then their answer for  $v$  appeared without any workings being shown. Some candidates rationalised their  $\frac{1}{v}$  before finding  $v$ , only to have to rationalise again. However, this was the best-answered question of the paper.
- Q.2 Part (a) was answered well by many candidates. The majority of candidates used the inverse method rather than solving simultaneous equations. Part (b)(i) was very poorly answered – a typical response was doubling the values in the matrix for a reflection in the line  $y = -x$ . A full follow-through was offered for part (b)(ii) and many candidates were able to obtain these marks, although some candidates were unable to find a midpoint of their coordinates, which was disappointing as this skill comes from GCE Mathematics Unit 1.
- Q.3 This question was answered very well by the majority of candidates, with a large number gaining full marks. Some candidates failed to write their answer as the required Cartesian coordinates, but only lost the final accuracy mark. However, some candidates tried to find the Cartesian equation of the line, or only used the direction vector element to substitute for  $x, y, z$ .
- Q.4 This was the most poorly answered question on the paper and was answered in one of three ways by candidates. Some believed this to be a proof by induction question and gained 0 marks. Some expanded the  $(3N - 2)^2$  and used the formulae for sums of series; depending on how they began their answer, some credit might have been given. For those who spotted that the left-hand side needed replacing by  $\sum r^2$ , the first two marks were gained well. Following this, many candidates failed to show sufficient working to gain full credit, often going from a cubic equation with non-integer coefficients to the solution. Of those who found the three solutions, the vast majority did not reject  $N = \frac{1}{2}$ , so lost the final accuracy mark.

- Q.5 This was the second best answered question on the paper. The majority of candidates scored full marks in part (a), with only poor algebraic errors leading to marks being lost. However, in part (b), candidates often gave geometric descriptions of their equation in (a), rather than an interpretation of the locus of  $P$  referring back to (a).
- Q.6 This was the most difficult question on the paper for many candidates. However, many candidates gained some marks for writing down values for the sum of roots, the sum of pairs of products, and the product of all the roots. Some candidates showed an understanding of the common ratio to gain further credit. However, of those candidates who progressed further, many failed to appreciate the two solutions from  $\alpha^2 = 3$  and therefore lost some accuracy marks.
- Q.7 Part (a) was answered very well. In part (b), many candidates were able to find the dot product and the product of moduli. However, whilst many candidates found the obtuse angle, they believed that subtracting  $90^\circ$  from their answer would lead to the acute angle.
- Q.8 Many candidates started answering this question well. They used the information from the Formula Booklet to set up a matrix equation and multiplied it out correctly. However, some candidates did not equate their expressions for the resulting  $x$  and  $y$  coordinates and so gained no further credit. For those who reached an equation for  $y$  in terms of  $x$ , many failed to show sufficient working to rationalise their surd fraction, losing the final two marks.
- Q.9 This question was answered more poorly than expected. In part (a), poor algebraic skills often lead to candidates making errors in dealing with the three fractions correctly, particularly subtracting a fraction. In part (b), most candidates realised the connection with part (a) and began by substituting values into  $r$ . However, errors in cancelling out the fractions were frequent and some candidates failed to obtain the required remaining fractions for simplification. In part (c), a variety of different answers were seen – many candidates found  $25/168$  and  $25/156$ , but many candidates encountered difficulties in simplifying this to a ratio.