Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Further Pure Mathematics F1(WFM01) Paper 01

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Introduction

This paper proved to be a fair test of student knowledge and understanding. There were many accessible marks available to all students as well as some more challenging question parts for higher ability students.

Question 1

The opening question on matrix inverses was a very good source of marks for nearly all students.

The overall method was recalled by almost all. It was also very rare to see any slips obtaining the determinant. A few cases of use of $ad+bc$ rather than $ad-bc$ were seen. There were a small number of errors in forming adj ($\mathbf{M}$) and occasionally $\mathbf{M}$ was used.

Although part (b) was slightly unusual, good scoring continued here. Most were able to use the given information to produce a relevant equation and not many slips were seen apart from a few cases of sign errors. Very occasionally an incorrect identity matrix was used. A very small number were unable to combine $2\mathbf{M}+8\mathbf{I}$ appropriately. A few students unnecessarily formed equations for all four elements of the matrices which sometimes led to the offering of additional incorrect answers.

Advice for teachers and students:

Recalling the formula for the inverse of a 2 by 2 matrix is expected.

Question 2

This question on matrix transformations also saw generally good scoring.

Most were able to correctly name the transformations for the matrices in parts (a) and (b). However, sometimes the angle was incorrect for the rotation and there was no reference to the origin as the centre of rotation. Just giving an angle is insufficient to imply a rotation. Similarly, the centre of enlargement was often missing in part (b). Some described the enlargement as a stretch. In part (c), where the transformation was given and the matrix was required there were a few slips. Those who had obtained a correct matrix for the transformation in part (c) were usually able to apply it to the given point correctly. Part (e) was a little more challenging with some misinterpreting the given information. A few numerical slips were seen, particularly with those who attempted the question by using an inverse.

Advice for teachers and students:

The expected descriptions for transformations using matrices are defined in the specification (reference 6.2).

Question 3

There was solid scoring with this question on numerical methods.

In part (i), the majority were able to use interval bisection correctly. However, some did not interpret the question correctly and instead thought they had to show that there was a root in the original interval. In some cases the final interval was never specified - this needed to be expressed mathematically. A few carried out further unnecessary bisections.

In part (ii) (a), the method for showing that the given equation had a root in a given interval was widely recalled. Failure to refer to the continuity of the graph was common.

Part (ii)(b) required linear interpolation. Most were able to produce an appropriate equation although there were some that did not correct the negative value to positive. A small number made slips in solving the equation including premature rounding. Diagrams were often helpful to students.

Advice for teachers and students:

Values must be seen when performing interval bisection.

The error of failing to change the sign of the negative value when forming an equation during linear interpolation remains common.

Question 4

There were many fully correct responses to this question on a rectangular hyperbola.

The "bookwork" of finding the general equation of a normal in part (a) was very well done. A few responses neglected to include an intermediate step before the final answer.

In part (b), almost all students were able to find the y-axis intercept of the normal although there were a few that found the x-axis intercept. A relatively common error was where $9\left(1-t^4\right)$ was wrongly expanded into $9-t^4$.

Part (c) required finding the area of a triangle and was found to be very straightforward for most but there were some unnecessarily long-winded methods and significant errors here. Those that sketched a diagram were more generally able to produce the correct answer with little fuss.

Advice for teachers and students:

Realistic diagrams are always useful in problems involving hyperbolas and parabolas.

Question 5

This question on complex numbers proved a little more discriminating.

In part (a) there were some who were obviously not familiar with the trigonometric form of a complex number. Confusion with the modulus of a product also led to the correct answer being seen somewhat less than expected. The question said "State", but several students showed a lot of unnecessary algebra.

In part (b), some weaker students did not understand how they could use the fact that the sum of two complex numbers being real to make any progress. However, those who set $z_2 = a + b\text{i}$ often had little difficulty finding values for a and b. Sign errors were common and also seen regularly was just one solution being offered despite the question making quite clear that there was more than one solution.

Part (c) required an Argand diagram of the roots and the first mark of the two was widely scored. However, the final mark required the correct relative positions and some rushed this task. It was surprising to see quite a few students plotting the correct values in the wrong quadrants. Occasionally the real and imaginary axes were labelled the wrong way round.

Advice for teachers and students:

Knowledge of the modulus-argument form of a complex number is expected.

This question clearly indicated on two occasions that there was more than one complex number z_2. It is vital to read questions carefully.

Argand diagrams need to be drawn carefully enough so that the relative position of points is correct.

Question 6

This question on the roots of quadratics was fairly well-answered but there were perhaps a few more slips seen than with similar tasks on previous series.

It was rare to see errors stating the value of the product of the roots in part (a) although a very small number made a sign error here.

The structuring of the question where a constant *k* needed to be found in part (b) caused a small degree of confusion for a tiny minority number of students.

The identity proof in part (c) saw good scoring although there were a few algebraic slips. Some fell foul of the need to show sufficient working and a small number did not follow the instructions which required starting with the expansion of $(\alpha + \beta)^3$.

The method for part (d) was well known. Identities used were invariably correct although there were a few slips in combining them and calculating the required values. A significant number confused the substitutions of $\alpha + \beta$ and $\alpha\beta$. Most remembered how to use their values to produce the new quadratic although there were a few slips in sign. An equation was required and a small number did not achieve this or produced one without integer coefficients.

Advice for teachers and students:

Performing all the work to find the coefficients within a quadratic equation is inelegant and often leads to errors.

When a quadratic **equation** with integer coefficients is required then both these requirements need to be satisfied.

Question 7

This question on the complex roots of a quartic saw something of a mixed response.

It was very rare to see any student unable to state the correct conjugate in part (a), and most then proceeded to use an appropriate method in (b) to establish a quadratic factor although there were a few slips with the algebra.

Part (c) proved to be a little more challenging. The best method was equating coefficients and the majority proceeded via this route. Slips in solving were not common. Alternative approaches via long division and substitution were also seen but these routes were not usually good choices and marks were often lost by students choosing these approaches.

Those who had obtained a second quadratic factor generally knew that all they needed to do was solve it in part (d). Unfortunately a significant number of students failed to take heed of the fact that the question said "Without using a calculator" so appropriate working needed to be seen was here.

Advice for teachers and students:

The demand for this question included "Without using a calculator". It is important that such instructions regarding use of calculator technology and requirements to show all stages of working are followed.

Question 8

This question combined summations with proof by induction and had a mixed response. For most this was the most difficult question on the paper.

Part (a) was well done by many. However, the fact that the upper summation limit was $2n$ instead of n was not taken account of by some. There were also slips with substituting into the sum of the squares formula and the sum of 1 from $r = 1$ to $2n$ was not always correct. This was a "show that" question and working was sometimes insufficient.

Part (b) was a summation proof by induction. Some were clearly confused by the fact that the given summation expression was unexpanded and so unnecessarily expanded it. The overall general method was fairly well recalled, although there were many who did not show sufficient substitution for the base case. Algebraic processing was sometimes insufficient and there were also many who did not give the final answer in terms of $k + 1$. The last mark for an appropriate conclusion/narrative was sometimes withheld for incomplete answers. It was unfortunate to see some students attempt proofs that did not use induction but reverted again to summation formulae.

In part (c), most knew what was required although there were some careless slips in substituting the previous results into the given expression. The question required all stages of working to be shown and also had a calculator warning so it was unfortunate to see some answers just stated without supporting algebra. It was common to see the inapplicable answers of $0, -1$ and (particularly) $\frac{2}{9}$ left unrejected.

Advice for teachers and students:

In proof by induction for summations, substitution must be explicitly seen into both sides of the given answer. Convincing algebraic working must be evident.

In questions where the upper limit of a summation is required, any solutions which are not positive integers must be rejected.

Question 9

The final question on a parabola was somewhat discriminating. Those who knew the focus-directrix property tended to obtain all four marks with little problem. However, those who weren't aware of the fact that the distance from a point on a parabola from the focus and directrix is the same often made little impact and got lost in algebra that invariably led them nowhere. A small but significant number made careless errors applying Pythagoras. A few variations using right-angled and other trigonometry were seen and these were also largely correct.

Advice for teachers and students:

Knowledge of the focus-directrix property of the hyperbola is expected. (Specification reference 4.3).

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