AQA

A-LEVEL
FURTHER MATHEMATICS

MFP4 Further Pure 4
Report on the Examination

6360
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General

Overall, the paper had a wide variety of questions. This allowed students to show their skills and understanding across a number of different topics. Stronger students encountered several challenging sections that allowed them to demonstrate their ability, whilst less able students had sections that allowed them to show their understanding and ability to do key skills in topics such as the geometry of planes, the triple scalar product and its link to volume, invariant lines, eigenvectors, factorising determinants, inverting 3×3 matrices and the intersection of lines and planes. Students seemed to have been extremely well prepared for the paper, with many showing a high degree of understanding and sound technical skills. Standard methods and skills seem to be very well understood and applied accurately.

Question 1

Almost all students handled this question well, but a surprising number fell at the last hurdle and forgot to put a final summative comment referencing both singular and p.

Question 2

Part **(a)** was a straightforward link from “no unique point” to the determinant of the x, y, z coefficients being equal to zero.

Part **(b)** was more challenging in that it required either elimination of a variable from three equations or the Augmented Matrix Method. Most students handled this well, though a noticeable minority made slips in the RHS. Only a very few students got confused with the meaning of a ‘sheaf’. Please note that it is acceptable to refer to this as an “intersection in a line”.

Question 3

In part **(a)** students were evenly divided between calculating the triple scalar product via two products or as the determinant of the vectors. The question was generally done well.

Part **(b)** was the first question where the most able students could really show their ability. Although more students than on the previous occasion that this type of question was set recognised that they had to consider ±13, they were still very much in the minority. Of these students most didn’t either explain/show that the equation didn’t give real solutions or didn’t appreciate that in a Cartesian coordinate system, complex coordinates are not possible.

Question 4

Most students did well in part **(a)**. The quality of response to part **(b)** was noticeably better than in recent years. More students realised that they had to substitute $m = 4$ and $m = \frac{1}{2}$ into the equation without x to justify that $c = 0$ in both cases. However, still only the most able students managed to earn full marks.

Question 5

In part **(a)** most students gained full marks. Only a few students used their calculators in **(a)(ii)** to solve the cubic equation directly, showing no working and thus gaining no marks.

Part **(b)** was only done well by the more able students. In **(b)(ii),** as students were asked to find the values of x, y and z and they had to write a final expression involving $x = \ldots$, $y = \ldots$, $z = \ldots$ but some failed to do this.

Question 6

This question really allowed the more able students to show their ability.

In part **(a)** the correct way of combining the columns in the factorisation process was not trivial. Only the strongest were able to get past extracting the first linear factor. Many then relied on the all-or-nothing approach of a full expansion, which was rarely successful.

In part **(b)** students are now expected to obtain one correct value of x, not just put their determinant equal to zero to gain any credit. A surprising number of students (even those who scored full marks in part **(a)**) were unable to find three correct values for x from equating their fully factorised determinant to zero.

Question 7

Part **(a)** was another good question for discriminating between students. A number of students successfully got the value of k, but then were not sure how to show that the image of every point satisfied the given equation.

Part **(b)(i)** was a standard question requiring students to find the inverse of a 3×3 matrix with an algebraic element. Students had obviously been well prepared for this question.

Part **(b)(ii)** is another standard question where students extract the invariant point equations, find the necessary value of k and then obtain the required Cartesian equation of the line. Again students had been well prepared for this type of question, though the less able students still sometimes get confused and obtain a Cartesian equation of a plane.

Question 8

This question allowed the most able students to show their ability, whilst still allowing the weaker students to demonstrate key skills.

Part **(a)** a standard question where the direction vectors had to be identified from the vector product form of the two lines. A satisfyingly large number of students managed to score full marks.

Part **(b)** many students used the main approach with great success.

Part **(c)**, as usual, caused all but the most able students great difficulties. Some students used the wrong value for the cosine, some used the wrong directional vector for the line. All in all a tough question.

As part **(d)** was the last question of the paper, students were expected to have navigated parts **(b)** and **(c)** well enough to have obtained real values for p and b in order to score any marks at all. This is a standard question on finding the line of intersection of two planes, but as all the parts had to be calculated in **(b)** and **(c)** only the most able scored full marks.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.
UMS conversion calculator