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Mathematics MFP1

(Specification 6360)

Further Pure 1

Report on the Examination

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General

Students generally coped very well with the demands of this paper and there were no obvious signs that students had any difficulty attempting the questions within the given time. A large majority of students completed their solution to a question at a first attempt and again, presentation of work was generally very good.

Teachers may wish to emphasise the following points to their students in preparation for future examinations in this unit:

- When an answer is given, students should take extra care to ensure that they show sufficient intermediate steps/evaluations before writing the printed answer.
- When correcting work, particularly in reaching a printed answer, it is important that all corrections are made in each line of a solution and not just in the penultimate line.
- Final answers should always be given in the requested form.

Question 1

This opening question which tested roots and coefficients of a quadratic equation proved to be a good source of marks for almost all students. As indicated in the previous report for a similar question in this unit, with the answer given in part (b), examiners expected students to show more than just a full substitution followed by the printed answer. Many students reached the correct result $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}=\frac{\left(\frac{7}{5}\right)^2-2\left(\frac{1}{5}\right)}{1/5}$ and so scored the first two marks but a significant minority then just equated this to the printed value. Examiners expected to see at least $\left(\frac{7}{5}\right)^2$ evaluated correctly before the printed answer for the award of the final mark. In part (c), other than arithmetic errors, the most common loss of a mark was a failure to give an equation, the '$= 0$' having been omitted.

Question 2

Most students understood the basics of what was required although a minority of others in part (a) just differentiated the expression and then substituted $-2 + h$ for x, for which no credit was awarded. The majority of students wrote down the correct expansion of $(-2 + h)^4$ but then some forgot to add $(-2 + h)$ before subtracting 14 and so ended up with a term in the form c/h in their expression which they then lost to reach an expression in the right form to match what was printed. In part (b) most students used '$h \to 0$' and generally gained credit but the small minority who just stated '$h = 0$', rather than considering any limits, did not score.

Question 3

This question which tested complex numbers was generally answered very well with the majority of students scoring full marks. In part (a) almost all students correctly used $z^* = x - \mathrm{i}y$ and $\mathrm{i}^2 = -1$ and errors were generally restricted to either incorrect expansion of brackets or incorrect collecting of like terms. Part (b) caused slightly more problems with some students failing to even equate real parts and imaginary parts separately to zero.

Question 4

There were many excellent solutions seen for this question on general solutions of trigonometric equations. Less successful students, however, found this question difficult with many of them failing to score because they just attempted to divide both side by '$\cos$' to form the incorrect 'equation' $\tan(70 - 2/3x) = 20$. The majority of students though, attempted to apply a correct method with most starting by replacing $\cos 20$ with $\sin 70$. Those who attempted to recall the formula for the general solution of $\sin\theta = \sin\alpha$ sometimes did so incorrectly and were penalised. The usual errors in rearranging the equations $70 - \frac{2}{3}x = 360n + 70$ and $70 - \frac{2}{3}x = 360n + 110$ to '$x = \ldots$' were seen in a minority of cases and a final mark was sometimes not gained because the final answer involved radians, or was left in an unsimplified form.

Question 5

In part (a), the equations of the vertical asymptotes were usually stated correctly, but the equation $y = 0$ of the horizontal asymptote was occasionally omitted or an incorrect equation, usually $y = 1$, was given. The very few students who failed to express the asymptote in the form of an **equation** gained no credit. In part (b), students generally understood the requirements but algebraic errors in rearrangement and expansion of brackets sometimes led to incorrect quadratic equations and solutions. In part (c), the curve was generally well sketched showing the main features of the three branches. The asymptotes were usually included which significantly reduced the number of times a mark was lost due to overlapping branches. The examiners also expected to see the central branch passing through the origin which was not always the case in students' sketches. The behaviour of the curve as it approached asymptotes was generally appropriate. The line $y = -1/2$ was not always clearly defined either by scale or label and surprisingly even oblique lines were occasionally seen. In part (d), average and better students often gained two marks but some lost the third mark because they did not use strict inequality signs at the -1 and 2 boundaries. A large proportion of students found this final part challenging and some did not use the graph they had drawn in part (c), preferring to embark on a fresh, complex, algebraic approach to solving the inequality which rarely led to success.

Question 6

This was the least well-answered question on the paper with only the most able scoring full marks. Part (a) was generally well-answered with only a small minority failing to give the matrix in surd form. In part (b)(i), better students showed clear working which related to part (a), and stated correct answers for both the scale factor of the enlargement and the angle of the rotation.

In part (b)(ii) the most common method seen was to find the matrix $\boldsymbol{M}^2$ first and use it to find the scale factor and angle rather than stating the scale factor to be the square of the scale factor in part (b)(i) and the angle to be double the angle in part (b)(i). Those using the matrix $\boldsymbol{M}^2$ usually gave the correct scale factor but 90º anticlockwise was a common wrong angle. Students generally scored both marks in part (b)(iii), although some others made an arithmetic error in their matrix multiplication or did not complete the question appropriately and thus lost the final mark. Part (b)(iv) proved to be very challenging and only a small number showed the deduction sufficiently rigorously. There were many examples of students obtaining the correct value of n but from incorrect reasoning. Most attempted this part using algebraic methods but relatively few gave due consideration to the negative sign.

Some excellent deductions based on geometric reasoning using the earlier results in the question were also seen.

Question 7

This question, which tested the numerical methods section of the specification, was another good source of marks for the students. In part (a), most students correctly evaluated the given cubic expression $(= \mathrm{f}(x))$ at both $x = 0.1$ and $x = 0.2$ and stated 'change of sign' but some then stated incorrectly that the root lies between -2.816 and 0.232, or failed to state the values between which the root lies, and so did not score the final mark. In part (b) most students correctly started by considering $\mathrm{f}(0.15)$ and then $\mathrm{f}(0.175)$ but a small minority subsequently forgot to state the interval within which the root then lies. In part (c), many students applied the Newton-Raphson method correctly and scored full marks, although some other solutions were presented which contained arithmetic errors, or a final answer which was not rounded to the four decimal places required.

Question 8

The majority of students had a clear understanding of the methods required to answer this final question which was based on the equation and translation of an ellipse. In part (a) most students were able to find the values of x when $y = 0$ and the values of y when $x = 0$ but a significant minority of students either gave the coordinates incorrectly or did not attempt to express the values in coordinate form. In part (b), the majority of students gave the correct equation of the translated ellipse but the incorrect answers $\frac{(x+p)^2}{5}+\frac{y^2}{4}=1$ and $\frac{x^2-p^2}{5}+\frac{y^2}{4}=1$ were also seen. In part (c), the correct substitution of $y = x + 4$ was generally used and most indicated that they knew how to clear brackets and fractions but in attempting to reach the printed result, algebraic working was not always absolutely correct. In such questions, each line of the student's solution has to be correct and any corrections made must be made to all relevant lines of working. In part (d), the majority of students correctly equated their discriminant to zero although some inequalities were also seen. Those who used $(40 - p)$ as their value for 'b' were slightly more successful than those who used $-(p - 40)$. Those who failed to arrive at the correct quadratic equation in p, which they then tried to solve, often knew they had to substitute their value(s) into the given quadratic in part (c) but could go no further. A minority of students however, having obtained the correct equation $p^2 + 8p + 7 = 0$ then surprisingly gave the x-coordinates as -1 and -7. Although sign errors were sometimes seen in substituting -1 and -7 for p into the quadratic in part (c), the majority of students who obtained the correct quadratic equations in x usually went on to find the correct coordinates of the points of contact.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website. UMS conversion calculator www.aqa.org.uk/umsconversion