AQA

AS
MATHEMATICS

MFP1 Further Pure 1
Report on the Examination

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General

Presentation of work was reported as generally being good, although some sketches were not drawn with sufficient care in Question 9. There was no clear evidence that students were short of time, and a large majority of students completed their solution to a question at a first attempt. Students generally coped well with the first six questions but found the last part of each of the remaining questions significantly more demanding.

Question 1

This question tested roots and coefficients of a quadratic equation. In part (a), almost all students stated the correct values for $\alpha+\beta$ and $\alpha\beta$. In part (b), most students used a correct identity to find the sum of the roots, with only a few making arithmetical errors. As in previous series, some students lost marks by failing to give an equation as the answer, just using x^2+Sx+P without the '$=0$' , whilst others had final answers which did not have integer coefficients.

Question 2

Almost all students realised that, in part (a), they needed to substitute $x=(2+h)$ into the expression for y, but a significant minority did not deal with the brackets accurately, which resulted in a sign error in their expression for the gradient of the line. In part (b), most students showed that they were considering the gradient of the line when $h \to 0$ before stating the value at the point $(2, 3)$. Students who made the sign error in part (a) frequently scored full marks in part (b) for a correct follow-through answer for the required gradient. The most common errors in part (b) were either writing $h=0$ or leaving the final answer as gradient$\to -3$.

Question 3

A majority of students scored full marks for this question. In part (a), students were expected to show the linear relationship between Y and x by taking $\log_{10}$ of both sides of the given equation, applying the two relevant laws of logarithms and writing Y for $\log_{10} y$. For the final mark in part (a), the expression '$\log$', without further explanation in part (a), was not deemed sufficient to represent $\log_{10}$ since some students later used $\log_e$. The vast majority of students in part (b)(i) stated the correct value for the gradient of the line although some positive values were seen. In part (b)(ii), students who used the result from part (a) were generally much more successful in finding the correct values for the constants a and b than those who referred back to the original equation. Very few students failed to give their final answers to the required degree of accuracy.

Question 4

The vast majority of students scored the mark in part (a) and used the link between part (a) and part (b) in their attempt to set up the general solution. A high proportion of students in part (b) correctly stated $2x-\frac{5\pi}{6}=2n\pi\pm\frac{\pi}{6}$, although it was disappointing to see some using $360n$ in place of $2n\pi$. In general, most students rearranged the above equation correctly to find x, but not all simplified their answers by combining the two constant terms, and so, as reported in previous series, the final A1 mark was not scored. A majority of students did not seem to know how to start to answer part (c). Identifying the only finite value as $\tan\left(\frac{\pi}{3}\right)=\sqrt{3}$ was credited without insistence on the general case, but the final E1 mark was linked both to consideration of the general case, $\tan\left(n\pi+\frac{\pi}{2}\right)$, and an understanding that this did not also give a finite value.

Question 5

In this series question, part (a) was answered correctly by most students. Other than poor use of brackets, the main reason for the loss of marks was the use of $\sum_{1}^{n} 1 = 1$ instead of $\sum_{1}^{n} 1 = n$.
Without a printed answer, students found part (b) to be more demanding. Poor use of brackets led to the wrong expression, $\frac{2n^2}{4}(2n+1)^2$ for $\sum_{r=1}^{2n} r^3$, being frequently seen. With this mistake, it was still possible to score the method mark for taking out the common factor $n(2n+1)$, but relatively few of these students spotted the common factors. Those students who stated $\sum_{r=1}^{2n} r^3 = \frac{(2n)^2}{4}(2n+1)^2$ and factorised $3n(4n^2-1)$ as $3n(2n-1)(2n+1)$ generally recognised the common factors and factorised $n(2n+1)(2n^2-5n+3)$ further to reach the correct final answer. Students who multiplied out the whole expression in order to obtain a quartic were less successful in achieving the correct four factors and many gave up at that stage. Some students went straight from the correct quartic $4n^4-8n^3+n^2+3n$ to the product of the four correct factors in n for full credit. Such an approach, which is based on using a calculator to find the solutions of the corresponding quartic equation in order to factorise the quartic expression, is effectively a 'no method seen' approach and so wrong answers were heavily penalised. The most common errors were to write the factors in terms of x or to give the final answer as $\left(n+\frac{1}{2}\right)n(n-1)\left(n-\frac{3}{2}\right)$.

Question 6

The vast majority of students either correctly applied the given translation to the parabola and convincingly showed that $a=2$ or applied the translation to the point (4, 7) and used the new coordinates with the original parabola to score all three marks in part (a). However, this latter method did not naturally lead into part (b), where the most common error was to use $ky=x$ with $y^2=4ax$ rather than with $(y-3)^2=4a(x-2)$. Those students who considered the discriminant of $y^2-(6+8k)y+25=0$ usually found the correct critical values, but the final mark was sometimes not scored because students did not link the inequalities together but left them as two separate statements.

Question 7

Most students correctly solved the quadratic in part (a) by either completing the square or by using the quadratic formula. A small minority of students only gave one answer. If working was shown and method marks could be awarded, then the penalty was limited to one mark, but for those who chose to just write the single answer without any working, all three marks were lost. In part (b)(i), students were expected to demonstrate in their explanation that they understood that complex conjugate roots would lead to a real coefficient of z and from there explain why in the given case q must equal -1. In general students had difficulty in providing a convincing explanation. Part (b)(ii), proved to be the most demanding question part on the paper. The most common approach was to substitute $p + 2\mathrm{i}$ for z and then to equate real and imaginary parts. This approach invariably broke down because, despite part (b)(i), students incorrectly assumed that q was again real when equating real and imaginary parts. Many pages of wrong work subsequently followed. Those relatively few students who took account of the work in part (b)(i) and used $q = -1 + k\,\mathrm{i}$, where k is real, to obtain $(p + 2\,\mathrm{i})^2 + (4 - k)(p + 2\mathrm{i}) + 20 = 0$ and then equated real and imaginary parts had no difficulty in showing that 12 and -4 were the two possible values of k, and hence $q = -1 + 12\,\mathrm{i}$, $q = -1 - 4\,\mathrm{i}$. For the vast majority of students, marks scored in part (b)(ii) were limited to a mark for stating or using the correct roots in terms of p and, less often, a mark for writing $(p + 2\mathrm{i})(p - 2\mathrm{i}) = 20$.

Question 8

Almost all students stated the correct matrix for $\mathbf{A}^2$ in part (a)(i). In part (a)(ii), a large majority correctly described the transformation. The common errors included a stretch of scale factor 2 parallel to the x-axis and the use of the word enlargement in place of stretch. Part (b) required students to write the given equation in the form $y = (\tan\theta)x$ to establish the angle and apply it to the reflection matrix given on page 6 of the formula book. Most students understood what was required, but the incorrect angle of $30°$ was a common value for theta. In part (c), the majority of students showed that the order for multiplying the matrices needed to be $\mathbf{BA}^2$, but the most common error was to then multiply the outcome by $\begin{bmatrix} 0 \\ -4 \end{bmatrix}$ rather than $\begin{bmatrix} x \\ y \end{bmatrix}$. Where the two simultaneous equations were correctly found, a disappointing number of students then failed to correctly solve them to find the correct coordinates of P.

Question 9

Most students stated the correct equations of the two vertical asymptotes but a minority then failed to state that the equation of the horizontal asymptote was $y = 0$. The common wrong answer was $y = \frac{1}{2}$, obtained by dividing the numerator and **each** of the brackets in the denominator by x before letting $x \to \infty$. In part (b), the majority of students scored all three marks. In addition to algebraic errors, a common error was to eliminate the factor $(x - 1)$ and then forget that it would also give a solution. The graph drawing in part (c) ranged from superb to very sloppy, and future students should continue be encouraged to use a ruler and consider carefully the nature of a curve where there are asymptotes present. Despite being informed that the curve contained no stationary points, it was not uncommon to see a parabola for the middle section of the curve. The line should have intersected the curve on both axes and at the point where $x = 2.5$, and this would then have led on to the inequalities required for part (d). Not all students made the required link. However, where this was successful, students either achieved full marks or dropped a mark for not using the strict inequality with the asymptotes.

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