A-level

Mathematics

MFP1 – Further Pure1

Report on the Examination

6360

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General

Presentation of work was reported as generally being good although some sketches were not drawn with sufficient care in Questions 6 and 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 Q7, Q8 and Q9 demanding.

Question 1

More students scored full marks for this opening question, which tested the use of the step-by-step method to solve numerically the given first order differential equation, than any other question on the paper. Other than arithmetical errors the loss of marks was mainly due to applying too many iterations or failing to give the final answer to four decimal places as required.

Despite this, as was the case last year, this opening question on numerical methods was not attempted by more students than for any other question. Not all of these were weaker students which was surprising especially as the required formula is given towards the top of page 9 in the formulae booklet.

Question 2

This question tested roots and coefficients of a quadratic equation. Almost all students wrote down the correct values in part (a) and applied the appropriate identity to obtain the correct value for $\alpha^2+\beta^2$ in part (b)(i). In part (b)(ii) more errors were made by those students who used the expansion of $(\alpha+\beta)^4$ than by those who used the identity $\alpha^4+\beta^4=(\alpha^2+\beta^2)^2-2(\alpha\beta)^2$. A significant number of students did not show sufficient evaluations before writing down the printed answer, a point made in previous examiners' reports. Also there were more examples this year of students making multiple independent errors before 'obtaining' the printed answer. There were many very good solutions seen for part (c). The more common errors were in the expansion of $\left(2\alpha^4+\frac{1}{\beta^2}\right)\left(2\beta^4+\frac{1}{\alpha^2}\right)$ where the first term appeared as $2\alpha^4\beta^4$ or the last term as $\frac{\alpha^2+\beta^2}{\alpha^2\beta^2}$. There was some careless work when writing the final quadratic equation; either the '=0' was missing, or more surprisingly, and resulting in the loss of two marks, an 'x' was missing as x^2-S+P was used.

Question 3
This question on series was answered correctly by a majority of students. The most common error, other than arithmetical, was to use $\sum_{r=3}^{60} f(r) = \sum_{r=1}^{60} f(r) - \sum_{r=1}^{3} f(r)$.

A small minority of students did not show that they had used the formulae for $\sum_{r=1}^{n} r^3$ and $\sum_{r=1}^{n} r^2$ and so were heavily penalised.

Question 4
This question testing the complex numbers section of the specification was answered correctly by the majority of students, although at the other extreme, there was a minority of students who did not replace z by $a+b\mathrm{i}$ or equivalent but just rearranged the given equation to find z in terms of z^*. Almost all other students gave a correct expression for z^*, used $\mathrm{i}^2 = -1$ and attempted to equate real parts and imaginary parts but some miscopying or incorrect manipulation led to the loss of accuracy marks. Examiners expected students to write their final answer in the form $a+b\mathrm{i}$ and not just state a value for a and a value for b.

Question 5
This question testing the calculus section of the specification proved to be a good source of marks. In part (a) the vast majority of students used the correct method to find the gradient of the required line but poor use of brackets resulted in a significant minority of students losing the A1CSO mark. In part (b) it was again pleasing to see the increased use of $h \to 0$ rather than $h=0$. Some weaker students just found the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at $x=-5$ for which they received no credit.

Question 6
Most students stated the correct equations of the three asymptotes but some others did not attempt to find the horizontal asymptote, $y = 0$. In part (b)(i) almost all students substituted $x = -1$ into the equation of the curve to find the correct y-coordinate of the stationary point but not all students made use of their answer for (b)(i) when sketching the curve. There were many correctly drawn curves but those students who drew curves which did not have three branches gained no credit. Some other students who lost one of the two marks because their branches did not approach the asymptotes in a correct manner might have been more successful if their axes had been drawn using a ruler. In part (c) many students found and used the correct critical values to obtain $x \le -4$, $x \ge 2$ but a much smaller proportion of students considered their graphs to obtain the other solutions $-2 < x < 0$.

Question 7

In part (a)(i) students generally stated a matrix that corresponded to a reflection but a significant number were reflections in the line $y = x$. In part (a)(ii) the most common wrong answer corresponded to an enlargement of scale factor 7. Students who just wrote down an incorrect answer in part (b) gained no marks, but those who showed the multiplication of their incorrect answers to (a) in the correct order scored the method mark.

Part (c)(i) was generally well answered with many students scoring the mark.

Part (c)(ii), as expected, was found to be demanding although some excellent solutions were seen. Students who made use of their answer to part (c)(i) obtained the correct scale factor of the enlargement and considered $\mathbf{A}$ as $\sqrt{12}\begin{bmatrix} -\frac{3}{\sqrt{12}} & -\frac{\sqrt{3}}{\sqrt{12}} \\ -\frac{\sqrt{3}}{\sqrt{12}} & \frac{3}{\sqrt{12}} \end{bmatrix}$, comparing $\begin{bmatrix} -\frac{3}{\sqrt{12}} & -\frac{\sqrt{3}}{\sqrt{12}} \\ -\frac{\sqrt{3}}{\sqrt{12}} & \frac{3}{\sqrt{12}} \end{bmatrix}$ with $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$ to make further progress. Such students normally scored at least 4 of the 5 marks. A larger proportion of students who started with $\begin{bmatrix} -3 & -\sqrt{3} \\ -\sqrt{3} & 3 \end{bmatrix} = \begin{bmatrix} k\cos 2\theta & k\sin 2\theta \\ k\sin 2\theta & -k\cos 2\theta \end{bmatrix}$ frequently failed to find the correct value for θ as they used $\tan 2\theta = \frac{1}{\sqrt{3}}$ and took the acute angle solution.

Question 8

The majority of students were able to find the correct general solution of the given trigonometric equation in part (a) although all the usual errors were also seen, including incorrect rearrangements and simplifications of $\frac{5}{4}x - \frac{\pi}{3} = 2n\pi + \frac{\pi}{4}$ and $\frac{5}{4}x - \frac{\pi}{3} = 2n\pi - \frac{\pi}{4}$.

Very few solutions were seen which mixed radians and degrees. In part (b), weaker students frequently gave up after listing some of the solutions in the required interval using their answer to part (a). Average ability students quite often listed solutions up to the 20π upper limit but frequently forgot to include the solutions from n=0. Some excellent solutions were seen from more able students who used formulae for the sum of the terms in an arithmetic series or used the first summation formula on page 4 of the formula booklet. Overall, relatively few students scored more than half marks in part (b).

Question 9

In part (a) the vast majority of students gave the correct values for the intercepts. In part (b), most students attempted to form a quadratic equation and then to use it to find an expression for b^2-4ac. Most expressions for b^2-4ac were correct but there were algebraic slips and more seriously some students took a=$(25+16k^2)$ and c= -144. Not all students used the strict inequality $b^2-4ac>0$ for real and different roots and a significant number of students failed to score the final A1CSO mark in (b) because their working showed an incorrect statement, usually either $k^2>25$ or $k<\pm5$, before the printed answer was written. The usual two methods for part (c) were both used on a regular basis. The method of applying the given translation to the ellipse E and then comparing the resulting equation with $9x^2+16y^2+18x-64y=c$ was generally more productive than completing the squares on $9x^2+16y^2+18x-64y=c$ and re-writing the resulting equation in the form $\frac{(x+1)^2}{16}+\frac{(y-2)^2}{9}=\frac{c+\lambda}{144}$ before comparing with the translated E. Some students had a mixture of both methods which, at times, was difficult to unravel. A significant number of students attempted part (d) by solving the two equations simultaneously, gaining no marks. There were again some excellent correct solutions seen which took just a few lines using the result from part (b) to deduce that the two tangents to E that were parallel to $y=x$ had equations $y=x\pm5$ and then applying the translation in part (c) to the two lines $y=x\pm5$ to obtain the equations $y=x+8$ and $y=x-2$ of the required two tangents.

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 www.aqa.org.uk/umsconversion