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General Certificate of Education

Mathematics 6360

MFP2 Further Pure 2

Report on the Examination

2008 examination - June series

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General

Candidates found this paper to be accessible and the great majority were able to display their knowledge and understanding of the specification on which this examination was based. There were very few scripts which showed candidates ill-prepared for the examination and at the other end of the scale there was a good number of candidates who displayed a very pleasing knowledge of the subject in depth. Presentation on the whole was good and improved from previous series.

Question 1

Most candidates scored full marks for this question. The only significant error was in the use of incorrect formulae for $\sinh x$ and $\cosh x$. These formulae were sometimes quoted without the halves, ie $\sinh x$ was written as $e^x - e^{-x}$ and $\cosh x$ as $e^x + e^{-x}$. In part (b), a small number of candidates thought that $\ln\left(3e^{2x} + 5e^x - 2\right)$ was equal to $\ln 3e^{2x} + \ln 5e^x - \ln 2$.

Question 2

A common error in part (a), when finding the values of A and B, was to write $1 = A(r+1)(r+2) + B(r+1)r$. This, in turn, frequently led to a correct answer for A (by incorrect means) but an incorrect value for B. In this case candidates tried to cancel out terms when in fact because of their incorrect value for B, their terms did not cancel out and so were unable to gain credit. A few candidates realised that their value for B was incorrect and that it had to be $-\frac{1}{2}$ and so proceeded to do part (b) correctly. Generally speaking, those candidates who found A and B correctly went on to score full marks. If they didn't, it was usually due to an incorrect value of r being substituted either at the beginning or the end of the series.

Question 3

There were many correct solutions to parts (a) and (b) of this question. Errors, if they did occur, were largely errors of sign. However, in part (c), a good number of candidates did not use the hint given in the question to replace β by $k\mathrm{i}$ but instead called the two remaining roots β and $2-\beta$. A quadratic equation in β ensued followed by the use of the quadratic formula and ended up with the square root of a complex number at which point solutions were abandoned.

Question 4

Apart from the odd sign error, part (a) was done correctly. Answers to part (b) and to some extent part (c)(i) lacked detail especially as the results were given or implied. Very few candidates scored credit in part (c)(ii) and when it was attempted it was almost always solved by finding the cartesian equation of the circle *C* and the line *L* and by showing that the resulting quadratic equation giving the points of intersection of *C* and *L* had two coincident roots. This method, of course, involved a considerable amount of algebraic manipulation, when in fact the consideration of the gradient of the line joining the centre of *C* to the point represented by z_1 would have given the result immediately. However, this was very rarely seen. It was surprising to see many candidates draw the circle *C* and the line *L* intersecting in two points on the Argand diagram (part (c)(iii)) in spite of the results candidates had been requested to show in the earlier parts of the question. There were many incorrect solutions to part (d), the most common being to place z_2 vertically below the centre of *C*.

Question 5

Solutions to part (a) were usually correct although not always very elegant. Part (b)(i) was usually correctly worked although $\sqrt{1+\sinh^2 x} = 1 + \sinh x = \cosh x$ did appear more often than expected. There were some good solutions to part (b)(ii) and when solutions were incomplete, they almost always ended at $S = \pi\left(\ln a + \frac{1}{2}\sinh(2\ln a)\right)$. It should perhaps be noted that when answers are printed, candidates must give sufficient detail in their working to show how that answer is arrived at.

Question 6

On the whole, responses to this question were poor. Many candidates were unable to handle the substitution for u in order to arrive at $36-u^2$ and many sign errors occurred in their working. Even of those candidates who arrived at $\int \frac{\mathrm{d}u}{\sqrt{36-u^2}}$, many seemed unable to connect the integral with $\sin^{-1}\left(\frac{u}{6}\right)$ and $\sinh^{-1}\left(\frac{u}{6}\right)$ or $\cosh^{-1}\left(\frac{u}{6}\right)$ or even merely algebraic forms appeared regularly.

Question 7

There were many good responses to part (a) and to part (b)(i) of this question, with the majority of candidates arriving at $3k^2+3k+6$ and many going on correctly to show that this expression was a multiple of 6. However, some candidates wrote the expression as $\frac{1}{2}.6\left(k^2+k\right)+6$ and claimed from this rewritten form that the expression was a multiple of 6. Solutions to part (b)(ii) were somewhat disappointing with many candidates failing to convince that $\mathrm{f}(k+1)$ was a multiple of 6 if $\mathrm{f}(k)$ was, and failing to realise that the formal method of induction requires crystal clarity.

Question 8

The algebraic manipulation in part (a)(ii) of this question was poor, especially from those candidates who failed to use the hint of part (a)(i) – a hint intended to simplify the algebra. Sign errors were frequent and in many cases led to multiples of sine rather than cosine in part (c) in spite of the form given in part (c). Many candidates did not score full marks in part (b)(i) due to their quoting that $(\cos\theta + \mathrm{i}\sin\theta)^{-n}$ was $\cos n\theta - \mathrm{i}\sin n\theta$, thus omitting the important fact that $(\cos\theta + \mathrm{i}\sin\theta)^{-n} = \cos(-n\theta) + \mathrm{i}\sin(-n\theta)$ from de Moivre's theorem. Part (c) was rarely fully correct. Common mistakes were either to assume that $\cos^4\theta\sin^2\theta$ was equal to the printed result with numbers substituted for A, B, C and D thus ignoring $\left(z+\frac{1}{z}\right)^4\left(z-\frac{1}{z}\right)^2$ completely, or by thinking that for instance $z^6+\frac{1}{z^6}$ was equal to $\cos 6\theta$ rather than $2\cos 6\theta$, leaving out the factor 2 altogether.

Mark Ranges and Award of Grades

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