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General Certificate of Education

Mathematics 6360

MPC2 Pure Core 2

Report on the Examination

2009 examination - June series

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General

Presentation of work was reported as being very good. Most candidates answered the questions in numerical order and completed their solution to a question at a first attempt. The performance of candidates on this paper was very similar to the performance of candidates in the corresponding June 2008 exam.

Once again, there was evidence that many candidates had not been reminded to complete the boxes on the front cover to indicate the numbers of the questions they had answered.

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

- When asked to find the value of *p* candidates should state the value of *p* explicitly and not just leave it embedded in an equation; for example, in Question 9(a)(i), the answer should not be left as '$\sqrt{125} = 5^{1.5}$' but should be followed by '$p = 1.5$'

- When asked to show or prove a printed result candidates should be aware that sufficient working and detail must be shown to convince the examiner that their solution is valid.

Question 1

Most candidates recognised that the cosine rule was required in part (a) but some misquoted it despite the formula being available in the formulae booklet. Those candidates who substituted values into the formula before rearranging were generally more successful than those who rearranged before substituting the given lengths. Some candidates failed to score all three marks because they did not show values to a sufficient degree of accuracy to justify the printed statement. There were some candidates who tried to verify the result by using 38.2 with $a = 8$ and $c = 7$ in a cosine rule to show that b was approximately 5. This approach could score no more than 1 mark.

Although the correct answer for the area of the triangle was seen many times in part (b), there was a significant minority of candidates who did not apply a correct formula. The most common error was the omission of the $\frac{1}{2}$ in $\frac{1}{2}ac\sin B$.

Question 2

Most candidates gave the correct value for n in part (a). The most common wrong answer was '$n = -\frac{1}{4}$'.

The expansion of $\left(1+\frac{3}{x^2}\right)^2$ in part (b) caused more difficulty than expected. A common wrong answer was '$1+6x^{-2}+9x^4$' although there were many other examples of incorrect answers offered.

In integrating $\left(1+\frac{3}{x^2}\right)^2$ in part (c) most candidates realised that their expansion in part (b) should be used but surprisingly the integration of 1 with respect to x caused just as many problems as the integration of the terms in x raised to negative powers. Although many candidates showed that they knew how to deal with the given limits, a lack of brackets in their numerical expressions frequently led to the wrong answer. The final mark was frequently lost because no **exact** answer (fraction or mixed number) was given.

Question 3

Most candidates were able to show that $k = 0.75$ in part (a) and the majority of these then found the correct values for u_3 and u_4.

The most common wrong answers to part (b) were $u_3 = 32$ and $u_4 = 40$, from those who assumed that the sequence was arithmetical.

The examiners expected to see, in answers to part (c)(i), a clear indication that candidates appreciated that both $u_{n+1} = L$ and $u_n = L$ when forming the equation for the limit. Although many correct solutions were seen, there were also many other candidates whose solutions incorrectly assumed that the sequence was geometric and the expression $\frac{a}{1-r}$ was used.

Question 4

The trapezium rule was again generally well understood with very little evidence of candidates mixing up 'ordinates' and 'strips'. Fewer candidates than normal failed to give their final answer to the required number of significant figures although there was some evidence of premature approximation/wrong rounding in a minority of solutions.

Part (b), as expected, caused more problems. Generally weaker and average candidates did not understand what was required and many better candidates failed to use brackets sensibly and gave the expression for $\mathrm{f}(x)$ as '$\sqrt{2x^3 + 1}$' for which they were awarded 1 mark.

Question 5

In part (a) most candidates differentiated the equation of the curve correctly and the majority of these recognised that at the maximum point the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ was 0, although some worked with $\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} = 0$.

In part (b) many candidates had difficulty solving the equation $22.5x^{\frac{1}{2}} - 2.5x^{\frac{3}{2}} = 0$. There was some invalid squaring of expressions and terms and also it was not uncommon to see $x^{\frac{3}{2}} \div x^{\frac{1}{2}}$ simplified incorrectly either to x^3 or to x^2.

With the equation of the tangent printed in part (d) candidates had to convince examiners that they were finding the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ at $x = 1$ for the gradient of the tangent in part (c). Although not all candidates did this convincingly, the majority did show sufficient evidence to reach the printed equation.

The final part of the question proved to be a good discriminator at the top grade level. Although some excellent solutions were seen these were rare. The most common wrong method was to assume that the length of *RM* was either equal to the length of *PM* or equal to half the length of *PM*. Unfortunately a minority of candidates who produced better solutions which started with the correct equation '$162 = 20x - 6$' failed to score the final mark due to an inability to solve this equation correctly.

Question 6

This question which tested the topics of length of an arc and area of a sector, but in an unstructured manner, was well received by the candidates and was indeed the best answered question on the paper. Many candidates presented a completely correct solution. The most common loss of marks was due to premature approximation in finding the value of r before substituting into a correct formula for the perimeter of the sector or for an incorrect rearrangement of '$33.75 = \frac{1}{2} \times 1.2r^2$'. It was a rarity to see candidates using wrong formulae for area of sector and arc length.

Question 7

Part (a) was normally answered correctly but those who relied entirely on a verification approach generally scored no more than 1 mark and many of these scored no marks because they failed to state a conclusion.

Most candidates were able to find the correct values for the first term and sum to infinity of the geometric series but many could make no progress in the final part of the question which involved the sigma sign. Of the better solutions, the very common error was to find the value of '$S_\infty - S_6$'. The most common correct methods involved either finding the value of '$S_\infty - S_5$' or recognising that the sum to infinity of a geometric series with first term $u_6 (= 48.6)$ and common ratio 0.6 was required.

Question 8

This question which tested trigonometrical identities and solutions of trigonometrical equations was by far the worse answered question on the paper. In part (a) candidates generally could recall the identity $\tan\theta = \frac{\sin\theta}{\cos\theta}$ but proofs to reach $\tan\theta = 5$ were not always convincing. Those who started with $\sin\theta - \cos\theta = 4\cos\theta$ were generally more successful than those who started by dividing the numerator by $\cos\theta$.

In part (b)(i) candidates could generally quote the relevant identity, $\cos^2 x + \sin^2 x = 1$, but could rarely use it in a convincing manner.

In the final part of the question, although the majority of candidates could see the use of the work in part (b)(i), a significant number of candidates could not solve the quadratic equation in $\sin x$. In some cases candidates just solved the equation by removing 'sin' wherever it occurred. Better attempts reached $2\sin x = 1$ and $\sin x = -1$ but then it was not uncommon to see '$2\sin x = 1$ so $2x = 90°$, $x = 45°, 225°$' and '$\sin x = -1$ so no solution'.

Question 9

The work required to answer parts (a)(i) and (a)(ii) was well understood but a significant number of candidates did not give an explicit value for p or an explicit value for x. Candidates at this level should not be leaving their answers in an embedded form, for example, in part (a)(ii) answers were sometimes left as '$52 \times 0.75 = \sqrt{125}$'.

Part (b) was answered better than the corresponding work in previous years and there continued to be an improvement in knowledge and use of the laws of logarithms as seen in solutions to part (c) where many candidates were able to score at least half marks by correctly applying two laws of logarithms. Only more able candidates either used $\log_a a = 1$ or applied $\log_a \frac{x}{k} = -1 \Rightarrow \frac{x}{k} = a^{-1}$ towards expressing x in terms of a correctly.

Mark Ranges and Award of Grades

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