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Mathematics MPC3

(Specification 6360)

Pure Core 3

Report on the Examination

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General

The paper appeared to be accessible to the majority of the candidates with few very low marks being seen. Candidates seemed to have managed their time well with no incomplete scripts seen.

Almost all of the entry were able to show some knowledge of the specification but very few managed to cope with all the longer questions successfully. Some parts of the specification had been covered less well, particularly the tangent function and logarithms. Candidates should be warned about not using the substitution x = a function of x, as this muddies the water and may obscure their method.

Question 1

Part (a) This part was well answered by the majority of candidates with many fully correct responses seen. Most candidates used substitution of $u =(x^3 – 1)$ to give $y = u^6$. Although $(x^3 – 1)^5$ was usually seen, errors did occur with the associated function of x.

Part (b)(i) This was very well answered, with a majority of candidates earning both marks. The major error was from candidates who did not treat this as a product and simply differentiated x to get 1 and $\ln x$ to get $\frac{1}{x}$.

Part (b)(ii) Again, this part was very well answered. Many fully correct responses were seen. The main error was with candidates who wrote the gradient as $1+ \ln e$ which earned the method mark. Then this was often evaluated as $1 + \ln e = 1$ or left unsimplified. Several candidates who obtained $\frac{dy}{dx} = 2$ then went on to use a gradient of $-\frac{1}{2}$.

Question 2

Part (a) This was well answered by the majority of candidates. Candidates should be encouraged to write down their relevant function before they begin to substitute – too many fudged their approach.
Most candidates used $f(x) = (x^2 - 4) \ln (x + 2) - 15$ and evaluated f(3.5) and f(3.6) correctly. There are still many candidates who still then write 'change of sign' therefore a root without clarification of where the root lies. Those candidates who used the alternative $f(x) = (x^2 - 4) \ln (x + 2)$ and then compared it with $y = 15$ were less successful, as they appeared to be unable to then make a correct statement.

Part (b) This was very well answered, the only real errors being ± missing in the final answer and some candidates losing a bracket in their working.

Part (c) This part was very well answered with full marks often obtained. The main error was stating $x_3 = 3.567$ through using premature approximation of x_2.

Question 3

Part (a)(i) It was clear that dx/dy confused many, they simply wrote down dy/dx = . Many solutions were correct, but some candidates missed the multiplier and some were clearly trying to use the product rule or split 3y and +1, which was an indication of poor understanding of work on trigonometric functions.

Part (a)(ii) This part was not very well answered by many candidates. Those who had managed to get the method mark in part (a)(i) often gained the method mark for obtaining $\frac{\mathrm{d}x}{\mathrm{d}y}$ = 3sec²(0). However, many incorrectly rearranged the function to $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{1}{3\cos^2(3y+1)}$ not $\frac{\cos^2(3y+1)}{3}$, so substituting into an incorrect function

Part (b) A large number of candidates had no idea of the shape of the inverse tangent graph. A few incorporated a turning point and many failed to put the correct values on the y -axis. For the correct shapes that were seen, the y -axis was often not labelled, so only part marks were awarded. The main error seen was a reflection of y = tan x in the y-axis and not in $y = x$.

Question 4

This question was generally answered very well and full marks were often seen.

Part (a) Many correct answers with correct notation were seen but there were many cases of $3 \leq f(x) \leq -3$ also seen. Where candidates lost a mark it was usually for poor notation.

Part (b)(i) Most candidates earned the method mark for swapping x and y but the $\frac{1}{2}$ confused many when trying to obtain $\cos^{-1}\frac{x}{3}$, with $\cos^{-1}\frac{2x}{3}$ and $\cos^{-1}\frac{x}{6}$ being common errors.

Part (b)(ii) Having the correct inverse function generally led to the correct answer here; unfortunately repeating incorrect algebra for part (b)(i) sometimes gave the 'right' answer, but obviously without reward.

Part (c)(i) This was very well answered.

Part (c)(ii) Most candidates achieved the method mark by drawing at least two continuous parts. Unfortunately many lost the final mark, as drawing multiple curves was a common error, as was labelling the x-axis incorrectly.

Part (d) This was well done; a few candidates had $\frac{1}{3}$ or $\frac{1}{2}$ as the scale factor and a handful introduced another wrong transformation.

Question 5

Part (a) This was very well answered, with the majority of candidates obtaining the correct function. The main error made by candidates who obtained a $\ln$ function was with the multiplying constant, which was often 2 or was completely missing. Omission of brackets was also a problem.

Part (b) Not many of the candidates answered this part fully correctly. Only a few integrated by parts 'the wrong way round' and some weaker candidates put $u = x$ and $v = \sin\frac{x}{2}$.

However most knew that they should integrate the $\sin\frac{x}{2}$ term, but did it wrongly, getting $\pm\cos\frac{x}{2}$ or more commonly $\pm\frac{1}{2}\cos\frac{x}{2}$. If the first method mark was earned, the second was generally scored as well.

Question 6

Part (a) Those candidates who used radians usually went on to earn full marks. Many candidates, however, used degrees without showing unsimplified correct expressions for y, and hence only obtained the B mark for 4 correct x-values.

Part (b) Almost everyone earned the first mark for $\frac{\mathrm{d}u}{\mathrm{d}x} = 3$; this was a distinct improvement from previous years.

Many candidates earned the first three method marks. The first accuracy mark was sometimes then lost through having an incorrect value for $\frac{1}{9}$ with $\frac{1}{3}$ and $\frac{1}{6}$ being quite common errors. Incorrect limits were seen but candidates usually managed to use the appropriate values either for u or for x.

Question 7

Part (a) Most candidates were able to obtain the first angle of 1.77 radians and hence obtain 2 marks. Many candidates also obtained the correct second solution, although 4.91 was a common error.

Part (b) This was the worst answered question part on the paper, with very few candidates having any idea of how to go about combining the two fractions. Very few completely correct solutions were seen. Those who managed to reduce the LHS to $\frac{-2\operatorname{cosec}^2 x}{-\cot^2 x}$ could often not complete the question. It was sad to see some very poor algebraic techniques in evidence here. There were many cases where candidates did not attempt the question.

Part (c) Far too many candidates failed to recognise both the positive and the negative roots for $\sec x$ and in consequence they did not score any marks, since they only found the solutions for $\cos x = 0.2$.

Question 8

Part (a) This was quite well answered by the majority of candidates.

Part (b)(i) Again, this was well answered.

Part (b)(ii) This was very poorly answered, with many candidates being unable to handle the negative indices. Some used logs wrongly and some assumed the value 4 for e^{-2x} from part (a). There was also evidence of incorrect factorisation, but some used substitution effectively.

Part (b)(iii) Although most candidates were able to differentiate the function, once the derivative had been found candidates were then unable to solve the equation for the same reason given in part (b)(ii).

Part (b)(iv) Most candidates lost the first B mark, usually for missing the '$\mathrm{d}x$'. Attempts at squaring the function often went awry; losing the middle term, losing the negative index, getting an x^2 power were all seen. After such errors only a few more marks were available. Treating the function as a square and thinking that they could integrate to a cube was very disappointing to see on an A2 paper.

Mark Ranges and Award of Grades

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