Version 1.0

General Certificate of Education (A-level)
January 2011

Mathematics MPC2

(Specification 6360)

Pure Core 2

Report on the Examination

Set and published by the Assessment and Qualifications Alliance.

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Registered address: AQA, Devas Street, Manchester M15 6EX.

General

The Question Paper/Answer Booklet was again used to good effect, with candidates' work being generally very well organised. There was sufficient space for almost every candidate to set their work out (even with corrections). However a few candidates used remaining working space within Question 7 to write their answer to the last part of Question 3. If candidates 'run out' of working space when answering a particular question, it is strongly advised that they should ask for, and use, a supplementary sheet rather than write their answer in the working space of a different question.

In general the paper seemed to be answered well with no obvious indication that candidates were short of time to complete the paper. The longer calculus question, positioned at Question 7, seemed to give candidates a boost and was a good source of marks for most candidates.

Question 1

This question provided many candidates with a good start to the paper. Most candidates quoted the general formulae for arc length in part (a) and for area of sector in part (b), showed the correct substitution and evaluated each correctly to score full marks. There was no single common error in part (a), although wrong rearrangement of $4 = 5\theta$ to get $\theta = 1.25$ was seen and this often led to a valid follow through answer in part (b), so scoring three of the four marks for the question. Candidates who worked in degrees were generally less successful. Some weaker candidates assumed that the chord AB was also 4cm and applied the cosine rule to find the value of θ. Other than quoting incorrect formulae for the area of the sector in part (b) there were no other notable errors.

Question 2

Most candidates stated, or clearly indicated, the correct values for p, q and r in part (a) and appreciated that these answers could then be used in part (b). There were many correct solutions seen, although a number of candidates resorted to using logarithms rather than just the rules of powers. The most common error in applying laws of indices was to express $2^{\frac{1}{2}} \times 2^x$ as $2^{\frac{x}{2}}$ rather than $2^{\frac{1}{2}+x}$ which led to the common wrong answer $x = -6$. For full marks in part (b), candidates were required to state the value of *x* explicitly rather than leave the last line of their working as $2^x = 2^{-3.5}$.

Question 3

In part (a), most candidates started by writing a correct cosine rule which they then rearranged correctly. A greater proportion of candidates than in previous series seemed to take heed of previous advice and qualified the printed answer of 97.9^0 with either greater accuracy or by giving its cosine value in exact form. Almost all candidates were aware of the relevant formula for the area of a triangle and a very large majority scored full marks for part (b)(i). The most common error was to apply the formula incorrectly by writing area $=\frac{1}{2}\times 10\times 8\times \sin 97.9$. In part (b)(ii), those candidates who recognised the relevance of their answer to part (b)(i) produced a correct solution in a couple of lines to find the length of the perpendicular AD. However, such candidates were in a minority and many more tackled this part by using the sine rule to find either angle B or angle C and then applying basic trigonometry to a relevant right-angled triangle. Although this was a multi-step approach there were many successful outcomes. A common wrong method was to assume that AD bisected angle BAC. Many less able candidates made no attempt to answer part (b)(ii)

Question 4

The majority of candidates presented a fully correct trapezium rule, working to the required degree of accuracy and so scored full marks. Common errors were normally arithmetical with relatively few candidates failing to score the method mark. In part (b), most candidates indicated that they knew that a multiple of 3 was needed somewhere, although fully correct solutions were rare. The most common error was to replace x^3 by $\frac{1}{3}x^3$ rather than by $\left(\frac{1}{3}x\right)^3$. Another, more serious, error was to multiply the given expression by 3 and write $\mathrm{g}(x)=3\sqrt{27x^3+4}$ or some other variation of this error, for example, $\mathrm{g}(x)=\sqrt{81x^3+12}$.

Question 5

A majority of candidates gave the correct binomial expansion in part (a), although a common error amongst the less successful candidates was to write the third term as $-3x^2$ instead of $+3x^2$. In part (b), most candidates picked up the method mark for their expansion of $(1+y)^4$. However, it was not uncommon to see errors in collecting like terms, the most common of which were '$6y^2 - 3y^2 = -3y^2$' or '$6y^2 - 3y^2 = 9y^2$'. It was disappointing to see a small minority of candidates either having expansions entirely in terms of x or having a mixture of terms involving *x* and *y* with no indication of any corrections despite the printed answer. Part (c) was generally only answered correctly by the most able candidates who replaced *y* in their expansion for part (b) by $x^{0.5}$ and then integrated the resulting expression with respect to x. A common error amongst other solutions was to integrate the expansion from part (b) with respect to y, with some either leaving their answer in terms of y or others replacing y after the integration by $x^{0.5}$.
Candidates who didn't appreciate the link between the parts and expanded again often met problems with either the 'new' expansions or the powers involved.

Question 6

Most of the candidates who used the expected algebraic approach successfully reached the required value for the common ratio. Very few candidates quoted incorrect formulae for the third and sixth terms. Those who assumed the value of r or just showed arithmetical working rarely gained any credit in part (a)(i). A large majority of candidates scored full marks in part (a)(ii) for finding the first term of the series. Most candidates realised that the sum of the first twenty terms of the series was required and so picked up the method mark, but errors such as '$4 \times 3^{20} = 12^{20}$' in intermediate working towards the printed answer was enough to lose the accuracy mark. Part (b)(ii) was not answered well, with a significant majority failing to score even a single mark. A common error was to replace u_n by the formula for the sum of the first n terms. Those candidates who did make progress usually substituted a correct expression, $4 \times 3^{n-1}$, for u_n, and a high proportion of these candidates then took logarithms and used an appropriate logarithmic law correctly. However, a significant number of these candidates failed to score the final mark because they gave the non-integer value 32.43 for n or they rounded down to 32. Some candidates used a trial and improvement approach in preference to taking logarithms with varying degrees of success. When applying a trial and improvement approach, candidates should be aware that it is insufficient to just use one value of n.

Question 7

Most candidates replaced $\frac{8}{x^4}$ by $8x^{-4}$ and differentiated correctly to score full marks for part (a). Some other candidates failed to score the accuracy mark because they included a '+c' in their answer. A very large majority of candidates realised that the value of $\frac{dy}{dx}$ at $x = 1$ was required in part (b), but a small minority did not appreciated that the value of y was also required. Although many candidates found the equation of the tangent correctly, it was not uncommon to see others finding the equation of the normal instead.

In part (c), a majority of candidates equated their expression for $\frac{dy}{dx}$ to zero and attempted to solve the resulting equation, although only about half of the candidates obtained the correct coordinates of M. Those who had wrong powers of x in their answer to part (a) were restricted to just two marks in part (c). The most common incorrect methods seen either involved solving $\frac{d^2y}{dx^2} > 0$ or looking for a link between the tangent in part (b) and the stationary point.

In part (d)(i), a high percentage of candidates were able to integrate $\frac{8}{x^4}$ correctly, but errors in the integration of $(x + 3)$ or the omission of the constant of integration resulted in a significant proportion of these candidates failing to score the final mark. Since answers to part (d)(ii) required explicit evidence that the answer to part (d)(i) had been used; the few candidates who just wrote down the answer without any other working gained no credit. However, most candidates applied the 'Hence', showing the values 2 and 1 substituted into their answer to part (d)(i) and carrying out the relevant subtraction. However, a significant number of candidates made arithmetical errors in carrying out the subtraction and so did not score the accuracy mark.

Only the more able candidates appreciated what was required in the final part of the question. The common wrong answers included 0 (presumably from the x-axis being a tangent), 12 (the y value from part (b)) and 5.5 (forgetting to consider the direction of the translation).

Question 8

Approximately half the candidates presented a fully correct solution to part (a). Although most of the other candidates scored a mark for applying a correct logarithmic law, normally writing $2\log_k x - \log_k 5 = 1$ as $\log_k x^2 - \log_k 5 = 1$, a significant proportion of these candidates either made the error illustrated by '$\log_k x^2 - \log_k 5 = 1$ so $\frac{\log_k x^2}{\log_k 5} = 1$' or made no further progress. Another common error, worthy of note, involves the lack of appreciation that the coefficient 2 in the expression $2\log_k x - \log_k 5$ has no affect on the term $\log_k 5$. It was not uncommon to see $2\log_k x - \log_k 5$ replaced by $2\log_k\left(\frac{x}{5}\right)$.

Part (b) proved to be more challenging than part (a). A majority of candidates scored one mark for correctly rewriting at least one of the given logarithmic equations in a non-logarithmic form and many of these candidates were able to eliminate a to obtain the equation $y = \left(4^{b+2}\right)^{\frac{3}{2}}$ and so scored the second mark. However, relatively few candidates were able to show that the right-hand side could be written as 2^{3b+6}. The most common error was to write $\left(4^{b+2}\right)^{\frac{3}{2}}$ as $2^{\frac{3}{4}(b+2)}$.

Question 9

Part (a) was generally answered very well although some candidates only gave one value within the range despite the clue in the question '….your answer**s** to…' or gave values in the wrong two quadrants.
Part (b)(i), as expected, proved to be the most demanding part question on the paper. The two most common successful initial steps seen were either replacing the 6 on the right-hand side of the equation by $6(\sin^2\theta + \cos^2\theta)$ or splitting the $7\sin^2\theta$ into $\sin^2\theta + 6\sin^2\theta$ and then rearranging to get $\sin^2\theta + \sin\theta\cos\theta - 6(1-\sin^2\theta) = 0$. However, for most candidates the maximum mark awarded was 1 for correctly using a relevant trigonometrical identity. Many candidates tried more than one approach, all of which were usually unsuccessful whilst many, having (wrongly) reached the stage $7\tan^2\theta + \tan\theta = 6$ appeared happy to lose the 7, rearrange and claim the printed result.
It was pleasing to see most of those candidates who attempted part (b)(ii) using the quadratic in $\tan\theta$ printed in part (b)(i) to start their solution. There were many correct solutions presented, although poor factorisation was seen in some attempts. It was surprising to see some candidates using their own version of the quadratic, $7\tan^2\theta + \tan\theta - 6 = 0$, in part(b)(ii) and this gained no credit.

Mark Ranges and Award of Grades

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