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Mathematics MPC2

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Pure Core 2

Report on the Examination

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General

The students' work was generally very well organised. It was pleasing to see that students who did require extra working space after crossing out earlier attempts had received a relevant AQA supplementary answer booklet to complete their solution rather than resorting to answering in the wrong working space.
In general the paper seemed to be answered well with no obvious indication that students were short of time to complete the paper. It was clear that students found this paper to be much more straightforward than the one in May 2012 although more demanding than the January 2012 paper.

Question 1

This question, which was the best answered question on the paper, provided most students with a very good start to the paper. In part (a), a correct expression for the perimeter was usually presented although a minority of students then lost the accuracy mark because they could not either solve the equation $r + r + 1.25r = 39$ or they did not provide a concluding statement after a verification approach using the given value for *r*. A large majority of students obtained the correct value for the required area of the sector in part (b). The most frequent error was, as in January 2012, to use the wrong formula, $A = r^2\theta$, for the area of the sector.

Question 2

The use of the trapezium rule was well understood with a majority of students presenting a fully correct solution to part (a) with the final answer given to the degree of accuracy requested. Students need to take extra care when transferring correct decimal values from a table into the formula; this was particularly relevant in this series to those values which had leading zeros, namely for $\mathrm{f}(4)$ and $\mathrm{f}(5)$. The most common method error was to use end values 0 and 4 for x instead of the correct end values 1 and 5. A small minority of students left their final answer in the form $\frac{694}{1105}$ which resulted in the loss of the final accuracy mark.
In part (b)(i), most students were able to integrate one of the terms correctly but it was not uncommon to see the integral of $x^{-\frac{3}{2}}$ resulting in a positive coefficient or an incorrect numerical simplification of $1/-0.5$. Very few students failed to score the method mark in part (b)(ii) for being able to deal with limits in a correct manner.

Question 3

As expected, this question which tested the area of a triangle formula $\frac{1}{2}ab\sin C$ and the cosine rule, applied to the case of finding and using an obtuse angle, generally proved to be a challenge to all but the better students. Approximately one quarter of the students answered both parts correctly. With method marks in part (b) being available to those students who used an incorrect angle from part (a), more than half the entry scored 4 marks for Question 3, usually after using the corresponding acute angle satisfying the equation $\sin C=5/6$. It is worth recording that a common error to find the obtuse angle in part (a) is illustrated by '$90+56.4$' rather than the correct method '$180-56.4$'.

Question 4

This question which tested the laws of logarithms caused problems for approximately half the students. Although many correctly wrote $\log_a N - \log_a x$ as $\log_a \frac{N}{x}$, a common error was to incorrectly write it as $\frac{\log_a N}{\log_a x}$. The majority of students who reached $\log_a \frac{N}{x} = \frac{3}{2}$ went on to present a full correct solution although others could not eliminate the logarithm correctly or failed to correctly change the subject of the resulting formula to write x in terms of N and a.

Question 5

In general, this question was a good source of marks for many students. Most students were able to find the correct expression for $\frac{dy}{dx}$ in part (a). In part (b), the majority of students were able to obtain the printed answer in a convincing manner by firstly clearly indicating that they were finding the value of $\frac{dy}{dx}$ at $x=2$. There were, however, some cases of students who obtained the printed answer by clearly incorrect methods and some by showing incomplete details; both of which were penalised heavily. In part (c)(i), those students who correctly approached the problem by trying to solve the equation $\frac{dy}{dx}=0$ generally picked up 2 of the 3 marks for finding the correct coordinates of M but quite frequently then forgot to state the conclusion, that the stationary point lay on the x-axis.

In a number of solutions, students, having solved $\frac{dy}{dx}=0$ correctly to get $x=-2$, just stated that the point M lay on the x-axis. In part (c)(ii), those students who produced a rough sketch were usually more successful in recognising that the x-axis was the required tangent than those who used the general equation of a line. In this context, it was not always the case that students realised that the product of zero and $(x+2)$ was 0. Those students who attempted part (d) generally understood the method of solution but the required coordinates of T were frequently incorrect.

Question 6

Students almost always scored full marks for their answers to parts (a)(i) and (a)(ii) but writing the *n*th term of the geometric series in the required form in (a)(iii) proved to be much more challenging. Although the majority of students started correctly by writing $420\times 0.7^{n-1}$, a large proportion of these students failed to write this in the form 600×0.7^{n}. The most common wrong answer, for those who attempted to re-write $420\times 0.7^{n-1}$ in the stated form, was 294×0.7^{n}. In part (b)(ii) there was some confusion with the term and sigma notation which resulted in the sum being equated to zero. The most successful approach was to solve $U_k = 0$ to obtain the value of the positive integer k and then to find the value of $\frac{k}{2}(240+0)$, which represents $\sum_{n=1}^{k} u_n$, the sum of the k terms of the arithmetic series with 1st term 240 and last term $0(=U_k)$. In a minority of cases where the correct expression for U_k was equated to zero, an incorrect rearrangement resulted in a negative value for k. Students who made this error did not seem to realise that such a value for k was meaningless.

Question 7

In part (a) a large proportion of the students recognised the transformation as a stretch although a significant minority incorrectly stated that it was in the x-direction with scale factor 1/3. In part (b) there were many correct sketches although it was not uncommon to see the y-intercept incorrectly given as 1. In part (c), the majority of students scored the first mark by eliminating y correctly to obtain $4^{-x} = 3\times 4^{x}$ although a significant minority failed to score even this opening mark because they tried to combine two steps which resulted in the incorrect initial equation, $-x\log 4 = x\log 12$. A significant number of the students failed to make any further progress. More able students who used the log laws correctly to reach $-x\log 4 = \log 3 + x\log 4$ were generally successful in finding the correct value for x. A common error in applying laws of indices, amongst those students who tried to rearrange the equation $4^{-x} = 3\times 4^{x}$ before taking logarithms, is illustrated by the incorrect equation $16^{2x} = \frac{1}{3}$.

Question 8

Part (a) was generally answered correctly although all the usual errors were seen in this simple type of expansion. A few students did not simplify the terms in their correct expansion in part (a) but credit was awarded retrospectively if the correct simplified expansion was seen in the later part (c). Many students understood what was required in part (b) but a very common wrong answer, $1+2x+7x^2+14x^3$, was seen due to the errors $\left(\frac{x}{4}\right)^2=\frac{x^2}{4}$ and $\left(\frac{x}{4}\right)^3=\frac{x^3}{4}$. In general, only the better students were able to find the three relevant products which led to the coefficient of x in the expansion for part (c) being 30.

Question 9

This final question resulted in a wide spread of marks. In part (a) a significant number of students did not see that the answers could be written down directly. The most common incorrect method led to incorrect equations similar to $x+30=89.27$, the right-hand side coming from $\tan^{-1}(79)$. Most students correctly recognised the geometrical transformation in part (b) to be a translation but the direction of the translation was quite frequently incorrect. In part (c)(i) the right-hand side of the given equation was usually expanded correctly with the correct notation seen and many recalled and used the correct relevant trigonometric identity to eliminate $\sin^2\theta$. However, solutions towards the printed answer were spoilt in a significant minority of cases by students incorrectly writing the correct expression $5+1-\cos^2\theta$ as $5-5\cos^2\theta$. Of those who obtained the correct simplified quadratic equation in $\cos\theta$, most were able to solve the equation correctly but not all of these students gave an indication that they had considered and rejected the value -2 for $\cos\theta$. The final part of this last question proved to be a challenge even for the more able students. Many solutions just consisted of solving $\cos\theta=\frac{3}{4}$ to obtain two solutions rather than stating the required equation as $\cos 2x=\frac{3}{4}$ and solving it to find the four solutions within the given range to the required degree of accuracy.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website: http://www.aqa.org.uk/over/stat.html

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