A-LEVEL
MATHEMATICS

MPC3 Pure Core 3
Report on the Examination

6360
June 17

Version: 1.0

General

Students had the opportunity to score marks on topics throughout the paper, with the final parts of some questions being a little more demanding. The vast majority of students tackled all of the questions.

The presentation of work by many students left much to be desired. Many students failed to include brackets in some of their expressions. Students also need to realise that when they are asked to show a given result, they must provide sufficient details in the solution to justify the result. Students also need to realise that if they are asked to use a specific method to find a solution then the use of alternative methods will be heavily penalised.

Question 1

(a) This was generally answered correctly.

The two main errors were the derivative of $\sec 3x$ given as $\frac{d}{dx}(\sec 3x) = \tan 3x \sec 3x$, and $\frac{d}{dx}(\sec 3x) = 3\tan x \sec x$.

(b) This part was also generally well answered with most students realising that it was a $\ln$ function required. The major errors were the omission of either the brackets, or the constant of integration or a value of k other than $\frac{3}{2}$.

Question 2

(a) This part was very well answered with the majority of students earning full marks. The main error was not writing the final answer to the correct degree of accuracy. Students also need to be more careful when substituting their values into formulae as, for example, a very common error was 6.60614 being written as 6.0614 .

(b) This part discriminated between students. Less able students often either could not differentiate the function or forgot to include brackets, with $3 - 3x^2 e^{3x - x^3}$ being a very common result. Most students earned the first method mark for equating their $\frac{dy}{dx} = 0$. The more able students realised that the exponential part of the expression could not equal zero and went on to correctly solve for x. Other students attempted to solve for the exponential, and in addition to the answer $x = \pm 1$, values of $\pm\sqrt{3}$ were seen. Students also lost marks by failing to find the y-coordinates and also by giving an incomplete conclusion for the final accuracy mark.

Question 3

This was very well answered by many students. Those students who managed to write the expression in terms of u only usually went on to score full marks. Some students left their final answer in terms of u and lost the final mark. Weaker students often only scored the first mark for

$\mathrm{d}u = -2\sin 2x\ \mathrm{d}x$. Other common errors involved the use of incorrect trigonometric inequalities, with $-\frac{1}{2}\int u^2(u^2-1)$ being a common error.

Question 4

This was very well answered by the majority of students.

(a) Only one very common error was seen: starting with the formula $\mathrm{f}(x) = \ln\left(\frac{3x+10}{3x+1}\right) - x$,

students, on both occasions, subtracted 1 to give $\mathrm{f}(1) = \ln\frac{13}{4} - 1 = -0.178$ and

$\mathrm{f}(2) = \ln\frac{16}{7} - 1 = 0.1733$.

(b) The main error was to not write answers to the required degree of accuracy.

(c) This part was also well answered with only a few students drawing a vertical line from x_1 to the line rather than to the curve.

Question 5

This was another very well answered question, with the majority of students obtaining full marks in both parts.

(a) The main errors were $\mathrm{e}^x = 3y+1$ becoming $\mathrm{e}^{x-1} = 3y$, which then led to difficulties in part (b), and also g(x) being wrongly given as $\mathrm{g}(x) = \frac{1}{3x+1}$.

(b) Students must be aware that, where an answer is given in the question, they need to ensure they show sufficient steps in their solutions to justify the given result.

Question 6

This question was very well answered by the more able student with many fully correct responses seen. However poorer students often failed to score any marks.

Some students set the problem up with $\frac{\mathrm{d}v}{\mathrm{d}x} = 3x$ and $u = (2x-1)^{0.5}$. A number of students ignored the instruction to use integration by parts and used integration by substitution thus gaining no reward.

Question 7

Despite many fully correct responses this question proved very difficult even for the more able students.

The first mark was lost by many students as they drew modulus graphs with two vertices on the positive x-axis. There were many attempts for the two graphs that had them meeting at the origin. The main error in the algebra appeared to be with the bracket, and $5x - 3k = -3x + 4k$ was very common along with $5x - 3 = 3x + 4$. Students also frequently obtained $8x = -9k$ and $2x = 15k$ and went no further. It was also not uncommon to see $k = -\frac{8x}{9}-$ and $k = \frac{2x}{15}$.

Question 8

(a) This was very well answered by many of the students, with full marks often awarded. For students who failed to score full marks, the first problem was notation, with the substitution of the correct trigonometric identity being seen as $\sec^2 - 1\left(2x - \frac{\pi}{6}\right)$. This was however often recovered to obtain the correct quadratic which in turn was usually factorised correctly. Some errors were seen in rearranging and solving the quadratic, with $\sec\left(2x - \frac{\pi}{6}\right) = 4$ and $\sec\left(2x - \frac{\pi}{6}\right) = -3$ being the most common. The next error was students only obtaining one value for the angle for each of the solutions to $\cos\left(2x - \frac{\pi}{6}\right) = \frac{1}{3}$ and $\cos\left(2x - \frac{\pi}{6}\right) = -\frac{1}{4}$. This meant that students could only earn one of the final four available marks.

(b) The majority of students earned half of the available marks. The translation was normally written correctly as $\begin{bmatrix} k \\ 0 \end{bmatrix}$ but k was often incorrectly written as $\frac{\pi}{6}$. Similarly, the stretch in the x-direction was normally given but the scale factor was often given incorrectly as $\frac{1}{2}$.

Question 9

(a) This was usually well answered, with the main error being that the maximum, which should have occurred on the y-axis, was often placed to the left or right of this axis. Another major error that occurred was the right hand outside section being omitted or continued down into the fourth quadrant.

(b) This was not as well answered as the previous part. The answer given was often a reflection of (a) in the x-axis, or a reflection of the correct answer in the x-axis. Many students earned the first method mark for a correct shaped graph but often lost the accuracy mark for poor symmetry.

(c) Many students scored full marks in both parts. A surprisingly common error was to leave the x-coordinate as $x = 0 - a$.

Question 10

(a)(i) This was usually well answered with many fully correct responses seen. The most common error was leaving the final equation with exponential terms.

(a)(ii) Students with a correct response in (a)(i) usually obtained this mark.

(b) Although the formula for the volume of the cone was given, far too many students attempted to find the value using the volume of revolution for the line found in (a)(i). Some students using the formula interchanged r and h. The B mark for the formula for the volume of revolution of the curve was also rarely obtained, with either the $\mathrm{d}x$ or the limits or both omitted. However, many students were successful in finding the value for the volume of revolution of the curve, followed by a successful evaluation of the required volume if they had used the formula for the cone properly. A significant number of students subtracted the area of a triangle instead of the volume of a cone.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.
UMS conversion calculator