A-LEVEL

Mathematics

MPC3 – Pure Core3
Report on the Examination

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General

The majority of students showed some understanding of most of the topics and, as the first half of the paper was quite straightforward, most started confidently. Question 4 (a) and (b) challenged many as did 5(b) and Question 7.
The paper was accessible to the majority of the students with few very low marks.
Students seemed to manage their time very well with very few incomplete scripts seen.

Question 1student

This was well answered by most of the students with many gaining all four marks. Some candidates lost the final accuracy mark through premature rounding, truncation, or not giving the answer to four significant figures.
The most common error involved the use of degree mode on the calculator and 0.1222 was often seen. This usually earned the first B1 and the method mark.

Question 2

(a) Being unable to differentiate 2e proved to be the biggest hurdle here. A high proportion of students gave $(2\text{e}-1)/(2\text{e}-x)$ for their answer. Other common answers were $2/(2\text{e}-x)$ and $2(2\text{e}-1)/(2\text{e}-x)$.
(b) The majority of students earned the B mark for $y=2$ although the unsimplified $y= 2\ln(2\text{e}-\text{e})$ was also seen. Most students managed to substitute e for x in their expression to find the gradient and go on to find the gradient of the normal. Those students who had the correct answer in (a) were usually successful in obtaining full marks in (b). Students who had expressions such as $2(2\text{e}-1)/(2\text{e}-x)$ substituted for x and got $(4\text{e}-1)/\text{e} = 4-\text{e}/2$ and then inverted incorrectly. Other errors involved not substituting e for x and writing an equation with the gradient still in terms of x.
(c)(i) Apart from the students who wrote $2\ln(2\text{e}-1)= 2.98$ and $2\ln(2\text{e}-3)=1.78$ and stated that there should be a change of sign, this question was very well answered with most students earning both marks.
(ii) This part was well answered. A small number of students confused three decimal places with three significant figures and a small minority failed to round at all.
(iii) This part was very well answered with most students earning both marks. There were some cases where x_3 and x_2 were labelled the wrong way around.

Question 3

(a) (i) This part was answered correctly by many students, although such cases as $\frac{5}{2}(x^2+1)^{3/2}$ were seen.
(ii) Generally, students differentiated the exponential correctly and used the product rule.
A small number of students forgot to put $x=0$ and a few equated to zero. Some students unfortunately made a slip in brackets or a power. A small number of students lost the coefficient of 2 with the exponential or had $2x$. A minority of students simply multiplied the two differentiated terms together.
(b) The quotient rule was usually applied correctly although in several cases the numerator terms were reversed, resulting in the loss of the accuracy mark. Many students went on to obtain full marks for this question. The main error resulting in an incorrect quadratic was where students expanded the second pair of brackets $-2x(4x - 3)$ and obtained $-8x^2 - 6x$. Several students gained no further credit after the original application of the quotient rule through incorrect cancelling.

Question 4

(a) Only about half of the students were able to answer this part correctly with a few of these losing a mark for showing a turning point instead of a cusp or wrong curvature at the left hand side of their sketch. A very small number of students failed to mark the 2 and -3 on the x-axis. However, many sketched $|f(x)|$ or $|-f(x)|$ instead of sketching $-|f(x)|$.

(b) Only a small number of students had a good sketch. Where students drew the curve symmetrically about the y-axis the points of intersection on the x-axis were often incorrect and 4 and -4 was a common error. Some students' sketches were correct between $x=-1$ and $x=1$ but the branches beyond there were above the x-axis.

(c)(i) The students who chose to start with the translation were generally more successful. The stretch was usually correct (only a few put sf2 in y-axis). The majority scored 3 marks.

(ii) The quality of response to this question tended to vary from centre to centre. If there was an error, it was usually with the x value rather than with the y value.

Question 5

(a) Often the correct answer was given. However, many students did not score both marks as they did not use $f(x)$ in their notation.

(b) This was the most poorly attempted part of the paper. Those students who had learned to interchange x and y at the start almost all scored the B1 mark. Only the most able students spotted that they were required to use the quadratic formula or complete the square. But of these students only a very small minority considered whether the negative square root was appropriate.

(c)(i) Nearly all students answered this part correctly.

(ii) Most students were able to form the two relevant equations and solve them, though only a few students went on to consider the domain and reject 1 and -1. A significant number of students had only one equation and some made an error in forming their equations. A small minority of students squared both sides but only the most able of these students were able to solve the resulting quartic equation.

Question 6

(a) Integration by parts was answered very well by the majority of the students. Very few students failed to set up correctly and most earned the first three marks. Because many students left their work in an unsimplified form such as $-\frac{1}{2}\boldsymbol{x}^2\cos 2\boldsymbol{x} - \int -\frac{1}{2}\boldsymbol{x}\cos 2\boldsymbol{x}(2\boldsymbol{x})$, errors started to occur with signs when starting the next stage. Also many students appeared to do their work in isolated sections and then try to bring the whole solution back together at the end often resulting in a sign error. Missing the constant of integration was common for losing the last A mark.

(b) The first mark here was for a completely correct expression of the required integral including the limits and dx and many students did not score this mark. Evaluating $F(\pi/2) - F(0)$ for their integral earned many students the method mark but there were frequent sign and fraction errors after that.

Question 7

To make significant progress here students had to deal with -1/3 in some form and many lost the negative sign and had 3 instead of 1/3. Those who cancelled the x^2 with x^5 first were more successful than those who tried to convert to *u* straight away. Some compounded the loss of the negative sign early on with using the limits on *u* the wrong way around. Unfortunately when some students did a check by calculator they assumed that their solution was correct. Those students who changed back to a function in *x* did not have the same problem. A small number of students integrated 1 (or 1/3) to *x* (or $\frac{1}{3}x$) instead of *u* (or $\frac{1}{3}u$) and were then confused when applying the limits.

Question 8

(a) This was the least well answered of the three parts in this question. Some students had difficulty combining the two fractions. Some others got as far as $(2\text{-}2\sin x)/(\cos x - \cos x \sin x)$ but were unable to complete the work. Of those progressed, it was important to cancel $(1\text{-}\sin x)$ and not just $\sin x$ and also to show $2/\cos x$ before the final given expression. Many students converted the first fraction to $\sec x - \tan x$ but then wrongly thought they could do something similar with the second fraction. However, a very small number of students multiplied the numerator and the denominator of the second fraction by $(1 + \sin x)$ and produced an elegant solution. It was good to see that there were very few attempts to deal with both sides and establish something like $\cos^2 x = 1 - \sin^2 x$.

(b) This part was answered very well, mostly by forming an equation in $\sec x$ or, much less commonly, in $\cos x$. Most students found all three solutions though a significant number rounded wrongly to 290°. A small number of students wrongly put $\sec x = 1 + \tan x$. Some students squared both sides of the given equation to get a quartic in $\tan x$ but it was seldom correct, and if it was correct it required correct factorisation and then elimination of extra values.

(c) Students who did well in part (b) usually went on to earn both marks in this part.

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 www.aqa.org.uk/umsconversion