A-LEVEL
MATHEMATICS

MFP3 Further Pure 3
Report on the Examination

6360
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General

Most students appeared to be well prepared for the examination and they were able to tackle all that they could do without there being any apparent evidence of shortage of time. In most scripts, students completed their solution to a question at the first attempt. Again this year, presentation of work was generally good.

Question 1

Most students scored highly on this question, which tested the complementary function and particular integral method for solving a first-order differential equation. Where students did not score full marks, the errors were usually either due to a lack of brackets when substituting $ax + b$ and their expression for $\frac{dy}{dx}$ into the differential equation or due to having the incorrect number of arbitrary constants in their complementary function.

Question 2

Most students were able to score the mark for part (a), which involved using the standard expansion for $\sin x$. Part (b) was more challenging. Successful students found the binomial expansion of $(1 - x^2)^{-1}$ and substituted this together with their expansion from part (a) into the given expression and equated coefficients correctly. Algebraic errors when expanding brackets caused issues for a number of students. The most common error, which resulted in the greatest loss of marks, was to just find the expansion of $(1 - x^2)\sin 2x - 2x(1 - px^2)$ without any further explanation or justification.

Question 3

This standard numerical methods question was a good source of marks for most students in part (a). The most successful attempts showed values for both k_1 and k_2 before substitution into the given formula. In part (b)(i), it was not uncommon to see $\ln(x + y)$ differentiated incorrectly as $\frac{\frac{dy}{dx}}{x + y}$, but most students gained credit for correctly applying the product rule and, with follow through marks available, many were then able to score highly in part (b)(ii) using their derivative. A significant minority of students did not give their answer to part (b)(i) in terms of x and y as requested but left it in terms of $\frac{dy}{dx}$.

Question 4

Most students were able to score the first three marks for using appropriate substitutions to transform the polar equation into a Cartesian equation, but a large minority of students gained no further credit. In order to compare directly with the original Cartesian equation to find the values of the constants c and d, successful students completed the square, which also led into determining the correct transformation as a translation with the appropriate vector stated.

Question 5

This question on using a substitution to solve a second-order differential equation was generally answered well, with most students correctly applying an integrating factor method, and the majority of them obtained the correct first-order differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{(2+x)^2}{1+x}$. Only a minority of students correctly solved this differential equation by writing $\frac{(2+x)^2}{1+x}$ in a suitable form that could be integrated directly. Most abandoned their solution after various attempts at integration by parts. A very small number of students tackled this question by using the complementary-function and particular-integral method to solve the first-order differential equation in u. Although a few full correct solutions were seen, these were very much in the minority.

Question 6

This question on the limiting process was a discriminating question again this year. Students needed to use precise limit notation throughout. Most students were successful in part (a) at using the given substitution to at least partly transform the given limit into one of the standard limits for this unit, but only a minority scored all three marks. In part (b), the majority of students were able to correctly use integration by parts. For the final couple of marks, students had to consider explicitly $\lim_{p \to \infty}\left[\mathrm{F}(p) - \mathrm{F}(1)\right]$ and either relate it to part (a) or give a precise explanation to justify their final value.

Question 7

Although one of the later questions on the paper, this unstructured question on solving a second-order differential equation was answered very well, and a large number of students scored highly. Considering that the 'obvious' form of the particular integral for the trigonometric terms was part of the complementary function, students performed much better than expected in dealing with this rarely tested idea. In general, algebraic errors in differentiating the particular integrals and substituting into the differential equation were the most common reasons for loss of marks.

Question 8

Students were generally able to pick up good marks across this question on polar coordinates. The most challenging part was (b)(i), where only a minority of students were able to find and apply a valid method to correctly obtain the printed result. However, it was encouraging to see most students using the printed result to find the correct value of α and use it as a relevant limit in the final part. When asked to show a printed result, as in part (c), it was important to show sufficient details in the solution and to ensure that all algebraic expressions were accurate, including brackets. Some students' expressions had brackets missing and so would not have equated to the given value for the area of the triangle. In the final part, a large minority of students did not subtract the area of triangle OAB from their evaluation of $\frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} (1+\tan\theta)^2 \, \mathrm{d}\theta$.

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