Version : 1.0 0108

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MFP3 Further Pure 3

Report on the Examination

2008 examination - January series

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX *Dr Michael Cresswell Director General.*

General
Presentation of work was generally good and most candidates completed their solution to a question at the first attempt with relatively few scripts containing attempts at parts of the same question at different stages in the answer book.

Although some excellent scripts were seen, there was a higher proportion of poor scripts than has been the case in previous series.

Candidates usually answered the questions in numerical order and most appeared to have sufficient time to attempt all eight questions.

A large number of candidates failed to complete the boxes on the front cover of their answer book to indicate the numbers of the questions that they had answered.

Teachers may wish to emphasise the following points to their students in preparation for future examinations in this unit:

- Where an answer is printed in the question, candidates are allowed to use it to help them answer later parts of the question even though they may not have been able to obtain it.
- An integral, with ∞ as a limit, is improper because the interval of integration is infinite.
- The 'bookwork', which was explicitly asked for in Question 8(a), should be learned and understood in preparation for any future questions which may be set using this particular type of given substitution, $x = \mathrm{e}^t$, to solve a second order differential equation.

Question 1
Numerical solutions of first order differential equations continues to be a good source of marks for all candidates. This was the best answered question on the paper. Although almost all candidates obtained the correct answer to part (a), some less able candidates showed a lack of understanding of the notation used in the given formula in part (b).

Question 2
This question, which tested the areas of regions involving a curve whose equation was given in polar form, was relatively poorly answered. Full correct solutions were not often seen. In part (a), candidates generally wrote down the correct definite integral, then expanded $(1+\tan\theta)^2$ and integrated $2\tan\theta$ correctly, but could not find a correct method to integrate $1+\tan^2\theta$. Those who used the correct trigonometrical identity had no problem integrating the resulting $\sec^2\theta$ and completing the solution to reach the printed answer convincingly.

It was disappointing to find a significant minority of candidates not attempting part (b) having failed to obtain the printed answer in part (a). Most of the other candidates found the correct lengths for *OP* and *OQ* but some then wrote down an incorrect formula for the area of triangle *OPQ*. Some others lost the final mark because they did not give the area of the triangle in an exact form anywhere in their working despite the form of the printed answer in part (a).

Question 3
This question, which required candidates to solve a second order differential equation, was generally a good source of marks. It was disappointing to see some candidates trying to solve the auxiliary equation, $m^2+4m+5=0$, by factorisation. They obtained real solutions and this error was penalised heavily. Better candidates were able to write down the correct complementary function and find the particular integral but some wasted valuable time by

starting with $y_p = ax^2 + bx + c$ and showing that both a and b were zero. Candidates who were able to find the correct general solution in part (a) usually went on to apply the given boundary conditions correctly in their answers to part (b).

Question 4

Part (a) was generally not well answered with a significant minority either not attempting it or making a statement which they then contradicted in part (c). The method of integration by parts was understood with the great majority obtaining the correct answer to part (b). Although there continues to be an improvement in candidates' solutions to the evaluation of an improper integral, there were still a significant minority who made no attempt to show the limiting process used.

Question 5

Although many candidates were able to write down the integrating factor in terms of an integral, a significant minority could not then integrate $\frac{4x}{x^2+1}$ correctly. Those who found the correct simplified integrating factor generally used it appropriately and either solved the resulting integral by a suitable substitution or, more frequently, just multiplied out and integrated $x^5 + 2x^3 + x$. Although some candidates failed to insert the constant of integration and so lost the final two marks, this was not a common error.

Question 6

Those candidates who replaced $\sin 2\theta$ by $2\sin\theta\cos\theta$ generally obtained the correct cartesian equation in part (a). The sketch of the curve *C* (rectangular hyperbola) required in part (b) was not answered as well as expected with many sketches consisting of closed loops. Candidates presented a variety of acceptable methods for part (c). Those who eliminated *r* were required to obtain a trigonometrical equation in a single angle before any mark was awarded. Usually candidates who had found the correct equation went on to obtain the correct exact values for the polar coordinates of *A*. The second most popular method involved working with the cartesian form of the equation of *C*. Candidates who recognised the cartesian form of the equation of the line equivalent to the polar form given in part (c) of the question generally had no difficulty getting the cartesian coordinates for *A* as (2, 2), but then a significant minority could make no further progress.

Question 7

Although many candidates were able to answer part (a) correctly, it was clear, since factorials were present, that some had not realised that the series expansion for $\ln(1+x)$ and its range of validity are both given in the formulae booklet. Methods of differentiation, chain rule and product/quotient rules, required in part (b) were either not known or not applied correctly by a significant number of candidates. Some candidates left expressions unsimplified before carrying out further differentiation, often leading to expressions which required multiple applications of the chain, product and quotient rules. Such an approach clearly used up valuable examination time. Those who did simplify their expressions generally scored the available marks for parts (b). Although careless sign errors were seen in solutions to find the limit for part (c), the general understanding of the principles involved was better displayed than in some previous series.

Question 8

This question tested a relatively new part of the specification. Part (a) required candidates to produce 'proofs' of forms of some standard results for the topic, which could be classed as standard 'bookwork'. Part (a) was generally poorly answered, especially part (a)(ii). It was encouraging to see most candidates attempting to use the results given in part (a) to write the given differential equation in part (b) into a more useful form. Those who attempted this usually obtained the correct differential equation involving y and t and applied correct methods to solve it. Most of these candidates, however, gave their final answer as ‘ $y = A\mathrm{e}^{6x} + B\mathrm{e}^{x}$ ’ instead of ‘ $y = A\mathrm{e}^{6t} + B\mathrm{e}^{t}$ so $y = Ax^6 + Bx$ ’. On this occasion, solutions with this error were generously marked and were not heavily penalised.

Mark Ranges and Award of Grades

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