RECOGNISING ACHIEVEMENT

FSMQ

Additional Mathematics

Free Standing Mathematics Qualification **6993**

Examiner's Report

June 2011

6993/R/11

Oxford Cambridge and RSA Examinations

This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Additional Mathematics FSMQ (6993)

EXAMINER'S REPORT

Additional Mathematics – 6993

General Comments

As ever there was a wide range of performance. Many more candidates are being prepared for this paper, with a few genuinely excellent scripts and a large number of very worthy ones. It was especially pleasing to note that a number of candidates scored full marks. It is, however, still a cause for concern that a sizeable number of students are prepared badly or not at all for this specification but are nevertheless entered for the examination; the overall statistics will show that nearly 10% of candidates scored 10 or less. For these candidates the experience cannot have been particularly positive.

Use of mathematical grammar and notation varied widely; the standard of algebraic expression in particular left a lot to be desired as did the use of calculus notation.

Candidates seemed to cope well with the answer booklet with only a very small number offering solutions to questions in the space dedicated to another question.

Comments on Individual Questions

Section A

1 A majority of candidates substituted or used Pythagoras correctly for their answer. A significant amount of candidates attempted to produce an equation for a circle with centre (5, 2).

2 A variety of incorrect answers were seen here. A good number were correct. Some candidates differentiated and did not know how to proceed while others substituted (3, 9) into the original equation. A number also thought that the gradient of the tangent was the gradient of the normal.

3 (i) Finding the angle P only (being the angle opposite the longest side) was the shortest (and expected) way to answer this question. Others found all three angles before deducing that P was the largest. There were many incorrect forms of the cosine rule used.

(ii) Apart from those who did not know the formula for the area of a triangle a number substituted the wrong set of data (ie two sides and the wrong angle). A small number thought that the triangle was right-angled and a few more decided that the height of the triangle was found by calculating the length of a median (which assumed also that the triangle was isosceles).

4 This question was very poorly done. Credit was given for some use of the identity $\tan x = \dfrac{\sin x}{\cos x}$, but we saw many incorrect attempts to manipulate the ratios and numbers resulting in such equations as $\dfrac{2}{5}\tan x = 0$ and $\dfrac{\sin 2x}{\cos 2x} = \dfrac{\sin x}{\cos x}$. A significant number who obtained the correct principal angle of 10.9° then found the other three angles.

5 (a) Finding the midpoint caused little difficulty.

(b) There was some confusion here, not helped by the "fudging" that went on to produce the correct answer.

(c) (i) The triangle was right-angled but showing this to be so did not come from part (b) as required. Some said "equilateral"; it was not clear whether they thought it was or whether they were confusing the words.

(ii) Pythagoras was required here and many found the correct results.

6 The responses to this question were disappointing. The most popular incorrect answer was $x \le 7 \text{ and } x \le 5$ but some could not even solve the quadratic equation. Only a few students sketched the curve to help with their solution.

7 (a) (i) The remainder theorem was correctly used by the majority of candidates. Those who performed a long division often made errors and so came up with the wrong conclusion.

(a) (ii) Those who performed long division would have spent a lot of time for the one mark allocated to this question.

(b) (i) Some did not use what had been achieved in part (a) and started again by trial and error. Some that knew that, because of the term 6 in f(x), the factors could only be ±1, ±2, ±3. Given that one factor is ($\tilde{x}$ – 2), possibilities could not be also (x + 2) and (x + 1). This cut down options and therefore time considerably.

(ii) This follow-through mark was usually gained by those who had given three linear factors in part (b)(i).

8 (i) This question was answered correctly by most students. However, many forgot to shade the region for which $x \ge 0$ and $y \ge 0$. There was also considerable confusion over which side of the sloping lines should be shaded.

(ii) Many lost the second mark in this part by not answering the question. They commented that the minimum value would occur at (0, 12) without saying what that minimum value was.

9 The usual proportion tried differentiating. Others substituted (2, 0) instead of (2, 2).

10 The response to this question was better than in previous years, but there was a significant proportion who did not understand the word "exact" and turned immediately to their calculator to find θ. Many of those candidates that used the correct method to obtain an exact answer (for which full credit was given) could not resist the temptation to find out what that approximate answer too!

Section B

11 (i) This part was well done by the majority of candidates, though a number only gave their answer to two decimal places.

(ii) This also was done well. We saw little evidence of a term without the appropriate coefficient.

(iii) This part was a different matter. Only a handful of candidates laid out their work in such a way that it was immediately obvious what they were doing. Many candidates did not seem to be able to decide whether they were calculating the probability of accepting (and then subtracting from 1) or the probability of rejecting.

12 (a) The question had a mixed response with some candidates using constant acceleration formulae for both parts and some integrating in both parts. In this part integration from a constant value $a = 2$ produces the correct answer, and many obtained the result. Some constant acceleration formulae quoted were incorrect.

(b) The most common error was to use a constant acceleration formula, using the given function of t as a constant value for a.

(c) (i) Most candidates were awarded M1 at least for equating their functions of t from the previous two parts, but we rarely awarded 2 marks.

(ii) A large majority obtained the first M mark for substituting their value of t in the previous part to one of the functions of t in part (a).

(d) The graphs were very poorly drawn. Very few understood the context in which the velocity graph for a car with constant acceleration would be straight but with variable acceleration it would be curved.

13 (i) This is a typical "show that" question where the examiner must be convinced that the candidate has been able to take the problem and produce the result. There were very many scripts where the result was "fudged".

(ii) Once again, the result is given and so the algebra needs to be convincing and often it was not.

(iii) The wording of the question did not alert all candidates to the fact that differentiation was required here.

(iv) Three ways are accepted. If values of the function are found either side of the turning value then all three points need to be found. If the value of the gradient is the chosen method then values of the gradients either side of the turning points are required. The second derivative (and showing it to be negative) was an acceptable and popular method.

(v) The angle was identified correctly, but ways of finding it varied.

14 (a) (i) It was not expected to find this value from the graph, but rather to see that the value is always less than 1 with the value of $x = 1$ being found to be the value at which the maximum is found.

(ii) This part was done well.

(b) This is another question where the answer is given and so it is the responsibility of the candidate to convince the examiner that he/she can do the work.

(c) This is a standard integration which needs to be done carefully. There were the usual errors in integration, especially with the factor outside the bracket (which often got integrated) and substitution.

The integration of the original function was, of course, acceptable, though outside the syllabus. In this case, the substitution of the limit $x = 0$ does give a value which some ignored. Unfortunately many candidates did try to integrate the original function without any idea how to do it and got nowhere.

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