FSMQ

Additional Mathematics

ADVANCED FSMQ **6993**

Report on the Unit

June 2008

6993/MS/R/08

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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 syllabus 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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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REPORT ON THE UNIT

6993 Advanced Free Standing Mathematics Qualification

Additional Mathematics

We can report a further rise in the number of candidates this year, but it is disappointing to feel that the extra candidates were not all entered appropriately. This is evident by the poor performance of a significant number of students. This specification is intended as an enrichment specification for more able students. Typically, we would expect them to have gained, or be expected to gain, a good grade at Higher Tier of GCSE. Our impression was that this was not the case for many candidates. We feel that this is not a good experience for candidates who are achieving less than 20%; many candidates scored less than 10%.

As in previous years, the rubric states that final answers should be given to three significant figures where appropriate. Where this was not done, a mark was deducted, though only once in the paper.

Section A

Q1 (Constant acceleration formulae)

Many candidates confused formulae; others confused signs of acceleration with deceleration. 3ms^{-2} was a popular answer in part (i).
[(i) $a = -3$, (ii) $s = 150$]

Q2 (Coordinate geometry)

Some weak candidates resorted to graph paper throughout and scored very few marks. This was compounded by the inability to be aware that choosing different scales on the axes had an effect on what perpendicular lines look like!

Most candidates used the $y = mx + c$ form of the equation for a straight line in both parts. This was disappointing, given that this is an enrichment specification that only marginally takes this topic beyond GCSE, thus giving scope for wider work.

The most appropriate form of line in part (i) was $\frac{x}{a}+\frac{y}{b}=1$ and in part (ii) $y-y_1=m(x-x_1)$.

In part (i) many neglected the –ve sign for the gradient. However, they used their gradient accurately thereafter.

Part (ii) caused problems as some thought the normal was just the reciprocal of the gradient. Some muddled the formula for the midpoint by considering half the difference rather than half the sum of the *x* and *y* values.
[(i) $4x + 3y = 24$, (ii) $4y = 3x + 7$]

Q3 (Coordinate geometry)

Better candidates had few problems. Weaker candidates produced equations such as $x + y = \sqrt{13}$. Some made clumsy errors in expanding the squared brackets. Some also failed to spot the numerical factor of 26 and being thus unable to spot simple factors, resorted to using the formula with large numbers.
[(−2, 3) and (−3, −2)]

Q4 (Binomial probability)

Generally well done. It was quite usual to see both correct answers to this question. Some candidates seem happy to give a probability > 1 as an answer!
[(i) 0.168, (ii) 0.3087]

Q5 (Turning points of a cubic)

On the whole, this was quite well done although some used laborious methods to solve $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$. Some weaker candidates tried to integrate. The main loss of marks here was either to omit the *y*-coordinates or not to classify the stationary points. This was usually done via the second derivative method, but the alternatives (values of *y* or $\frac{\mathrm{d}y}{\mathrm{d}x}$ close on either side) were perfectly acceptable.

The sketch in part (ii) was usually correct although there were some strange 'cubic' graphs seen! Candidates should be aware that a sketch does not require graph paper and that some sort of scale to indicate intercepts on the axes and the turning points should be given. Many failed to fulfil these criteria and lost the mark, or plotted the function accurately on graph paper, thus losing a lot of time.
[Maximum at (−1, 3), minimum at (1, −1)]

Q6 (Variable acceleration)

This question was either done very well or very poorly. A significant number used constant acceleration formulae. Those who used calculus were usually successful (with the occasional slip in arithmetic in one of the terms) although some integrated in part (i) and differentiated in part (ii).
[(i) $a = 0.72t - 0.072t^2$, (ii) 60 m]

Q7 (Trigonometry)

On the whole candidates were successful with this question. Weaker candidates assumed in part (ii) that angle ACB was 90º and thus gained no marks.

This was the first question where a mark may have been deducted for giving the answer to too many significant figures. Some candidates like to give everything they see on their calculator! Others thought that 9.10… was given to 3 significant figures by writing 9.1.
[(i) 8.39 m, (ii) 9.10 m]

Q8 (Trigonometry, including the Pythagoras identity)

Better candidates knew the identity and were able to show the printed result in part (i). Others just floundered quoting their own ‘identities’ in order to fudge the result as convincingly as possible. There were a number of places in the paper where candidates were expected to “show that….” including in this question. This is in part to test the ability to reason well and in part to give an answer for remaining parts. Candidates should be aware that examiners need to be convinced that they are getting to the given result by correct mathematics.

In (ii) some were able to make progress despite not being able to do part (i). Others seem to be unable to recall the quadratic formula or have any understanding of how to solve a quadratic equation.
[30^0, 150^0]

Q9 (Cubic function)

This rather atypical question was very poorly done. Not even the best candidates made much progress. It was based on the initial ability to understand that 26 had the three distinct factors 1, 2 and 13. The question was completed satisfactorily by a few by multiplying out brackets and others by obtaining f(1) = 0 and f(2) = 0 and solving the subsequent simultaneous equations.
[$a = -16$, $b = 41$]

Section B

Q10 (Algebra)

Part (i) was usually correct. Very few explained clearly in part (ii), however, how the given equation arose. Rearrangement to the given quadratic was generally well done although weak candidates often made fundamental algebraic errors.

Those who had been entered appropriately had few problems with part (iii). Weaker candidates, once again, fell down through an inability to solve a quadratic equation.
Many failed to complete the question, believing that their answer to the quadratic equation in *v* was the time.

An inappropriate number of decimal places was often given for *v* and the answer for the times, required “to the nearest minute”, was often given as a decimal part of hours.
[151 and 166 minutes]

Q11 (Calculus and area)

Part (i) was normally correct. However, the remainder of the question was usually left unanswered by many candidates. Those who attempted part (ii) managed to differentiate but thought their general expression was the gradient for the tangent at T. Despite these cases, better candidates scored 6 marks very easily and efficiently.

The final part (when answered) was quite poorly done. Many made the error of integrating the curve and the line between the same limits. Others just found the area beneath the curve and did nothing else.
[(i) $\frac{1}{8}$. (ii) (2, 0), (iii) $\frac{2}{3}$]

Q12 (Linear programming)

Some weak candidates did not number their parts so it was quite difficult to follow their work. For many, however, this was a good source of marks. Few had problems with part (i) and the usual (very common) error in part (ii) was to write $x \geq 3y$ or similar.

Some candidates presented graphs without scales and, occasionally, lines were drawn freehand.
It was astounding to see so many who wrote the wrong inequality in part (ii) 'fluking' the correct line $y = 3x$ on their graph!

As in previous questions, the reasoning mark was difficult to access and candidates struggled to explain the mathematical statement in clear English.

Success in part (v) was usually dependent upon the correctness of their lines as many gave no indication of *how* they were using the objective function to maximise the profit.
[30, 90]

Q13 (Trigonometry)

This proved to be a challenging question and a good discriminator for better candidates.

In part (i) a number wrote $\alpha + \beta = 180$ but had no idea of the consequence of this.

Understanding of how to derive the value for the cosine of an angle greater than 90^0 did not seem to help even the better candidates to explain why $\cos(180 - \alpha) = -\cos\alpha$.

Part (ii) was disappointingly done due to many not bracketing the $\left(\frac{a}{2}\right)^2$ term. Fudging was then evident as they could not get the required coefficients.

Many deduced the expression for $\cos\beta$ although a number unnecessarily repeated their work in part (ii) and made similar errors.

Part (iv) was only attempted by better candidates and, on the whole, was done successfully.

The final part was attempted by many. More able candidates saw the relevance of part (iv) and easily scored 2 marks; the remainder either wrote nonsense (using Pythagoras' theorem) or used a long-winded method involving two applications of the cosine rule. They might have noted that the double use of the cosine formula, had it been required, would have attracted rather more marks than 2!
[16 m]

Grade Thresholds

FSMQ Advanced Mathematics 6993

June 2008 Assessment Series

Unit Threshold Marks

Unit	Maximum Mark	A	B	C	D	E	U
6993	100	68	58	48	38	29	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
6993	26.4	36.8	46.7	56.2	64.9	100	7323

Statistics are correct at the time of publication

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
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