Version

Free-Standing Mathematics Qualification
June 2012

Mathematics Advanced Level 6992

(Specification 6992)

Modelling with Calculus

Report on the Examination

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FSMQ Advanced level – Written paper

General

Many candidates were well prepared for this paper, and achieved very creditable marks. Unfortunately, there were a few candidates whose basic algebraic skills were very disappointing. These candidates struggled, for example, in question 1 to solve the equation: $31 - 10t = 0$.
A number of answers were given in the question paper in order to give candidates a reasonable attempt at subsequent parts of the question, but as usual, a proportion of candidates used very inventive work to reach these printed answers.

Question 1

A few candidates attempted to solve the equation without using calculus, and therefore scored no marks in part (a). For those who did use appropriate methods, most found $\frac{\mathrm{d}p}{\mathrm{d}t} = 31 - 10t$, and solved this to find $t = 3.1$. A few forgot to find the value of p, but the common error was in finding p to be 48.05, forgetting that the number of people was in thousands.
The sketch for the model in part (ii) was usually correct, although the points were often plotted. In part (iii), most candidates failed to notice that the model was not appropriate for larger values of t as the model gave a negative value for the number of people entering the mall.
Some candidates did not use four strips as required in part (b). Those who did could not always apply the trapezium rule correctly.
In part (c), only a few candidates stated that the reason all the trapezia had smaller areas than the appropriate section of the curve was because the curve was concave. Many simply repeated the common answer that integration gave a more accurate answer than the trapezium rule. This was not accepted.

Question 2

Most candidates found $\frac{\mathrm{d}p}{\mathrm{d}t}$ correctly in part (a) and the majority also found the values of t at the stationary points by using the quadratic formula. In part (b), $\frac{\mathrm{d}^2p}{\mathrm{d}t^2}$ was also found correctly. Part (c) caused difficulty to many candidates. Inserting $t = \frac{25}{3}$, gave $2314.8\ldots$, but many candidates did not insert this value into the function for L to obtain $25.17\ldots$. Of those who did find $25.17\ldots$, many did not 'add' this to the starting year to obtain 2010 (or 2011) as the best year to retire. A number of candidates failed to find the value of $\frac{\mathrm{d}^2p}{\mathrm{d}t^2}$ to prove that it was a maximum value.

Question 3

A few candidates did not integrate as required. The majority who did try to integrate were successful. In part (b), many candidates did not divide $33\,750$ by 30 before inserting this value into the function to find the average length of time.

Question 4

This question proved a good source of marks for those who did not use calculus for any of the paper, providing they used their calculators correctly in parts (e) and (f).
Part (a) was a standard solution of a differential equation, and this was well attempted by the majority of candidates. However, there were a significant number of errors showing that some did not know what they were doing, writing for example, $e^{\lambda t} + c = \ln e^{\lambda t} + e^{c}$. The justification required in parts (b), (c) and (d) were often unconvincing. In part (b), it was necessary to prove the value of c to be 3000 before showing that $v = 3000e^{\lambda t}$.
Many errors caused by truncation were seen in parts (d) and (e), for example, $\frac{5}{3} = 1.6$ or 1.7, and a significant number of candidates showed that they did not appreciate the difference in $e^{\lambda t}$ being 1.05^{t} rather than $1.05t$.

Question 5

Few candidates showed that they appreciated the nature of the trigonometrical function having a period of 2π, or in the case of $\cos\frac{3\pi}{2}t$, having a period of $\frac{4}{3}$. They also showed no confidence in realising that that the highest point for Simon on the swing was when the height of Simon below the swing was at a minimum. More candidates than in previous yeas did appreciate that the angle was in radians when they found the value of s. In the differentiation to find $\frac{ds}{dt}$, candidates were penalised if they did not simplify its value to $-\frac{3\pi}{10}\sin\frac{3\pi}{2}t$ or $-0.3\pi\sin\frac{3\pi}{2}t$.

FSMQ Advanced level – Portfolios

The standard of portfolios submitted for this award was generally very credit worthy with most centres following the Specification carefully. Working with Algebraic and Graphical Techniques was the most popular unit followed by Using and Applying Statistics and Using and Applying Decision Mathematics.

Generally centres encouraged their candidates to produce portfolios which showed independent work and realised for a high mark in Strand One initiative must be demonstrated in the development of the investigation. Some centres, however, did not appreciate that if a portfolio is incomplete scaling of marks must take place as indicated in the Specification.

It was pleasing to see that most centres encouraged their candidates to validate their work by carrying out a thorough range of 'checks'. However, the candidates from some centres did not produce work of the correct standard, this was particularly apparent in the Statistics unit where often only core material was developed. Some candidates did not produce "A report of fitting a function to non-linear data by plotting a linear function" for the Algebra unit and so could only be awarded a maximum mark of 24.

There were some very exciting portfolios which were rightly awarded a high mark, the assignments had been developed independently and the conclusions had included an explanation of how the initial data affected the findings. It should be remembered, however, that for a high mark in the Statistics unit, work on tests of significance, Mann Whitney test, Wilcoxon signed rank or similar topics must be seen. Similarly, in the Calculus unit integration/differentiation of more advanced functions must be attempted if a high mark is to be awarded.

The provision of samples was very efficient and most centres provided detailed comments on the Candidate Record Forms which greatly assisted the moderation process.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics pages of the AQA Website.

UMS conversion calculator www.aqa.org.uk/umsconversion.