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Free-Standing Mathematics Qualification

Modelling with Calculus 6992

Advanced Level

Report on the Examination

2010 examination – June series

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Modelling with Calculus (6992)
Examination

General

Although there were a number of very weak candidates, there were also a few excellent ones who gained the maximum mark of sixty.
In general, algebraic skills were often poor. To solve a quadratic equation, for example, in question 2 part (a), a large proportion used the quadratic formula but could not complete their solutions. It was rare to find candidates using a graphic calculator; those who did usually obtained the correct solutions quickly. Algebraic skills needed in question 3 part (a) (iii) were also found lacking, with $100 = 150(1 - e^{-kt})$ typically becoming $\ln 100 = \ln 150 - kt$.
Candidates scored well on questions 1 and 2 whereas the later questions, particularly questions 3 and 5, were found challenging.

Question 1

Parts (a) to (e) of this question were found to be a good source of marks by most candidates. In part (b), a significant number incorrectly found $\frac{dh}{dx}$ to be $0.1x$, which caused problems in part (c) where the solution of $0.1x = 0$ was rarely found correctly.

In part (f), the value of h when the ball hit the ground was -2. The better candidates used the -2 and found the distance. Weaker candidates used $h = +2$; these candidates could rarely solve their incorrect quadratic.

Question 2

Most candidates found $\frac{dS}{dt}$ correctly and equated this to zero. Relatively few managed to find their solutions correctly. Some candidates successfully used their graphic calculators but most found themselves lost in a sea of algebra.
Part (a)(iii) was usually completed well, but many candidates used the techniques of last year's paper and found t when $\frac{d^2S}{dt^2} = 0$
A significant number of candidates were successful in all the sections of part (b). In part (b)(i) a few used 0, 1.1, 2.2, 3.3 for the values of t, hence finding the mean over the first 33 days. This was condoned.

Question 3

Only the better candidates made good progress in the question. In part (a), most realised they had to integrate, but instead of using $\int \frac{dh}{150 - h} = \int k \, dt$ many used $\int \frac{dh}{h} = \int k - 150 \, dt$

Many of those who did use $\int \frac{dh}{150 - h} = \int k \, dt$ omitted the minus sign in the integral of the left hand side. The conversion of $-\ln(150 - h) = kt + c$ into $150 - h = A e^{-kt}$ was often not convincing.

In part (a)(iii), many candidates substituted the values of t and h into the equation given in part(a)(ii) to produce $100 = 150(1 - e^{-30k})$. Unfortunately this often resulted in expressions such as $\ln 100 = \ln 150 - 30k$, or $50 = e^{-30k}$. Relatively few candidates could obtain correct expressions. The working shown in part (b) was similarly disappointing.

Question 4

A significant number of candidates answered this question successfully. A few gave their answers in part (a) to four [sometimes to six] decimal places, rather than the five as required in the question. These candidates could only find the estimate required in part (b) to one significant figure [0.04] rather than the three significant figures required.

Question 5

Although part (a) required the candidate to "show that..", solutions were often lacking in clarity. It was necessary to obtain cos π and state that this was – 1.

A significant number of candidates were successful in part (b) with most also being successful in part (c) (i). Those who completed part (c) (ii) correctly usually drew a sketch to find where $\sin \frac{\pi}{2}t = -1$.

Portfolio
FSMQ Advanced Level – June 2010

It was pleasing to see a great deal of variety in the portfolios produced for the Advanced level FSMQ. In the spirit of FSMQ many centres encouraged candidates to obtain data or develop projects from other areas of study. It should be noted that a high mark in Strand One cannot be achieved by candidates unless independence in the true sense of the word is demonstrated, not just carrying out a given project without advice.

Most centres submitting 'Working with Algebraic and Graphical Techniques' portfolios ensured that candidates produced a report on fitting a function to non-linear data by plotting a linear function. This is an essential requirement and candidates not including this work can only achieve a maximum mark of 24. There should also be a demonstration of algebraic manipulation and techniques and if this is not present the maximum mark would be 35.

There were some interesting portfolios produced for 'Using and Applying Statistics' with examples from biology and geography. For a mark of 40 or over candidates must include high level work on such statistical topics as Mann-Whitney, t-test, Chi-squared or Wilcoxon signed rank test etc.

Portfolios produced for 'Using and Applying Decision Mathematics' developed a range of projects, from wedding planning to a dinner party. Candidates can often relate their analysis to 'real life' by carrying out the tasks described and finding if there are any hidden pit falls not realised during the design.

The vast majority of candidates demonstrated the need to check their work, especially in the Algebra portfolios; although some candidates did not actually state that they were "checking".

Candidates did summarise their work and in many cases looked at their initial assumptions and how they affected the outcomes.

It was very pleasing to see excellent internal moderation from centres and also the detailed comments on the Candidate Record Forms. Please continue to provide these as they greatly assist in moderation.

Mark Ranges and Award of Grades

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