A-LEVEL
Mathematics

MS04 – Statistics 4
Report on the Examination

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General

The small number of candidates entered for this paper was, in the main, well prepared for the topics examined and it was very rare to see a question attempted by an incorrect method. Somewhat surprisingly for those studying further mathematics, candidates were much more confident when answering questions involving applied topics than in answering those requiring proofs using pure mathematics.

Question 1

Not unexpectedly, part (a) was answered correctly. In part (b), most candidates found the correct value for *n* but some answers were let down by the use of pq^n or 0.01.

Question 2

In part (a), a small minority lost marks through quoting 2-tailed critical values. Many candidates could have saved time here by calculating $\chi^2 = \dfrac{37100.25}{45^2}$ rather than first calculating the value of s^2. The factor of 2 caused problems in part (b). Following often correct hypotheses, degrees of freedom, critical value and determination of s_{S}^2 and s_{N}^2, most candidates evaluated the F-statistic as $\dfrac{s_{\mathrm{S}}^2}{s_{\mathrm{N}}^2}$ or $\dfrac{s_{\mathrm{S}}^2}{2s_{\mathrm{N}}^2}$; a loss of two marks.

Question 3

Answers to part (a) were usually fully correct. Where marks were lost, it was usually the result of a careless slip. Correctly justified conclusions were also the norm in part (b).

Question 4

This question proved the first major hurdle for many candidates. After some fudging of the substitution of limits in part (a)(i), most candidates opted for finding an expression for $\mathrm{F}(x)$ and then for $1-\mathrm{F}(x)$. This was perfectly acceptable providing integration was used, but the simple statement of $1-\mathrm{F}(x) = 1-\left(1-\mathrm{e}^{-\frac{x}{\theta}}\right) = \mathrm{e}^{-\frac{x}{\theta}}$ scored no marks. Very few candidates scored both marks in part (a)(ii). Whilst some candidates tried to evaluate a value for *m*, apparently not aware that $\mathrm{P}(X < m) = 0.5$, even better candidates left the answer as $0.5 - e^{-1}$. Answers to part (b)(i) were often correct though a minority of candidates evaluated $\mathrm{e}^{-0.5} - \mathrm{e}^{-2.5}$. The synoptic assessment of the application of a binomial distribution was lost on most candidates. Even those who realised its need, often only evaluated the probability for exactly 5 out of 6 and/or used $p = 0.3472$.

Question 5

This question clearly came as a welcome relief after Question 4 as it was rare not to see full marks scored in part (a) due to candidates coping well with the integrations of $\mathrm{f}(x)$ and the relationship between X and D. In part (b), again most candidates scored highly through correct:

- statement of hypotheses;
- combinations of outcomes;
- degrees of freedom and critical value;
- evaluation of the test statistic;
- conclusion in context.

It was interesting to see the normal expression of $\sum \frac{(O-E)^2}{E}$ evaluated correctly here using $\left(\sum \frac{O^2}{E}\right) - 540$.

Question 6

Following correct, though somewhat opaque, answers in part (a)(i), many candidates failed to take due account of $\frac{1}{3}$ and $\frac{1}{2}$ or of the required divisors of n and $2n$. These omissions had inevitable knock-on effects on accuracy in parts (a)(iii) and (b). It was disappointing to see the large proportion of candidates unable to make sensible headway in part (b)(i) where attempts at $\frac{\mathrm{d}V}{\mathrm{d}n}$ was more common than $\frac{\mathrm{d}V}{\mathrm{d}c}$. Nevertheless, the stated value for c gave candidates an opportunity to find an expression, though rarely correct, for $\mathrm{Var}(Y)$. Part (b)(ii) proved a step too far for most candidates. Following correctly stated hypotheses, most candidates quoted a critical value for the t-distribution; this despite a known value for σ^2 having been given. Even the few candidates who had $\bar{y} = 6$ and $\mathrm{Var}(Y) = \frac{16}{90}$, then calculated $t = \frac{6-5}{\sqrt{16/(10 \text{ or } 20 \text{ or } 30)}}$. As a result, the marks scored for this final part usually ranged from two to four out of a total of seven.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator