A-LEVEL
FURTHER MATHEMATICS

MS04 Statistics 4
Report on the Examination

6360
June 17

Version: 1.0

General

The previous high level of overall achievement on this paper was continued this year. As a result there was a significant proportion of high level achievers including three who scored full marks; an outstanding achievement. It was notable to see fewer students than previously attempting incorrect techniques in questions where a choice had to be made.

Question 1

Most students scored well on this question with all but a very small minority correctly applying a paired *t*-test and not a two-sample *t*-test. In one or two instances, the sign of the inequality in H_1 did not match the differences and subsequent analysis.

Question 2

Answers to part **(a)** were generally sound although a minority of students used $pq = 0.36$.
A number of students gave no reason for discarding $p = 1.8$ or $q = -0.8$ but this was not penalised as they were deemed to be obvious incorrect values.

Answers to part **(b)** were less impressive due in most instances to students working with $P(2.8 < X < 7.2)$ rather than $P(2 < X < 7)$ or $P(3 \le X \le 7)$, apparently forgetting that X was discrete. Even those students who changed to integer values often then evaluated an incorrect expression.

Question 3

In part **(a)**, any loss of marks was due to working with incorrect F-values or not taking square roots as a final step. Given the request was for $\frac{\sigma_4}{\sigma_1}$, the degrees of freedom were 9 and 15. Students who used correct degrees of freedom sometimes used their F-values incorrectly. Constructing confidence intervals for the ratio of two variances or two standard deviations is an area for improvement.

In part **(a)(ii)**, moist students realised that unity and not zero was key.

Save for the rare occurrence of not pooling variances, answers in part **(b)** were most impressive with students using the quoted value of 30 correctly in both their hypotheses and *t*-statistic.

Question 4

Many students started by finding $F(x)$ with a few then obtaining an incorrect expression for $3 \le x \le 5$. Given the simple form of $f(x)$, repeated integrations appeared the safer option. A very small minority of students simply dreamed up expected frequencies without any apparent reference to $f(x)$. The method for calculating χ^2 from O_i and E_i was well understood as was the subsequent test procedure.

Question5

Answers to part **(a)** displayed knowledge of the method required although there was some 'fudging' in part **(a)(ii)**. Here most students missed the 'trick' of realising that, after the first integration by parts, $\int_0^\infty 2x\mathrm{e}^{-\lambda x}\,\mathrm{d}x = \frac{2\mathrm{E}(X)}{\lambda} = \frac{2}{\lambda^2}$.

Answers to part **(b)(i)** using $\mathrm{Po}(12)$ were invariably correct but this did not continue into part **(b)(ii)**. Some students continued using Poisson whilst many others were totally confused by minutes and hours when deciding upon the value of λ. Even in part **(a)**, calculations based on an exponential distribution and resulting in a non-zero answer were not unusual.

Question 6

This final question proved more accessible than was envisaged. Whilst it was expected that part **(a)** would be accessible to most students, it was a pleasant surprise to see the number of students who were able to answer the somewhat non-standard part **(b)**. The common but rare errors in part **(a)** were to not square constants or work with X_1 and X_2 when finding $\mathrm{Var}(Y_1)$ and $\mathrm{Var}(Y_2)$.

In part **(b)**, there were sometimes the same errors and a failure to replace $(n-1)$ with numerical values. However, many students adapted the given information to the actual situation and so provided correct answers.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

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