Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2A Statistical techniques
Report on the Examination

1350
June 2018

Version: 1.0

Further copies of this Report are available from aqa.org.uk

General

This was the third examination for this specification and students performed much better this year. It was pleasing to see that many students scored a good proportion of marks in each question part. The mean score was higher than the previous two exam series. Students made good use of both their calculators' statistical functions for regression and of the statistical tables to work out values of regression lines and probabilities respectively. However, questions that require qualitative response and evaluation were not well answered and this is clearly an area for focus when teaching.

Topics that were done well included:

- Checking validity using numerical operations
- Extracting and critically analysing given data and information
- Calculating cost using currency exchange rates
- Identifying pmcc and its strength
- Calculating and drawing regression lines
- Calculating confidence interval

Topics which students found challenging included:

- Identifying improvements on charts/graphs
- Understanding the use of confidence interval
- Normal distribution calculations
- Random sampling

Question 1

Students generally scored highly on this question. There were few incorrect answers in part **(a)** with the majority of students able to deal confidently with percentage calculation. The most common incorrect response was 71.6 due to incorrect rounding.

In part **(b)**, most students identified some improvements to be made. Only on a very few occasions were errors stated rather than suggestions for improvements given. Many incorrect suggestions were related to the labelling of the axis and the article itself. Students found Graph 2 more difficult to address than Graph 1.

In part **(c)** the majority of students scored at least one mark for working out the first step. However, some did not gain the accuracy mark as they got their final digits wrong. Common mistakes included not knowing how many weeks there are in a year, the number of zeros in millions/billons and writing standard form as an ordinary number. Several students summarised their working using the terms "millions" or "billions". Several students incorrectly wrote the larger numbers but were able to self-correct when they gave their answer within the stated range.

In part **(d)** students did the calculations correctly but then did not comment on the validity of the comments. In the majority of cases, students discussed the difference between their calculated percentage and the reported value without explicitly making a judgement, thus not securing the final mark for Tim. In Kelly's part, most students were able to score at least 1 mark. The best responses involved forming the ratio of remainers to leavers and simplifying it to the form 1:n, manipulating this ratio to 12:12.9(….) and approximating. In Larissa's part**,** many were able to

score the first method mark and some scored full marks by following through a multiple step solution to find the percentage of votes. In several instances students did not get the final mark as the degree of accuracy of their calculated percentage was not to the degree of accuracy required to make an informed judgement.

Question 2

This question was generally well answered. The common response was to incorrectly calculate the rate of conversion from £ to euros though many students did go on to score at least 4 marks. Students who converted their monetary values to £ were more likely to successfully complete the question. Many did not gain the first method mark due to not being able to calculate the 2014 exchange rate using reverse percentage.

Question 3

In part **(a),** two third of students correctly identified that 1.379 cannot be a correct value of pmcc. The common incorrect answer was 13/25 as many students probably thought that pmcc cannot be written in a fraction form.

In part **(b)** a significant majority of students matched the pmcc correctly to the correct scatter diagrams, although some only managed to match two out of the four scatter diagrams and score just 1 mark.

Marks were often lost in part **(c)** for making reference to positive correlation to justify why they felt it was correct. There were some students who were saying 'correlation does not imply causation'.

Question 4

Students mostly scored full marks for 4a for correctly plotting the missing points in part **(a).**

In part **(bi),** it was pleasing to see that students can identify the coordinates that do not fit with the data pattern and were able to identify them as being outliers. A few students gave their coordinates in the form *(y,x)* rather than *(x,y).*

In part **(bii),** the proper use of statistical functions found on the scientific calculator was evident. Where marks were lost, students were able to calculate values for "a" and "b" but then failed to give an equation for the regression line and many left it as an expression. There were a substantial number of students unable to resolve signs using the syntax "+ -" to represent "-".

In part **(biii),** some students who did not state an equation of the regression line of J on T, managed to score full marks by drawing a correct regression line of best fit and scored the full marks for this part. Where marks were lost, it was usually for plotting the calculated line inaccurately, either by eye or by using only the mean point, instead of using two calculated points.

Students who used their graph to find the required time often scored full marks in part **(c).** Few recognised the importance of plotting the line $T + J = 60$ in finding the solution. A number of students attempted to interpolate their result from the table with very little success. A common answer was 8:10am which scored at least 3 marks providing they had shown evidence of using the regression line or equation. This part was very poorly answered.

Question 5

Almost all students attempted this question and it was generally well answered. The majority successfully found the mean and the correct z-value for part **(a).** Many were able to correctly use the formula to find the confidence interval. However quite a large number of students made one or more errors in the formula, with the values of standard deviation and variance often being mixed up. Students who did not use the correct z-value were able to get 4 marks.

In part **(b),** students scored at least 1 mark for their judgement though many did not appreciate that their interpretation was based on the value being within or outside of their confidence interval. Many students made reference to the value being close to the sample mean calculated in the previous part of the question.

Question 6

Students found normal distribution very challenging and this is reflected by a low mean score in parts of the question that require calculating probabilities of a normal distribution. Students made good use of the provided booklet of formulae and tables in the first three parts.

In part **(a),** half of students scored full marks. In many instances, students were able to use their scientific calculators effectively to find the correct answer without having to write down any working, which gained full marks. Some only scored 1 mark for finding the z-value using the correct formula. Very few students calculated the 10% interval about the mean, instead confusing this as a confidence interval calculation in part **(b).** Students who did correctly identify the correct region went on to standardise their values and find at least one of the correct probabilities. Very few students went on to get the final accuracy mark. Students who scored full marks provided additional diagrams to help them find the correct probabilities.

For most students, part **(c)** proved to be the very demanding. Full marks were very rare here. There appeared to have been much learning by rote of techniques but a lack of experience in using reverse operations to find the value needed. Many students were able to form an equation involving their z-value to get 1 mark. Those who identified the z-value as 0.67(45) did not go on to appreciate that this had to be interpreted in terms of the bottom tail distribution which would mean the value would be negative.

Parts **(di)** and **(dii)** were very well answered with full marks being common.

Question 7

This proved to be the most difficult question in the paper. A large number of students scored very few marks, in many cases 0, which was as a result of not fully understanding the concept of random sampling.

In part **(a)**, many students struggled to define a random sample. They often explained the process to carry out a simple random sample such as putting names into a hat rather than defining it. However, some were able to identity that a random sample is an unbiased sample and scored the mark. In part **(b),** very few students understood the nature of random number tables. They did not know how to use a table of random numbers to conduct a simple random sample. A significant

majority of students attempted to use the random numbers given in the table by simply assigning them in equal number to each teacher, which gained no mark. A third of students were able to score the first mark for assigning a number to their teacher. Few students were able to get the second mark for resolving their random number to a 2 digit number (which assigned to their listed teachers).

Mark Ranges and Award of Grades

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