A-level

MATHEMATICS

Paper 3
Report on the Examination

General

The vast majority of students appeared to have sufficient time to tackle the paper, and scores were achieved throughout the possible range.

Question 1

The vast majority of students answered this multiple choice question correctly, giving the answer 9π.

Question 2

Again, the vast majority of students answered this multiple choice question correctly, giving the answer 7.

Question 3

This was the least well answered of all the multiple choice question on the paper. However, a large majority of students still gave the correct answer of $3x - 2y = 7$.

Question 4

The majority of students gained full marks on this graph sketch. A number of students lost marks for not labelling one or other of the intercepts, whilst quite a few had the vertex drawn at $(0, a)$ on the y-axis and therefore had no x-intercept. A small number of students did not know the basic shape of a linear modulus graph and therefore scored no marks.

Question 5

Whilst a few students did not understand the point of this question, most were able to carry out a small angle approximation successfully. Unfortunately, a few students then failed to make an appropriate conclusion in order to fully answer the question.

Question 6

In (a), most students realised that the domain would take values $x > 1$ in this question. However, in order to gain full marks it was necessary to state the domain in a complete form involving the notation $x \in \mathbb{R}$, which most students failed to do.

In (b), a large number of students started to differentiate the printed result for $f'(x)$, rather than differentiate $f(x)$. Many then realised their mistake and restarted the question on a continuation sheet, with a good number scoring full marks.

There was a wide spread of marks across question 6(c). Most students understood that they needed f''(x)= 0, though a number instead used $f'(x) = 0$. Of those students who successfully solved the correct equation, very few scored full marks, as they either failed to correctly deal with the solution $x = 1$ or failed to test either side of their correct solution $x = 4$. Only a small proportion of students identified the correct interval in 6(d).

Question 7

The majority of students scored full marks on 7(a), and the vast majority at least scored 1 or 2 marks for using a log law correctly.

7(b) was less well answered with many students who identified that $-\frac{3}{2}$ was not a valid solution failing to clearly explain why. Other students gave irrelevant comments criticising the setting out of the work rather than the mathematical validity.

Question 8

8(a) was very well answered with around two-thirds of students scoring full marks.

8(b) proved to be quite a challenging question with a wide spread of marks. A number of students failed to see the connection to 8(a) despite the "Hence…" in the question, and so never arrived at an appropriate integrand to integrate. There were a wide variety of methods used to integrate including inspection and various substitutions which had the potential to be successful, and some very imaginative approaches were seen. Some students used a substitution of $x = 2\theta$ initially but failed to correctly replace $d\theta$, meaning that, despite correct later work, they were unable to arrive at a valid, correct solution.

Question 9

The vast majority of students were able to correctly answer 9(a) with answers given in a variety of forms.

9(b) was quite well answered, though a significant number of students failed to identity the sequence as geometric and so were unable to make any progress.

Only a small proportion of students scored full marks on 9(c), often because they failed to make a clear enough statement about how the total length would be affected.

Question 10

This question generally produced very strong or very weak responses. Several students had memorised the proof very clearly. A number of students were able to set up the proof but got lost trying to show that a and b were even, whilst weaker students were unable to make any progress.

Question 11

The vast majority of students answered this multiple choice question correctly, giving the answer $\frac{1}{10}$.

Question 12

A large majority of students answered this multiple choice question correctly, giving the answer $[170,180)$.

Question 13

Whilst a significant number of students answered well enough to gain full marks, a larger number scored zero as they failed to realise that the question was related to rounding. Other students scored some marks but were not clear enough in their explanation to gain full marks.

Question 14

Many students scored full marks on 14(a), though significant numbers scored 1 out of 2 because their conclusion was not drawn clearly enough. In addition, significant numbers failed to score at all because they did not understand the significance of the probabilities in determining independence.

14(b) was a very well answered question, with the majority of students scoring full marks, though there was some confusion about the meaning of "mathematics or biology or both".

Question 15

This was a very well answered question overall. Parts (a), (b), (c) and (d) were all answered correctly by the majority of students, with many making very good use of the calculator. Only part (e) proved problematic, with many students failing to score, often as a result of making comments not clearly enough related to the binomial conditions, or otherwise by not stating them sufficiently in context.

Question 16

Overall students performed quite well on this question, but there were a significant minority who appeared insufficiently prepared for this topic and unable to gain much credit. In general, students performed well on parts (a) and (b), with the majority scoring full marks. Most students did not score well on part (c), failing to appreciate the significance of likely negative values within the 3 standard deviation spread. Part (d) had a very mixed response. Many students scored full marks but many others could not use the inverse normal distribution correctly.

Question 17

A wide spread of marks was seen on (a). Most students understood the correct structure and components of a hypothesis test, but only a relatively small number managed to successfully include them all correctly.

A significant number of students scored full marks in (b) for a correctly derived answer of 14. However, many others lost marks by arriving at their answer incorrectly (for example, $20 \times 0.7 = 14$), incorrectly interpreting their working (13 was a common answer) or by looking at the wrong tail of the distribution.

Question 18

The majority of students correctly identified the sampling method in (a).

Unfortunately, in (b) the vast majority of students failed to identify the problem with the sample as being that it was not random. As with question 17, most students showed they understood the idea of a hypothesis test, though a greater number this time were unable to correctly state the hypotheses from which the solution follows. It is important that students are aware of the importance of concluding in context which most, but not all, managed to do.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.