Examiners' Report

Summer 2016

Pearson Edexcel Advanced Extension Award in Mathematics (9801/01)

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AEA Mathematics

Specification 9801/01

Introduction

The question paper proved accessible to all the students with the majority of students scoring well on questions 4, 6 and most of question 7. There was plenty of challenge, for those aspiring to the distinction grade, in questions 2, 5 and 7(d).

Question 1

A common error in Q01(a) was to ignore the domain and simply use the minimum point to give the range of f(x). Q01(b) though was answered correctly by nearly all students. Q01(c) proved more challenging. Few students seemed to know that the domain of gf is the domain of f and $x \geq 4$ or $x \geq 6$ were common errors. Many knew that to find the range of the function they needed to look for the largest value of gf but, using $\frac{10}{(x-2)^2+6}$, they often gave an answer of $\frac{10}{6}$ or even 1, failing to pay careful attention to the domain. Even when the correct value of $\frac{10}{7}$ was seen it was rare to see the correct interval as gf > 0 was often missing.

Question 2

Most students scored the first mark for stating that arccos $\frac{1}{\sqrt{2}} = \frac{\pi}{4}$ and some scored the second for stating that $\sin\alpha = \frac{1}{3}$ and either drawing a suitable right-angled triangle or finding another trigonometric function of α. Beyond this few made any progress. Those who attempted to find $\tan(2x)$, where $\tan x = \frac{1}{\sqrt{2}}$, could sometimes see the link between α and $2x$ and then obtain the answer very quickly. There were some nice, clear geometrical solutions.

Question 3

Again most students could make a sensible start and many scored the first mark for finding suitable vectors or distances between the given vertices. They then needed to pin down the right angles and some did this effectively using the scalar product or Pythagoras' theorem but many simply guessed which lengths represented the edges of the cuboid and failed to give a clear argument to establish these. Those who did have the correct edges were usually able to find the position vector of E and often went on to find the volume of the tetrahedron in Q03(b) but, curiously, the factor of $\frac{1}{2}$ was often missing. Some tried to use a scalar triple product in Q03(b) but they were often using incorrect vectors or made arithmetic errors.

Question 4

Some attempts at Q04(a) lacked the careful explanation required to secure full marks but there were many effective demonstrations some using the change of base formula and others working from first principles.

Q04(b) was answered extremely well by almost all the students and seemed to suggest that these students had a confident grasp of the logarithms topic. There were a few arithmetic errors and some could not factorise their quadratic in Q04(iii) correctly but many scored full marks and secured an S1 for a clear and succinct solution to this question.

Question 5

In Q05(a) most realised that they were looking at a geometric series but far too many only summed to n terms, not $(n+1)$, and then had to adjust their working to reach the printed answer.

Some used a "first principles" approach here, which sometimes helped them when tackling Q05(b), and a few used proof by induction. Most of those who attempted Q05(b) used a calculus approach but there were often errors with signs or in the final simplification. Some however, multiplied the series by x or $\frac{1}{x}$ and after subtracting were able to find an expression for the sum.

In Q05(c) many realised the need to split the sum and often went on to secure the first three marks for finding $\sum_{r=0}^{n} 3\times 2^{-r}$ but few were able to rearrange the second term into the form $10\sum_{r=0}^{n} r\times 2^{-(r+1)}$ and then use their result from Q05(b) to obtain the final answer.

Question 6

This was generally well answered with most students achieving a double figure score.
Apart from occasional sign errors, Q06(a) was answered very well and most were able to substitute $x = \frac{\pi}{2}$ correctly and verify that this gave a turning point, though some failed to give the y coordinate in Q06(b).

There were many correct solutions to Q06(c) from those who "spotted" the integral or those who used substitution though sometimes in this approach there were errors with signs and swapping the limits. Some attempted to integrate by parts and made no progress and some lost the final mark for failing to simplify sin (1) – sin (–1) to 2 sin 1.

In Q06(d) most reached $\tan(\cos x) = 1$ and usually went on to reach $\cos x = \frac{\pi}{4}$ and often $x = \text{arcos}\frac{\pi}{4}$, although some were confused by their solutions of the form $\cos x = k\pi + \frac{\pi}{4}$.
Finding the y-coordinate in an acceptable form caused problems for some students but there were plenty of correct solutions seen.

Those who integrated successfully in Q06(c) were usually able to complete Q06(e) as well though there were a number of sign errors and difficulties with the limits of the integrals.

Question 7

Most students were confident about the start to this question and, after forming a quadratic in *x*, were able to use the discriminant to find the critical values. Sometimes the complement of the required region was given and there were a few arithmetic errors but generally the quality of the work here was high. Some students used a calculus approach, finding the *x*-coordinates of the turning points successfully but often struggling to obtain the required region.

Q07(b) was answered very well and most went on to answer Q07(c) successfully too, though occasionally they forgot to give the full coordinates of these points.

Many students found Q07(d) challenging and, rather than reflecting on the given graph and the work they had just completed, embarked on an extensive number search which invariably missed some of the required pairs. A few gave thorough explanations here which contributed towards an S2 score.

Despite struggling with Q07(d) most students were not put off attempting the rest of the question and in Q07(e) they usually identified $m = -2$ and $n = 1$ though some did not provide clear evidence to show that this transformation worked.

The graphs in Q07(f) were usually correct. Occasionally the left hand branch failed to cross the horizontal asymptote and sometimes this asymptote was given as the minimum point of the curve not $y = 2$.

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