Principal Examiner Feedback

Summer 2015

Pearson Edexcel Level 3 Award in Algebra (AAL30)

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Introduction

The performance of students in this Level 3 qualification continues to improve and there were many excellent scripts. It is encouraging to report that there were again fewer students entered who were well out of their depth. There were good answers to questions set from all areas of the specification though for questions 5, 6, 9, 11, 16 and 17 there were noticeably fewer very good responses.

Most students showed a good knowledge of standard techniques and formulae. Some students confused the two results for the sum and product of the roots of a quadratic equation and others confused the results for the *n*th term and the sum of an arithmetic series. It is interesting to note that these topic areas are not generally covered at GCSE level and it may be to students' benefit for some centres to spend a little more time on them.

The ability of students to evaluate numerical expressions without a calculator was generally good. This was demonstrated, for example, by the accuracy with which many students calculated the points needed to plot the cubic graph in question 9.

Examiners noticed that in the responses to questions 6 and 12, students often failed to identify and use connections between parts of the question. The structure in these questions was meant to help students but often did not seem to do so.

Reports on Individual Questions

Question 1

This question proved to be straightforward for most students. The weakest students sometimes only partially factorised the expressions in parts (a) and (b), whilst other students gave $(x - 4)^2$ as their response to part (c).

Question 2

Many students scored both marks on this question. However, a significant proportion of students appeared not to have access to a pair of compasses and so it was sometimes difficult for examiners to tell whether (i) the student had intended to draw a circle and (ii) where they intended the centre of the circle to be. Centres are advised to make sure that students have this equipment. Incorrect responses seen included circles with centre (1, 0), (1, 1) or (0, 0). Circles seen almost always had the correct radius.

Question 3

There were more students than had been the case in previous sessions who found this question to be routine and who scored full marks. A large proportion of students scored the 3 marks available in part (a). Sometimes marks were lost when students found the value of the constant of proportionality but did not write out the formula with this value. Some students did not simplify $\frac{117}{9}$ in part (a) and/or $\sqrt{\frac{52}{13}}$ in part (b) and some students made errors when working out the value of these fractions. Students at this level should be able to identify situations where further processing of such fractions should be carried out. In part (b) students who got as far as $v^2 = 4$ usually, but not always, identified the two values ± 2. Some students used "proportional to v" or "inversely proportional to v^2". These students severely restricted the number of marks available to them. Students are urged to ensure they read questions carefully.

Question 4

An appropriate first operation in this question requiring the subject of formula to be changed was almost always successfully carried out. Most students then realised the need to isolate terms in x on one side of the equation. Far fewer students then factorised their expression and completed the transformation successfully. In part (b) of the question, a majority of students obtained the correct answer though there was a significant number of students who divided by 2 instead of $\frac{1}{2}$ and gave the incorrect answer 18. Some students attempted to expand
$(2x - 7)^2$, often unsuccessfully, before making the substitution of $x = \frac{1}{2}$.

Question 5

This question was possibly the least well answered question on the paper. Students are advised to give more attention to this topic area. A significant number of students were unable to find where the graph intersected the y-axis. This should have been routine for students at this level. Where they did know what to do, students often gave only the
y coordinate of the point. Relatively few students could identify the asymptotes in part (b) of the question and under a half of all students gained any credit for their sketch in part (c). A large number of students resorted to calculating and plotting points. This usually led to partial graphs. Examiners were looking for clear sketches showing the general shape as well as the behaviour of the graph as $x \to \pm\infty$ and as x approached the asymptote
$x = -3$. Completely correct sketches were rarely seen.

Question 6

Most students knew and successfully used the quadratic formula to start the process of finding the roots of the quadratic equation though a significant proportion of them then made errors in reducing $\frac{6\pm\sqrt{12}}{2}$ to the form $p \pm \sqrt{q}$ where p and q are integers. In this question credit could not be given to students who attempted to solve the equation by other means. The second part of the question was less well answered with many students not recognising the connection between the two parts of the question. Solving quadratic inequalities is a core skill in this specification.

Question 7

This question was well done with about two thirds of all students scoring full marks. Surprisingly, perhaps, more students made errors in drawing the line $y = -2$ than in drawing

$x + y = 3$ or $y = 2x - 2$. The line $x = -2$ was often drawn instead. Identifying which side of each line should be shaded was usually carried out successfully.

Question 8

The better students scored full marks on this question though some students did not clearly show their values as two distinct pairs at the end of their working. However, the question was generally not well done. Many students chose to write x in terms of y from $y + 2x = 1$ then attempt to substitute in $2x^2 + 3y = -1$ rather than the easier route of writing y in terms of x. Students using the former strategy often simplified $2 \times x^2$ to $(1 - y)^2$ instead of the correct $\frac{(1-y)^2}{2}$. A number of students used a different strategy, that of multiplying the second equation by 3 then subtracting one equation from the other to eliminate terms in y. In general, they were no more or less successful than students who used the substitution method.

Question 9

Graphs were usually well drawn in the first part of this question and it is encouraging to report that students' working was generally accurate even when dealing with negative numbers and the cubic expression given. The vast majority of students produced a table of values with integer values for x and at least 4 correct corresponding values for y. Curves were carefully drawn. Part (b) was less well answered with relatively few students realising that they needed to use the curve to find at least one x value where $y = -2$. This is a topic where students would benefit from more practice.

Question 10

The algebraic manipulation in this question was usually handled well. About two thirds of students successfully completed parts (a), (b) and (c). There were some errors when dealing with signs in part (a) and the responses $4y^2$, $2y^8$ and $4y^8$ were seen quite often in part (c). Students usually scored at least 2 of the 3 marks available in part (d) for successfully identifying and using a common denominator to add the fractions. A much smaller proportion of students had the confidence to know when their answer was in its simplest form. Many students divided their final answer by 2, a move which meant examiners could not award all three marks.

Question 11

Success in this question varied widely. Part (a) of the question was answered correctly by a much larger proportion of students than part (b). A minority of students had a good knowledge of relevant formulae and could manipulate them with apparent ease. Many students stated incorrect formulae or were unable to use them efficiently. For example, it was disconcerting to see so many students simplify 6 + 29*d* to 35d in part (b) of the question.

Question 12

Students were usually able to complete the square in part (a)(i) of this question. Of the students who were able to do this, only about a half of them were able to use their answers to complete the next part of the question. Many students started again and often made errors in solving the equation by other means. All four marks in part (a) were awarded to about a third of students. When answering part (b) of the question, students often failed to realise that their answers to part (a) could be used to help them sketch the graph of the quadratic. Most, but by no means all, of the students gained some credit for realising that they should sketch a U shaped parabola. Only a small minority of students sketched an accurate representation of the function accompanied by full and clear labelling of the points of intersection with the axes and of the turning point.

Question 13

This question was not well answered. The question was straightforward for students who have a good understanding of the use of the discriminant to determine the nature of the roots of a quadratic equation. Unfortunately, only a minority of the students taking this examination showed such knowledge and understanding.

Question 14

Manipulating and using the equation of a straight line is a key area of the specification and examiners would expect students to be able to write equations in the form $y = mx + c$ then use this form together with other information to be able to find the gradient and equation of related straight lines. In part (a) of this question, just over a third of students were successful in stating the correct gradient. However, some students gave the equation of the straight line in the form $y = mx + c$ without highlighting the gradient whilst others gave the response "$\frac{2}{7}x$". These students earned some credit. In part (b), relatively few students scored all three marks but a large proportion of students gained at least one mark for using "$m_1m_2 = -1$" and/or for substituting the given point into their equation to find the value of "c".

Question 15

This question proved to be an "easy" 3 marks for over a half of all students. Some students did not attempt the question, whilst other students used incorrect formulae. On many occasions students used the formula for the sum of the roots as the formula for the product of the roots and vice versa. Some students who did not know the formulae attempted to solve the equation and then use their solutions to work out the sum and product of the roots. Few students following this approach gained full marks.
It appears that a significant number of students do not ensure they know results which do not appear in the GCSE specification but which do appear in this specification. This can have a critical bearing on overall performance.

Question 16

Part (a) of this question was answered quite well with most students producing a sketch which earned them two marks. Sometimes students sketched $y = 4\sin x^{\circ}$. They were awarded one mark for recognising that the transformation is a stretch parallel to the y-axis. Translations were also often seen. In part (b) the success rate was much lower. Again, translations were often seen as were stretches parallel to the y-axis. These transformations did not receive any credit. Some students identified the correct transformation (stretch, factor $\frac{1}{2}$ in the direction of the x-axis) but did not sketch the graph to extend over the whole of the range of x values. They were awarded one mark.

Question 17

Most students scored some marks in this question. In part (a) about three quarters of students simplified $\sqrt{3} \times 2\sqrt{3}\ (= 6)$ or $\sqrt{3} \times \frac{1}{\sqrt{3}}$ (= 1) correctly but a much smaller proportion of students got the final answer (7) correct. Rationalising the denominator of the fraction in part (b) was also a good discriminator. A good proportion of students knew that they should multiply by $\frac{5+\sqrt{7}}{5+\sqrt{7}}$ and most of them could carry out the subsequent multiplications without too many errors. However, only the best students recognised that $\frac{75+15\sqrt{7}}{18}$ could be further simplified. Students who did not multiply by $\frac{5+\sqrt{7}}{5+\sqrt{7}}$ usually multiplied by either $\frac{5-\sqrt{7}}{5-\sqrt{7}}$ or by $\frac{\sqrt{7}}{\sqrt{7}}$. These students could not be awarded any credit for their response to this part of the question.

Question 18

Many students did not seem very familiar with the topic covered by this question. For those that had a good understanding, the 5 marks available were relatively easy to access. In part (a) some students multiplied 20 by 15 as if they were working out the distance covered in 20 seconds by a cart travelling at constant speed. Students often carried out a similar calculation in response to part (c) and, instead of working out the area of the triangle under the graph (which represented the distance travelled by the accelerating cart), worked out the area of a rectangle 7.5 by 10 or 15 by 20. Part (b) of the question was almost always answered correctly.

Question 19

This question was a good discriminator. The great majority of students showed some understanding of the trapezium rule and most were able to identify the ordinates needed in the calculation. However, many students either used only 3 strips or attempted to find an area different to that required by the question. The fact that the last strip was in fact “triangular” seemed to confuse some students. About a half of students scored full marks with a further quarter of students gaining partial credit.

Summary

Based on their performance on this paper, students are offered the following advice:

- ensure you have an accurate knowledge of standard results and formulae, particularly relating to arithmetic series and for determining the nature of the roots and the sum and product of the roots of a quadratic equation.
- make sure you can manipulate and interpret the equation of a straight line.
- practise your skills at sketching curves involving "$\frac{1}{x}$" type functions.
- ensure you have a good understanding of how to use completed square form to determine the roots of a quadratic equation and the coordinates of the turning point of the corresponding graph.
- practise your skills in simplifying fractional expressions involving surds.
- ensure you can use graphs to solve equations, particularly where some manipulation of the equation is needed first.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
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