Principal Examiner Feedback

Summer 2014

Pearson Edexcel Level 3 Award
In Algebra (AAL30)

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Introduction

There were many excellent scripts with students gaining marks well in excess of the marks needed to gain a pass in this level 3 qualification. It is encouraging to report that, compared to last year, there were less students entered who were well out of their depth. More students seemed to have been prepared to answer questions on all areas of the specification though there were still many students for whom this was not the case.

Most students showed a good knowledge of standard techniques and formulae. There was however still a significant proportion of students who could not quote relevant formulae correctly and this often badly affected their overall performance. The accuracy of students work had improved from previous sessions but a lack of fluency in the manipulation of algebraic expressions and equations was seen more often than examiners would have liked.

Students at this level are expected to be able to evaluate numerical expressions and use algebra with confidence as well as being able to solve a multi-step problem successfully. For example in Q4(b), we would expect students to be able to carry out the substitution and solve the equation generated. In part (a) of the same question we would not expect students to evaluate $\frac{6\times 27}{3}$ as 2×9. Similarly, students should be able to solve the simultaneous equations in Q8 and consider the best way to do this in order to avoid over awkward calculations.

Reports on Individual Questions

Question 1

The great majority of students successfully multiplied out the brackets in part (a) of this question. However, about one in every ten students entered for this level 3 examination could not simplify the expression obtained correctly. Very weak students appeared to add rather than multiply so $3x \times x$, $3x \times 2$ and $+2 \times -2$ were too often simplified to give $4x$, $5x$ and 0 respectively.

In parts (b) and (c), most students demonstrated a good understanding of single step applications of the laws of indices. The last part of the question proved to be a good discriminator. It was disappointing to see so many students "cancelling" the x^2 terms in the numerator and the denominator of the fraction and giving $\frac{-9}{-4x+3}$ as their answer. Too many students clearly did not understand that the numerator and denominator must be written as a product of factors before "cancelling". Where they did understand, many incorrect factorisations were seen. Students are advised to check their factorisation, perhaps by multiplying out.

Question 2

Students usually scored about 4 marks in this question. However, the calculation of values in part (a) of the question was met with mixed success. Some students had difficulty in calculating values of y for negative values of x. This skill is crucial when dealing with questions requiring the graph of a cubic function to be plotted and further practice is likely to give students an advantage in several of the questions on this paper. Level 3 students should be familiar with the general shapes of graphs associated with cubic expressions. Such knowledge might have nudged students towards checking their calculations. Nearly all students drew axes with a sufficient range of values on which to draw their curves. However, some scales led to very small graphs and students often appeared to believe that the same scale had to be used for both axes.

Part (c) proved to be more challenging than the first two parts of the question and some students did not attempt it. Regrettably most of the students who did attempt this part read off their graph from y = 5 rather than y = 3 so could not be awarded any marks. Again, this is a skill which should be well practised at this level.

Question 3

This question was well answered by a substantial proportion of students. Many students were able to rearrange the equation in part (a) but some students left the equation in either the form $3y = 2x + 24$ or as $y = \frac{2x+24}{3}$. These forms could not be awarded full marks.

Attempts at part (b) were not as successful and some students suggested that the gradient of a line parallel to the given line would have gradient $-\frac{3}{2}$, apparently confusing parallelism with perpendicularity.

Question 4

To their credit, nearly all students showed a correct initial substitution in part (a) of this question and most students evaluated their numerical expression correctly to score both the marks available. A significant number of students, were however disadvantaged by an inability to evaluate their numerical expression. A common error was to simplify their expression to $\frac{6\times27}{3}$ only to follow this with $2 \times 9 = 18$. A common sense check would have lead to students rethinking their answer – for example $\frac{6\times27}{3}$ suggests an answer that is bigger than 27. A substantial number of students left their answer in the form $\frac{162}{3}$. They were not awarded the second mark.

In part (b) many students did not seem to have the confidence to deal with a substitution process followed by the manipulation needed to write the equation in the form $at^2 + bt + c = 0$ before solving it. A large number of students made errors in the manipulation stage, for example, $36 = \frac{9(t^2+3t+9)}{3} \div 3$ was often followed by $12 = 9(t^2 + 3t + 9)$. In many other cases, once students had simplified their expression to a quadratic equation without a fraction they could not see their way to writing it with all terms on one side of the equation and, if appropriate, dividing through by a common factor so they could use the formula more easily. Of the successful attempts, few students used completing the square to solve their equation, most opting for use of the quadratic formula. Unsimplified answers of the form required, for example $\frac{-9\pm\sqrt{189}}{6}$, were accepted.

Question 5

This question was very well answered with over a half of all students gaining full marks. Nearly all students gained some credit for their answers. The most common errors seen involved drawing $y = x + 1$ or $y = \frac{1}{2}x + 1$ instead of $y = 2x + 1$, $x + 2y = 6$ instead of $x + y = 3$ and $x = -2$ instead of $y = -2$. Students usually clearly indicated the region satisfying all three inequalities.

Question 6

Most students successfully found a correct expression for the nth term in part (a) of this question though a surprising number of students wrote down $8 + (n - 1)3$ (presumably because they used the formula for an arithmetic series) but did not simplify it. There were a small number of weak students who gave $n + 3$ or $5n + 3$ as their answer.

Part (b) answers were often long winded with students finding the 62nd and 63rd terms and finding the difference between them – a pity they did not think about the properties of an arithmetic sequence! Nearly all students scored the mark for this part of the question.

Part (c) was also quite well answered. Many students knew and could use the formula for the sum to n terms but a significant number of students evaluated $2 \times 8 + (20 - 1)3$ as $(16 + 19)3$. There were also many students who wrote down and used an incorrect formula. Students who resorted to attempting to add up the 20 terms concerned usually made errors in their arithmetic and so scored no marks for their attempts.

Question 7

This question was well done, particularly part (b) where nearly all students were successful.

Part (a) was also done well though it was the subject of a fair number of errors which might have been eradicated with more careful checking on the part of the students.

$7a^2b(2ab^2 - 3a)$ was a commonly seen incorrect response. There were fewer students than usual who partially factorised the expression. These students usually scored one of the two marks available.

Question 8

The best students scored full marks on this question. However, the question was generally not well done. Students attempts were often spoilt by errors such as multiplying x by 2 and writing it as x^2, squaring $x + 4y = 7$ and writing it as $x^2 + 16y^2 = 49$ or expanding $(7 - 4y)^2$ as $49 - 4y^2$. One of the most popular approaches was for students to write x in terms of y from the linear equation and substitute into the second equation to get a quadratic equation in y. This approach was probably the one that also yielded most marks for students. Students taking this approach usually earned between 2 and 4 marks. However, many students seemed under-confident at factorising a quadratic expression in which the coefficient of x^2 was not one and so restricted themselves to three marks at the most. Many students could not handle the quadratic equations they derived as they had unnecessarily large coefficients. They did not divide through their equations by a common factor and subsequently could not factorise them or made arithmetic errors when trying to use the formula to solve them. Responses to this question were often difficult to follow with many aborted attempts, much crossing out and no apparent order to the working in the space provided.

Question 9

Most students were able to score the first two marks available for responses to this question. They successfully found the two critical values, usually by factorising the quadratic expression, but then often gave $x = 1$, $x = 4$ as their final answer. Of those students who did try to use an inequality in their answer about two thirds of them were able to express the solution correctly

Question 10

There were more students than in previous sessions who appeared to know that the sum of the roots = $-\frac{b}{a}$ and the product of the roots = $\frac{c}{a}$. However there were still many students who did not score any marks. Students are advised to show their use of these two results clearly; otherwise it is sometimes difficult to award part marks where the answer is not fully correct. A significant minority of students wrote $2x^2 + 5x + 7$ instead of $2x^2 + 5x + 7 = 0$ as their answer. These students were awarded 2 marks. Some students left the question unattempted.

Question 11

This question was not well answered but acted as a good discriminator. Completing the square in part (a) of this question was tackled with mixed success. Many students identified $-\frac{7}{2}$ as the value of a but there were also many students who gave $\frac{7}{2}$ or another number in their response. Fewer students also found the correct value for b though there were some students with a incorrect but b correct. There was some evidence that many students were not able to work with fractions confidently

It was clear that the connection between parts (a) and (b) was missed by many students. Examiners were surprised and disappointed at the low proportion of students who recognised that the graph should be that of a parabola. Tables of values were often seen from students not used to the request to "sketch the graph". Many students, even those who drew straight lines, were able to show that the graph crossed the y axis at 6. Fewer students were able to show where it crossed the x axis and it was rare to see a correctly labelled turning point. Very few students scored all three marks for this part of the question. Inverted parabolas were commonly seen.

Question 12

Often only one mark was scored by students answering this question, the mark for multiplying both sides by $g - 4$. Students who did carry out a second stage correctly often carried on to complete the question successfully. This question focussed on a standard technique and only about 2 in every five of students seemed proficient in this technique. Many students would benefit from more practice on questions like this.

Question 13

The response to this question was much improved compared to similar questions on this topic in past papers, though there were a significant number of students who did not attempt the question at all and other students who wrote down the full formula for solving a quadratic equation therefore revealing they did not know what the term "discriminant" meant. Credit was given to students who wrote down the expression $b^2 - 4ac$. Students often failed to rewrite the equation in the form $3x^2 + 5x + 8 = 0$ and incorrectly substituted $c = 18$ into the expression for the discriminant.

About one quarter of students scored all three marks for a fully correct response to part (a) of the question. Most students who obtained a negative answer to part (a) went on to give the correct interpretation of "no real roots" in part (b).

Question 14

There were many correct answers seen to this question on arithmetic series. More students seemed familiar with the topic and the formula needed than had been the case in the past. However, only about a half of students gained some marks for their answers. A significant number of students wrote down a correct equation in d only to make an error in simplifying and/or solving it. $8 + 39d$ was often simplified to $47d$.

Question 15

This question proved to be an “easy” 3 marks for about a half of all students. Some students left the question unattempted and this left examiners wondering whether this was because they had no access to a pair of compasses or because they did not recognise the equation as that of a circle. A large number of students lost accuracy marks because they tried to draw circles freehand. Weak students sometimes took the square root of the equation and drew the line $x = 3 - y$.

Question 16

A good number of students had an understanding of the trapezium rule and found this question straightforward. They applied the formula with clarity and accuracy. However some students attempted to find the area under the curve between $x = -3$ and $x = 3$ whilst other students did not use the correct number of ordinates. Some students left the question incomplete or could not state a correct version of the rule.

Question 17

This question was a good discriminator. It was uncommon to see a completely successful attempt at the first part of this question though most students gained some credit either for an attempt to rationalise the denominator of $\frac{1}{\sqrt{5}}$ or, in fewer cases, for an attempt to combine the two terms into a single fraction.

Part (b) was successfully attempted by more students than part (a) though multiplying the numerator and the denominator by $4-\sqrt{6}$ was not identified by as many students as examiners expected. Multiplying both the numerator and the denominator of the given fraction by $4+\sqrt{6}$ was a common error seen.

Question 18

This question tested the basic results relating to interpretation of a speed time graph. Those students who realised that the gradient would give them the acceleration found part (a) of the question straightforward and about three quarters of all students correctly answered this part. The most commonly seen error was that of students multiplying the speed by the time thus confusing acceleration with distance travelled at constant speed.

A majority of students seemed to realise that for part (b) they needed to work out the area under the graph but many attempts were spoiled by inaccurate reading from the scale on the x axis or by a failure to show their method in sufficient detail. Some students merely multiplied 3 by 7 and gave 21 as their answer, presumably from using distance = speed $\times$ time.

Question 19

This question was quite well answered and was a good discriminator. The most common error seen in part (a) was for students to translate the graph parallel to the x axis. These students scored no marks. A good proportion of students clearly used the helpful strategy of finding and plotting the image of particular points on $y = \mathrm{f}(x)$ and then made sure these points were included on their curves. This paid off. Some students did not cover the whole range of y values on their graphs of $y = \mathrm{f}(x) + 2$.

In part (b) the vast majority of attempts seen consisted of a reflection in the x axis. Students were awarded one mark for such a response. Only the best students scored both marks in this part.

Question 20

This question was a straightforward application of proportionality and as such should not have posed any real problem to most students at level 3. In practice, students usually fell into one of two camps, those who completed it successfully to score full marks and those who used the equation $y = \frac{1}{x^2}$ to work out the remaining values in the table despite the fact that the given pair of values did not satisfy it. Some students did not attempt the question.

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.
- make sure you can manipulate and evaluate numerical expressions quickly and accurately taking the “best” route where possible.
- practise your skills at solving problems involving direct and inverse proportion.
- ensure you have a good understanding of all topics in the specification.
- practise your skills in gathering evidence for and sketching the graphs of quadratic functions.

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