Examiners' Report
Principal Examiner Feedback

Summer 2018

Pearson Edexcel Level 3 Award
In Algebra (AAL30)

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Introduction

Students generally performed very well in the examination. Centres and students are to be congratulated on the way in which responses were presented. They were generally clearly and logically structured with accurate working. Possible exceptions to this occurred where more calculations were required, for example in the question on series (Q15) and in the question on the area under a graph (Q17(b)). Q12(a), Q15, Q16(a) and Q19 provided fewer fully correct answers than other questions on the paper, but even for these questions there were still a good number of answers which scored full marks. Few students presented very weak scripts. The question focussing on completing the square of a quadratic function was again poorly answered as it has been in recent previous series.

Most students showed a good knowledge of standard techniques and formulae and there were few students who confused the two results for the sum and product of the roots of a quadratic equation and the results for the *n*th term and the sum of an arithmetic series. Again, this follows a trend from recent series.

Report on Individual Questions

Question 1

Parts (a), (b) and (c) of this question were usually completed successfully though there was a significant minority of students who gave one of the incorrect responses $4.5x^2$ or $9x^2$ as their answer to part (a).

Part (d) of the question provided more challenge but most students scored at least 2 of the 3 marks available for answers to this part of the question.

In part (b), $a^7 \times a^{-3}$ was correctly simplified by nearly all students though there were some incorrect responses. Usually these were of the form a^4.

Most students scored the mark available for a correct response in part (c).
x^{-5} was the most commonly seen incorrect response.

Part (d) attracted a fully correct answer from less than a half of all students though many other students scored part marks for a correct approach. This was usually for obtaining the correct value for *f*. The incorrect value, $d = 2$ was often given as a result of students writing $(2q)^2$ as $2q^2$. Students taking this examination in the future are advised to practise the skills involved here in order to gain more confidence when dealing with questions involving both fractional indices and division.

Question 2

A majority of students scored both marks on this question and it was relatively rare to see freehand attempts to draw a circle. Incorrect responses seen quite often included circles with centre (0, 0) and radius 4 units. There was also a significant number of students who drew either the parabola with equation $y = 4 - x^2$ or the straight line with equation $y = 2 - x$.

Question 3

Answers to this question were usually fully correct. However, some students thought they could "simplify" $2x^2 + 4x + 20$ to $x^2 + 2x + 10$. A number of weak students expanded $(x + 4)^2$ as $x^2 + 16$ and $(x - 2)^2$ as $x^2 + 4$.

Question 4

Many students found this question to be routine and they often scored full marks, particularly in parts (a) and (b). There were some students who were unable to write down a correct link between the variables *F* and *d* at the beginning of the question and so ruled out the possibility of gaining any credit for their answers. Students are advised to check that they have read the question carefully. It appeared that a significant number of students failed to read the word "square" in the first sentence and proceeded to answer the question using $F = \frac{k}{d}$ instead of $F = \frac{k}{d^2}$ Some students gave their answer to part (a) with a proportionality sign rather than an equals sign.

Students who were successful with the first two parts of the questions were often able to sketch the graph in part (c). Weaker students often sketched straight lines or quadratic curves in this part of the question.

Question 5

Nearly all of the students sitting this paper gained at least 1 mark for their attempt to find the gradient of any line parallel to **L** and most students scored both marks. A common error was for students to give the full equation of the line in rearranged form, for example, $y = -\frac{4}{3}x + \frac{5}{3}$ or to give the gradient as $-\frac{4}{3}x$. These students gained partial credit for their answer. A large proportion of students gained some or all of the 3 marks available in part (b) of this question but of those, only a minority wrote their equation in the form required.

The question was a good discriminator and demonstrated which students were able to work with equations of straight lines in different forms.

Question 6

A large majority of students correctly expanded the brackets and simplified the resulting expression fully to score 2 marks. Students who did not get the answer fully correct usually scored 1 mark for a correct method. Where full marks were not scored, it was usually because of either an incorrect simplification of $-9x + 4x$ or in the evaluation of -3×1 as $+3$.

Question 7

This question was answered very well with the majority of students gaining all 5 marks. Where there were errors, it was sometimes where students were careless in drawing the line $4x + 3y = 24$ though diagrams were in general clear and accurate. The region defined by $4x + 3y < 24$, $x > -2$ and $3y > 9 - x$ was usually correctly identified.

Question 8

The great majority of students fully factorised the expression in part (a) to score full marks.

In part (b) most students were successful in factorising the expression as a product of two factors, one in terms of *a* and one in terms of *b*,
eg $(2a - 4)(2b + 1)$.

However, it was rare to see a fully factorised answer, eg $2(a - 2)(2b + 1)$.

Most students recognised the expression in part (c) as the difference of two squares. Weaker students sometimes factorised the expression in part (c) as
$(x - 3t)^2$, $(x - 3)(x + 3)$ or $(x - 9t)(x + 9t)$

Question 9

This question was answered well. There has been a noticeably high success rate in questions on this topic in recent examination sessions. There were no commonly seen errors made in this question testing the recall and application of standard results. A few students tried to use factorisation or the quadratic formula in order to get the answers. They were invariably unsuccessful.

Question 10

The first part of this question on the use of a given formula was quite well answered but a surprising number of students evaluated $7x^3$ as $7x^2$, which resulted in an answer of 66, and so usually lost the 2 marks available to them. Some students did not observe the rules for the order of operations and calculated 7×3^3 as 21^3. There were also cases where $3^3 = 9$ was seen.

In part (b) nearly all students applied an appropriate first operation, multiplying by $(a - b)$. A good number of students were able to make further progress and it was pleasing to see how many students completed the rearrangement successfully. This shows a definite improvement in performance compared to previous examination sessions. Students are reminded that changing the subject where the collection of terms and factorisation is needed is a key skill at this level.

Question 11

Full marks were scored in this question by about one half of all students who were entered for the examination. Many students identified the more straightforward route of subtracting the equations to eliminate y leading to a simple quadratic equation in x to solve. Students who followed this route generally completed the solution successfully to give two correct pairs of values for x and y. Most other students gained some credit for their answers but this was often restricted to the award of one or two marks for obtaining a quadratic equation in one of the variables, usually x.

Students who chose a route using one equation to write one variable in terms of the other then substitute into the second equation were less successful, usually because of an inability to deal with negative signs or squaring expressions accurately.

In particular, students who chose to substitute for x from $2y + 2x = 3$ to get a quadratic equation in y often made an error with signs or could not deal with the fraction involved in the substitution. In this instance, after making a substitution for x in terms of y in the first equation the term $2x^2$ was often incorrectly simplified to $(3 - 2y)^2$.

Question 12

Only about one in every six students gave the correct answer to this linear inequality question. This was a disappointingly low proportion from students entered for a level 3 examination. There was some carelessness in the manipulation of the inequality but by far the most common error seen resulted when students wrote $8y - (3y - 15)$ as $8y - 3y - 15$ and gave their final answer as $y < \frac{29}{5}$. This answer was awarded one mark to reward accuracy in solving the inequality apart from the error in signs. The answer $y < 29$ was also frequently seen. This arose when students made 2 errors and wrote down $4y - 3y - 15 < 14$. Students doing this could not be awarded any marks.

In part (b) most students identified the correct critical values of 1 and 2 and many students scored full marks for the correct response $1 < x < 2$. However a significant minority of students either found incorrect critical values or made errors in using inequality notation in their final answer.

Question 13

Though there was a significant proportion of students who scored at least two marks for their graph in part (a), this question proved problematic to many students. Some students prepared a table of values with integer values for x from −4 to 4 and plotted their points whilst other students sketched a graph. Either way, asymptotes were not always identified by either stating their equation, drawing lines on the graph or showing clearly that the graph of $y = \frac{1}{x} + 3$ approached the asymptotes Where values were calculated, working was generally accurate though a good number of students, having plotted points correctly, joined the two branches of the curve. Sometimes students included the point (0, 0). Nearly all students had chosen a suitable scale for their graphs.

Part (b) was not well answered and quite a proportion of students did not realise that to solve the equation $3.6 - \frac{1}{x} = 3$ they needed to consider the intersection of the line with equation $y = 3.6$ with the graph. Where the correct method was used, examiners gave credit to students who did not give a value in the range listed on the mark scheme but who had used a reasonable curve and line.

Question 14

The great majority of students could write down the quadratic formula in part (a), the most common errors being to omit a negative sign in front of the b in the formula or to write $b^2 + 4ac$ instead of $b^2 - 4ac$. Most students obtained the correct answer of $\frac{-7 \pm \sqrt{89}}{10}$ in part (b) although there were indications of careless arithmetic from some students. This was often demonstrated by sign errors made in the calculation of the discriminant. About two thirds of students scored full marks in parts (a) and (b).

Part (b) was also answered successfully by most students. Substitution into the discriminant was usually accurate and where students had written down 16 − 144 followed by a correct conclusion, full marks were awarded. Examiners assumed that students had realised that the value of the discriminant was negative without a full evaluation. Only a very small number of students misinterpreted their value for the discriminant.

Question 15

More able students scored full marks in this question and it seemed in general that questions involving series are now better understood by students taking this paper.

Part (a) of the question was quite well answered though there were some careless arithmetic errors, not least of which was for students to equate the difference between 338 and 208 to $10d$ where d is the common difference of the series. This often resulted in students getting a value of 13 for d instead of the correct value −13. Some students wrote down a first term which was less than the 15^{th} term and seemingly did not realise that this contradicted the fact that terms of this series decreased in size. There were a significant number of students who tried to use the formula for the sum of an arithmetic series to find *d* and *a* rather than the formula for the *n*th term.

A large proportion of students could state a result to enable them to find the sum of the series in part (b) of the question. Students were given full credit for answers gained from incorrect values in part (a) provided they used a correct result and worked out their answer accurately.

This question proved to be a good discriminator across the ability range.

Question 16

Most students made some progress with the first part of this question by identifying a common denominator for the two algebraic fractions and going on to combine the two fractions. These students usually scored 2 of the marks available. Unfortunately, very few students identified the lowest common denominator by first factorising the denominators of the two fractions and so they made it less likely that they would be able to give their answer in its simplest form. Where fractions were combined, many students made errors either in dealing with signs or multiplying out expressions. Needless expansions of the common denominator were commonly seen.

In part (b) most students, though by no means all students, started by multiplying both the numerator and the denominator by an appropriate expression, for example $\frac{\sqrt{p}}{\sqrt{p}}$ or $\frac{2\sqrt{p}}{2\sqrt{p}}$ or $\frac{-2\sqrt{p}}{-2\sqrt{p}}$. Students were awarded the first mark at this stage in their working. Far fewer students were able to complete the working needed to gain all three marks in this part. Errors arose in the multiplication of algebraic expressions and for those who did multiply accurately, many either did not simplify the resultant algebraic fraction or made mistakes in trying to. Only about one in every six students gave a fully correct final answer to this part of the question.

Question 17

Students usually scored at least 4 marks in total for their answers to this question. Most students used the graph correctly to find the acceleration of the car during the first 5 seconds of the journey. Occasionally students left their answer in the form $\frac{12.5}{5}$. This could not be given full marks. Some weaker students multiplied 12.5 by 5. Part (b) of the question was answered less well. Students usually realised that it was the area under the graph which they needed to find and they scored at least 1 mark for finding a relevant area. However, many students made errors in finding the total area. Finding the area of a triangle caused a problem for some students and other students attempted to use the trapezium rule with strips of width 5 units. This was not appropriate. Methods used were not always clear to examiners and inevitably, some students may have lost marks because of this. Errors in arithmetic were also commonly seen. About three quarters of all students answered part (c) correctly.

Question 18

This question was well answered by a minority of students. Common errors seen in part (a) included students translating the graph and inaccuracies in carrying out the correct combination of transformations, namely a stretch and reflection.

In part (b) little working was seen. Students were rewarded for getting at least one of the coordinates correct by indicating that they had either translated the point by 6 units to the left or that they realised that the y coordinate would remain unchanged. A majority of students scored full marks in this part of the question.

Question 19

This question was answered well by only a small proportion of students. Marks scored for this question were often low.

The negative coefficient of the x^2 term in part (a) caused most students a problem. More often than not students could not obtain the $(x + 2)^2$ part of the required expression. Many students used $(x - 2)^2$ instead, indicating they could not deal with the sign issues involved in this part of the question. Clear working was not seen in most students' responses.

In part (b) some students retrieved a mark for correctly using their expression from part (a) to identify the coordinates of the turning point though, again here, there were many sign errors seen. Perhaps not surprisingly, the most common incorrect answer seen in part (c) was E. This seemed to indicate that students recognised the general shape and orientation of the curve needed to represent the given equation but that they were less sure how to check the placement of the turning point. This part of the question was less well answered than examiners expected.

Question 20

Most students used a correct version of the trapezium rule. About fifty per cent of students scored full marks. Less successful attempts were usually due to students either not knowing the formula for the trapezium rule or because they read off the y values from the graph incorrectly. Some students used areas of rectangles and triangles but these students often made errors in calculating the area of a relevant triangle.

Summary

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

- ensure you always take care to consider signs carefully in questions involving the manipulation of algebraic expressions, for example in questions 12(a), 16(a) and 19(a) on this paper.

- remember that when you see $\sqrt{x}$ you should use the positive square root of x only (but when you are solving, for example equations of the form $x^2 = c$, both the positive and negative values should be taken).

- practice questions which involve writing the sum or difference of two algebraic fractions as a single fraction in its simplest form, particularly with regard to identifying a “lowest common denominator”.

- read questions involving proportionality carefully to identify in full the relationship being described.

- practice questions involving “completing the square” including cases where the coefficient of x^2 is negative.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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