Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel Awards
In Algebra Level 3 (AAL30)
Paper 01

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Edexcel Award in Algebra (AAL30)
Principal Examiner Feedback – Level 3

General Comments

Students in this examination usually presented their working in a clear and logical way and worked accurately to demonstrate a very creditable performance overall. There was a good proportion of fully correct answers for each question. Questions which proved most challenging included questions 9(b), 19(b) and 21(b). Very few students presented weak scripts. Most students showed a good knowledge of standard techniques and formulae. However, it was notable that there seemed to be an increase in the number of students who miscopied from questions or who did not give their final answers in the form required by the question. Examples of this included question 14 where the “+f” was often omitted when the formula was written down and question 17(b) where the form of answer was prescribed but often not given.

Reports on Individual Questions

Question 1

Nearly all students correctly expanded the brackets in part (a) and simplified the resulting expression fully to score both marks. Students who were not credited with 2 marks, usually scored 1 mark for giving the correct, but unsimplified expression, 2y^2+6y-3y-9. Any loss of marks was usually due to an incorrect simplification of $+6y - 3y$.

Answers to part (b) were also usually fully correct although a number of students gave the answer $4 + 25x^2$.

There were many correct answers to part (c) but errors were commonly seen. These included giving 8/3 or 8 as the coefficient in the answer and giving 15 or 36 as the power of r, though errors in the power of r were less frequently seen than those with the coefficient.

Part (d) was well answered. Answers by lower attaining students often suggested that these students had the multiplied the indices instead of adding them.

Question 2

This question on the change of subject of a given formula was quite well answered. Almost all students gained at least one of the three marks available for an initial first step of multiplying both sides by $x^2 + 1$. Many students made further progress to isolate terms in x^2 on one side of the equation and then make x the subject of the formula. However, a large number of students did not include the ± before the square root sign in their final answer and so were restricted to scoring 2 of the 3 marks available.

Question 3

The great majority of students could write down the quadratic formula and so scored at least one mark for their response to this question. Most students made accurate substitutions into the equation and wrote their solutions in the required form, that is $(2\pm\sqrt{76})/6$. There were however, a significant number of students who made an error when evaluating the discriminant, often getting −68 instead of 76.

There was no requirement for students to reduce this expression to $(1\pm\sqrt{19})/3$ and some students lost a mark for making an error at this stage in their working. Students are advised to note carefully any requirements given related to the format of their answers.

Question 4
This question was answered very well with the great majority of students gaining at least 3 marks and most students gaining 4 marks or more. There were many fully correct answers seen. Where there were errors in drawing the lines, it was often where students did not draw the line $2x + 3y = 6$ correctly or where students had not correctly identified the region satisfying all four inequalities.

Question 5
A majority of students scored both marks in part (a) of this question but it was disappointing to see how many students made a freehand attempt to draw the circle, often leading to the loss of a mark. Students are advised that the specification states that students are expected to be able to construct a circle and so should make sure they have access to a pair of compasses for use in this examination.
Part (b) presented few problems for most students sitting this paper. The tangent was usually drawn accurately. The most commonly seen error was for a student to draw a tangent at (7, 0) or occasionally at another incorrect point on the circle.

Question 6
The majority of students gave the correct answer to the linear inequality in part (a) of this question though examiners were surprised that a significant proportion of students made errors, either in isolating terms in y on one side of the equation or in failing to give the correct inequality sign in their final answer. For example, some students correctly isolated terms to get $-5y < -15$ only then to give the final incorrect answer, $y < 3$
In part (b) most students successfully factorised x^2+x-6 and then identified the correct critical values of 2 and −3. Fewer students were able to express the solution of the inequality correctly. The most frequently seen incorrect solution seen was $x < -3$, $x < 2$.

Question 7
For part (a), most students realised the need to give the equation of a line with gradient 3/4, but some students did not give the equation of a line through the origin. The inclusion of a "+ c" meant that a student could not access the mark here. It was encouraging to see that a good proportion of students were able to write down the equation of the line in the form $3x = 4y$, realising there was no need to rearrange the equation.
Part (b) of the equation led to the loss of a mark for too many students who gave the equation of a line rather than the gradient. Examiners

were able to award 1 of the 2 available marks for such answers. Similarly, the often seen answer $-5/2\ x$ was awarded one mark. A small number of students erroneously used the result that the gradient of a perpendicular line is the reciprocal, rather than the negative reciprocal, of the given line.

Question 8

Many students found this question straightforward and scored full marks by showing the discriminant ($b^2 - 4ac$) had a value of zero leading to a conclusion that the quadratic equation had 2 real and equal roots. A small number of students obtained the correct value of the discriminant but concluded that the equation had no real roots. Examiners were able to award some credit to these students for the correct evaluation of the discriminant. Some students did not appear to be familiar with the meaning of the term "discriminant" and they attempted to answer the question by factorising the quadratic equation. This was fruitless as marks could only be awarded to students who answered the question to "Use the discriminant..."

Students are reminded that when substituting a negative number into a formula, it is advisable to use brackets, particularly if the number is to be raised to a power. For example, in this question $b = -12$ and b^2 should be written as $(-12)^2$ and not -12^2. This would make clear to examiners that a correct substitution has been made.

Question 9

A great majority of students fully and correctly factorised the expression in part (a) to score full marks. Most other students gave the partially factorised expression 3x(2xy^2-3x^2 y).

Few students were able to fully factorise the expression in part (b) and nearly all students gave p^2 (p^2-q^2) as their final answer, scoring one mark for this. It was disappointing to see so few students at this level recognising the difference of two squares.

A small number of students scored one mark for $(p^2-pq)(p^2+pq)$, $p(p-q)(p^2+pq)$ or $p(p^2-pq)(p+q)$.

Question 10

Completing the square seemed to be a familiar process to students who were generally successful in answering part (a). Many students were able to use their answer to part (a) to give the coordinates of the turning point of the curve and there was a noticeable improvement in the number of students being able to answer this successfully compared to previous series. That said, there were still a good number of students who gave incorrect responses such as (3, 4), (3, −4) and (−3, −4). Some students did not appreciate the connection between the two parts of the question and gave the incorrect answer (6, 13) apparently using the coefficient of x and the constant term from the quadratic expression.

Question 11

Most students showed a good understanding of arithmetic series and the associated standard formulae for the nth term and sum of such a series. In part (a) some students left their answer in the form 4 + 7(n − 1) and were awarded 1 mark. An answer in simplest form was required for full marks.

When part (a) was answered correctly, so usually was part (b) and often part (c). A relatively small percentage of students showed poor recall of required formulae and so failed to gain any credit for their answers. A number of students were able to give a correct numerical expression in part (c) but made errors in evaluating the expression. There were also some students who attempted parts (b) and (c) by writing out all the terms. This sometimes led to correct answer in part (b) but not in part (c).

Question 12

A large proportion of students found this question to be routine and they often scored full marks. The most common error seen in part (a) was for students to use direct rather than inverse proportion. A correct approach in part (a) usually led to a correct response in part (b), though there were some errors seen, most noticeably evaluating 240/80 as 30. Students who were successful with the first two parts of the questions were often able to sketch a correct graph in part (c). However, straight lines with a negative gradient were commonly drawn. They could not be credited with the mark available in this part of the question.

Question 13

This question tested the recall and application of standard results for the sum and product of the roots of a quadratic equation. Students who knew these results usually scored both marks, though there were a few students who confused the result for the sum of the roots for the results for the product of the roots and vice versa.

More students did not attempt this question than any other question on the paper. There were also some attempts at answering the question without reference to the standard results. These attempts were invariably unsuccessful.

Question 14
Most students started this question by substituting values into the formula though there were some students who started by rearranging the formula to make h the subject. The latter approach was generally less successful. It was noticeable that, when substituting values into the formula, a number of students forgot to include the "+ 12" ("+ f") as the last term in the formula.
Following the substitution of values into the formula, there were several routes students could follow. The most successful of these was when students subtracted 12 from both sides of their equation as their second stage. Students who decided to multiply both sides of the equation by 3 as their second stage often forgot to multiply the + 12 on the right hand side by 3.
Relatively few students started by simplifying the fraction (12(6h-3))/3 to 4(6h – 3) but those students who did often completed the question successfully.
There were many fully correct answers to the question. However, students should note that answers expressed as a numerical fraction should be presented in simplest form to ensure full marks are awarded.

Question 15
This question acted as a good discriminator between students of different abilities. The majority of students realised that the graph was that of a hyperbola and scored the mark available for a correct shape. Many students could also identify one or both of the asymptotes but marks were often lost here with some asymptotes incorrectly placed or not labelled. The specification states that students should consider asymptotes and points of intersection of graphs with the axes, and the question directed them to do this. A significant number of students failed to label the point of intersection with the y axis or the asymptote x = 2. Some students gained credit for drawing the hyperbola xy=c2 which they drew as a fallback.

Question 16
A large number of students gave a complete and correct solution to the simultaneous equations in this question. It was encouraging to see so many students opting to form a quadratic equation in x by substituting y = x + 1 into the equation y = 〖3x〗^2+6x-1. This provided an easier route than eliminating x to form an equation in y. Weaknesses seen in students' work included not realising that, to solve a quadratic equation, all terms need to be taken to one side of the equation. This affected the progress of a good number of students who had successfully eliminated

a variable at the previous stage. The great majority of students who obtained correct values for x and y paired them successfully in order to gain full marks.

Question 17

This question was a good discriminator.
Nearly all students scored at least one mark for a correct method to expand the brackets in part (a). Very few students dealt with $\sqrt{12}$ before expanding the brackets. However, they could usually go on to either write $\sqrt{12}$ as $2\sqrt{3}$ or to simplify $\sqrt{12}\sqrt{3}$ to 6 thereby gaining a second method mark. An encouraging proportion of students were able to complete the simplification to gain full marks. Where errors crept in, they included simplifying $5\sqrt{12}$ to $7\sqrt{3}$ rather than $10\sqrt{3}$.
In part (b), most students recognised that they should multiply both the numerator and the denominator by $1 + \sqrt{13}$ in order to rationalise the denominator. Many students then successfully expanded the brackets in both the numerator and the denominator. Any errors made were usually due to an error in a sign. Of the students who correctly expanded and simplified their expressions, too many left their answer in the form $(-11+\sqrt{13})/(-12)$, a form not consistent with the $-\sqrt{13}$ required by the question.

Question 18

This question also differentiated well between students of different abilities. Most students gained at least one mark for finding the gradient of the line L. Students then usually used the form $y = mx + c$ rather than the form $y - y_1 = m(x - x_1)$ when trying to find the equation of the line, so they proceeded by trying to find the value of c. Many students did this successfully but a large number of students made errors and so could not obtain the mark for a correct equation (in any form). Students using $y - y_1 = m(x - x_1)$ could write down a correct and complete equation for the line more easily and so gain the second method mark. Students are advised to ensure they can work with, and choose, the most suitable form to find the equation of a given line. Some students left their equation in the form $y = -15/4x + 13/4$ and so were unable to access the final mark for writing the equation in the form $ax + by + c = 0$ where a, b and c are integers.

Question 19
A great majority of students used a suitable scale for their axes before plotting points accurately and joining them with a smooth curve. A small proportion of answers showed fractional values of y plotted in the third quadrant.
Only a minority of students could make any headway in solving the equation by using their graph. Instead, many students used linear interpolation to get an answer of 3.5. This method was not accepted by examiners who expected to see $2^{(x-1)} = 6$ and a line drawn on the graph at $y = 6$ as evidence that a correct method using the graph had been used.
In contrast, a large majority of students successfully used the trapezium rule to find an estimate for the area of the region defined in part (c) of the question. Less successful attempts were characterised by students either not knowing the formula for the trapezium rule, or because they found an estimate for the area between $x = -2$ and $x = 4$ and not an estimate for the area asked for.

Question 20
In part (a) of this question it was clear that most students understood that the transformation required was a translation. The correct translation was not always executed correctly, with a translation of 2 units in the x direction and a translation of (0¦2) seen quite often.
Though there were many fully correct answers, part (b) was less well answered than part (a). One mark was awarded to some students who correctly identified 2 points of the transformed shape.

Question 21
A large percentage of students scored at least 2 marks in part (a) for identifying and using a common denominator for the two algebraic fractions. Most of these students then went on to combine the two fractions to get $(4x-8)/(x^2-16)$ or equivalent. Unfortunately, some students then continued to “cancel” their fractions incorrectly and so could only be awarded two marks.
It was disappointing for examiners to see that many students who gave a correct answer in part (a) could not use their answer to solve the equation in part (b). Noticeably, there were many errors made in attempts to deal with the fractions and in writing the resultant quadratic equation in the form 〖ax〗^2+bx+c = 0. There were too many students who showed little understanding in this part of the question by mistakenly trying to equate $4x-8$ to 4 and x^2-16 to 5.

Question 22

The success rate in all three parts of this question was high, particularly so in parts (a) and (c) where full marks were usually scored. In part (b), a large majority of students appreciated that the gradient of the first section of the graph gives the greatest acceleration of the cyclist. However, many students scored only 1 of the 2 marks available because they did not convert the time involved to hours and so used 20/(15) or equivalent for the gradient instead of 20/0.25 or equivalent.

Summary

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

- ensure you always take care to copy down details from a question carefully, for example copying down a given formula accurately or the correct value for each of the variables given.

- remember that, in questions involving squares in the change of subject of a formula, there may be a need to use “±” in final answers, for example in question 2 on this paper.

- where answers are numerical fractions, make sure your final answer is in simplest form.

- always check that answers are given in the form required by the question, for example, in questions 17(b) and 18.

- practise questions involving sketching graphs of reciprocal functions.

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