Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel Awards
In Algebra (AAL30)
Paper 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2023
Publications Code AAL30_01_2306_ER

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

Introduction

Most students taking this examination showed a good knowledge of standard techniques and formulae. However, there did seem to be more students than usual who made errors in their arithmetic or who could not accurately recall some standard formulae, such as those for the *n*th term and sum of an arithmetic sequence.
Students generally presented their working in a clear and logical way and most worked accurately. There was a good number of fully correct answers for each question. Questions 1, 2, 11, 15, and 16 attracted a high proportion of very good responses whereas questions 8, 12(a), 13, 18 and 20 proved to be the most challenging on the paper. Very few students presented weak scripts.

Reports on Individual Questions

Question 1

This question was answered well. Nearly all students were able to fully factorise the expression in part (a). A number of students may have benefitted from checking their answers by multiplying them out and comparing them with the original expression.

In part (b), the great majority of students were able to factorise the quadratic expression. However most students did not take out 2 as a factor and left their answer as either $(2k + 6)(2k - 1)$ or $(k + 3)(4k - 2)$. These students could only be given partial credit for their responses.

Part (c) was also answered well with most students expanding $(w + 6)^2$ and $(w - 7)^2$ correctly. The most common error made by these students was to get an incorrect total when adding 36 and 49.

A small number of students expanded $(w + 6)^2$ and $(w - 7)^2$ as $w^2 + 36$ and $w^2 + 49$ respectively and were unable to score any credit for their answer.

Question 2

Though there were some students who factorised the equation incorrectly, the overwhelming number of students provided correct solutions to this question. Some students started by dividing through the equation by 10. Most, but not all, of these students completed the question successfully.

A minority of incorrect or incomplete responses arose from students giving incorrect factorisations or from giving the factorisation as their answer.
Few students used methods not involving factorisation in their responses to this question.

Question 3

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 usually where students did not draw either the line $x + 5y = 5$ or the line $x - 3y = 5$ correctly. In cases where all three lines were drawn correctly but the correct region was not identified, it was usually because a student used the wrong side for one of these two lines. These students scored 4 of the 5 marks available.

There were very few weak answers to this question.

Question 4

Nearly all students could write down the quadratic formula and so scored at least one mark for their response in part (a) of this question. Most students made accurate substitutions into the formula and wrote their solutions in the form $\frac{4\pm\sqrt{76}}{6}$. Just under a half of all students taking the paper could write a correct equivalent expression with a denominator of 3. The incorrect answer $\frac{2\pm\sqrt{38}}{3}$ was commonly seen. Students who gave an incorrect final answer often scored 2 of the marks available.

Completing the square in part (b) seemed to be a familiar process to students, but not all students handled this process confidently. Many were able to make a good start in their bid to find the value of p and the value of q with most students finding a correct value for p. Fewer students were also able to find q correctly. Lower attaining students often either failed to consider the coefficient of the x^2 term and gave a value of -3 for p or they started by expanding $(x + p)^2$ but then could not make any further real progress. This part of the question was a good discriminator.

In part (c), students usually scored at least one mark for either stating the general result for the sum of the roots or for collecting all terms on one side of the equation. A large proportion of students scored 2 marks in this part of the question. There were, however, some students who would have benefitted from checking their work for errors, particularly with regard to the negative sign.

Question 5

A large majority of students reduced the given equation to $x^2 + y^2 = 25$ and constructed the circle with accuracy to score both marks in part (a).

Answers to part (b) were not as accurate. A correct first step on the way to making y the subject of $3x^2 + 3y^2 = 75$ was often seen but there were relatively few fully correct answers. Instead, many students got as far as $y = \sqrt{25 - x^2}$ only then to write $y = 5 - x$ as their final answer. Few students attached a ± sign to their final answer, meaning they were not awarded all 3 marks.

Question 6

There were many excellent answers to this question involving the division of two algebraic fractions. Responses were often presented clearly and concisely.

Nearly all students gained some credit for their answers either because they showed the inversion of and multiplication by the second fraction and/or they factorised at least one of the quadratic expressions correctly. Students who scored only part marks often showed less organisation in their answers with working scattered around the working space. Factorisations were usually correct. A significant number of students presented correct working but then gave $x - 2$ as their final answer. Some lower attaining students attempted to multiply out the numerator and denominator and left their answers as a fraction with a cubic expression as the numerator and a quartic expression in the denominator.

Question 7

Nearly all students scored the 2 marks for substitution and evaluation in part (a) of this question. Occasionally, following a correct substitution, students made an error in working out the value of the expression.

Part (b) of the question distinguished students of different abilities. Most students scored at least one mark for a correct method to expand the brackets or to reduce at least one of the surds $\sqrt{32}$ or $\sqrt{8}$. A good proportion of students were able to complete the expansion and simplification to gain full marks. However, there were also many students who made errors along the way.

Question 8

Responses to this question, focussing on the laws of indices, were varied. Though there were many good answers to part (a), there were also many errors, particularly when students tried to rewrite the terms in x in a different form before multiplying out the brackets. For example, some students rewrote $10x^{-2}$ as $\frac{1}{10x^2}$. Such errors inevitably led to a significant loss of marks. There were also many errors when multiplying the powers of x, for example writing $x^{-2} \times x^8$ as x^{-16}.

Similarly, in part (b), many students were able to simplify one of the two terms to get $8t^2$ or $5t^2$ but fewer students simplified both correctly to score more than 1 mark in total for their response. In general, students dealt better with the powers of t than they did with the coefficients in this part of the question.

Question 9

This question differentiated well between students of different attainments. Most students gained at least one mark for finding the gradient of the line $\mathbf{L_1}$ in part (a) and many of them completed the question successfully. Answers given in the form $y = mx + c$ were given due credit though examiners noted the mixture of fractions and decimals often given in final answers. One or the other would be preferable. Some students used "difference in x values ÷ difference in y values" to work out the gradient in this part of the question and this ruled out the award of any marks for answers to this part of the question.

Question 9 (cont.)

In part (b) there was also a good number of fully correct responses. However, a significant number of students lost a mark for leaving their answer in the form $y = -2x + 6$ rather than the form $ax + by = c$ as required.

On occasion, students who did not score any marks in part (a) went on to score full marks for their response in part (b) as all the marks were follow through from the value of the gradient as stated in answers to part (a).

Few students used the form $y - y_1 = m(x - x_1)$ to find the equation in either part of the question.

Question 10

The table of values in part (a) of this question were usually completed successfully and most students went on to plot and draw an accurate graph of the cubic function. Where there were errors in the table, it was usually in one or both of the *y* values corresponding to negative *x* values. Values from the table were usually plotted accurately and curves drawn were generally smooth and accurate.

Question 11

A large proportion of students found this question to be routine and often scored full marks. They could express the relationship as an equation and find the value of the constant of proportionality. They then used the relationship successfully to answer part (b) of the question. However, there were some students who evaluated the square of 40 as 160 or took the square root of 40 and so could not be awarded full credit for their answers in part (b).
Any errors seen in part (a) were usually either due to a misinterpretation of the question, for example writing $p = \frac{k}{\sqrt{n}}$ or $p = kn$ or in writing down a value of 2 from $5 = 10k$ rather than $\frac{1}{2}$.

Question 12

Only a minority of students could make any headway in solving the cubic equation by using the given graph, but those who did generally read accurately from the graph to score 2 marks. Successful students usually rearranged the given equation to $x^2 - 10x + 45 = 30$ first. The alternative method of considering a translation of the given curve was not often seen.
In contrast, a majority of students successfully used the trapezium rule to find an estimate for the area of the region defined in part (b) of the question. Less successful attempts were characterised by students either not knowing the formula for the trapezium rule or not using 3 strips of equal width. A commonly seen error was for students to omit brackets when substituting numbers into the trapezium rule with a consequent incorrect evaluation. Errors with the arithmetic spoiled some solutions.

Question 13

Only higher attaining students knew what was expected here. Many students sketched $y = x^2 + 2$ and not $x = y^2 + 2$. This could not be awarded any marks. Of all the students who did sketch a parabola with the correct orientation to score one mark, only a small number of them drew a curve symmetrical about the *x* axis and marked the intercept at (2, 0).

Question 14

Many students showed a good understanding of arithmetic series and the associated standard formulae for the nth term and sum of such a series and there were many fully correct answers. However, a number of students mistakenly tried to use the formula for the sum of an arithmetic series in part (a) of the question and some students could not correctly recall this formula and quoted "$\frac{1}{2}n[a + (n-1)d]$" instead of "$\frac{1}{2}n[2a + (n-1)d]$".

In part (a), students usually worked accurately to get 950 as their answer, whereas in part (b), there were many errors in arithmetic seen, for example in working out 42 800 ÷ 100.

Question 15

Most students were able to choose the appropriate word from the given list to describe each of the three graph sketches and scored all 2 marks. The most common error was to interchange the words exponential and reciprocal, that is to label the graph of an exponential graph as reciprocal and vice versa. Nearly all students matched the word linear to the straight line graph to score at least one of the three marks. Few students used the word circular for any of the graphs.

Question 16

Students usually understood the principles underlying this question, those of area under a speed-time graph representing distance and gradient representing acceleration.

There were many correct answers to part (a) of the question though a significant number of students worked out the total area under the graph rather than the area between t = 0 and t = 2.5. These students could only be awarded one of the three marks available. Some student's answers were restricted to working out 2.5 × 8. This could not be given any credit.
Part (b) of the question was also well answered. As students were asked to find the deceleration, an answer of $\frac{8}{3}$ or equivalent was expected. However, examiners also accepted an answer of $-\frac{8}{3}$ or equivalent. The most common error seen was students who used an incorrect time interval rather than the correct 3 seconds.

Question 17

In part (a) of this question it was clear that most students understood that the transformation required was a translation. The correct translation was usually carried out but a translation of $\binom{0}{3}$ was seen quite often as were translations of $\binom{3}{0}$ and $\binom{-3}{0}$. Examiners were able to reward any students who used a translation in the y direction.

Question 17 (cont.)

Part (b) was less well answered than part (a) though there were a large number of correct answers seen. One mark was awarded to some students who correctly stretched the function with stretch factor 2 in the x direction instead of by stretch factor $\frac{1}{2}$.

Question 18

Only higher attaining students were able to give a complete and correct solution to the simultaneous equations in this question. A significant number of students started either with the incorrect deduction $x - y = \sqrt{8}$ or similar from one of the equations, $x^2 - y^2 = 8$ or with the incorrect statement $4x = 5y$ or equivalent. Students who did form a correct quadratic equation in x by substituting $x = -\frac{5}{4}y$ or an equation in y by substituting $y = -\frac{4}{5}x$ often made good progress to get correct values for x and/or y. A significant number of students who worked accurately only gave the positive solution when taking the square root. The great majority of students who obtained two correct values for x and for y paired them successfully in order to gain full marks.

Question 19

This question helped distinguish between students of different abilities. The majority of students were able to sketch the general shape of the graph with correct intersections of the x axis at 0, 180 and 360. A significant number of students failed to show the y values at the minimum and maximum points. Some lower-attaining students appeared to confuse $y = \sin x$ with $y = \cos x$ or with $y = \sin 2x$

Question 20

There were some excellent solutions to this question.

However, many students found part (a) of this question to be challenging and failed to give a chain of reasoning using the equation and to recognise that there were no real roots. Successful solutions, given that the equation had no real roots, started with a statement of the condition $b^2 - 4ac < 0$. This was followed by subsitutions for a, b and c, simplification of the expression obtained and then factorisation, leading to the required result. A commonplace weakness in the work seen was a failure to state the condition $b^2 - 4ac < 0$ at the beginning. Instead, many students seemed to put in the "< " as an afterthought when they realised it appeared in the statement on the question paper. These students could often only be awarded the mark for substitution in $b^2 - 4ac$.

Part (b) of this question was also answered inaccurately. A relatively small proportion of students identified both critical values, 0 and −36. A significant number of students worked with the incorrect critical values ±6. As a result, only a small minority of students gave a fully correct solution to the inequality. These students often sketched a graph to help them find the range of values for t.

Summary

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

- practise questions which involve manipulating an equation so that a given graph can be used to solve the equation.
- 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 5(b) on this paper.
- where numerical fractions are involved, make sure they are in simplest form unless otherwise advised.
- always check that the equation of a line is given in the form required by the question, for example, in question 9(b).
- practise questions involving the manipulation of expressions which may involve fractions and negative indices.
- check all calculations.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom