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Principal Examiner Feedback

Summer 2013

Edexcel Level 3 Award (AAL30)
Algebra

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Summer 2013
Publications Code EA035287

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

Introduction

This level 3 exam paper provided all candidates with the chance to show what they knew.

Many candidates were clearly well prepared and scored high marks. They had a good knowledge of standard techniques and formulae from all areas of the specification and were able to work with them accurately.

There were also a large number of candidates who were clearly not prepared for a level 3 paper and whose interests may have been better served by entry at level 2.

Candidates should expect to be tested on all topics and will be at an advantage if they have a good knowledge of all topics including those which are not common with a GCSE specification. In this series, a significant number of candidates showed limited knowledge of roots of a quadratic equation, solving quadratic inequalities, using the trapezium rule or solving problems involving arithmetic series.

Reports on Individual Questions

Question 1

Most candidates demonstrated a good understanding of single step applications of the laws of indices giving correct answers to parts (a), (b) and (c) of this question.

The last part of the question proved to be a good discriminator. It was disappointing to see so many candidates writing $d^2 - d$

A significant number of candidates stated that $x = 1$ but far fewer also stated the correct value for y.

Question 2

Nearly all candidates successfully factorised $x^2 + 8x + 15$ in part (a) of this question and the majority of candidates were also able to factorise $4y^2 - 9$ in part (b).

Part (c) was also answered very well though not all candidates factorised the expression fully and so were not awarded full marks. Centres are advised to emphasise the need for candidates to consider whether factorisations are complete.

Question 3

This question was very well answered by a substantial proportion of candidates. The best candidates drew the lines accurately and showed the correct region of points which satisfied all three inequalities. Where lines were not drawn correctly, lines with equations $y = 1$, $x + y = 5$, $x + y = 10$, $2x + y = 10$ and $y > \frac{1}{2}x$ were often seen.

Candidates who drew 2 of the 3 lines accurately were awarded some credit for shading the region which satisfied two of the inequalities. Examiners condoned the use of dotted or full lines drawn in response to this question.

Question 4

This question was one of the least well answered on the paper. It appears that many candidates were not used to completing the square or were unfamiliar with the way the question was presented.

This was perhaps a sign that they had not been exposed to sufficient level 3 type questions. Candidates at this level should ensure that they can complete the square of a quadratic function as a matter of routine.

Many candidates attempted to expand $(x + p)^2 + q$ but then did not know how to proceed from there. Comparing coefficients or substituting two values for x to produce simultaneous equations in p and q were possible but perhaps not preferable routes.

The equation in part (b) of the question could have been solved using part (a) but alternative methods including expansion of the brackets followed by factorisation or using the quadratic formula.

This part of the question exposed the inability of many candidates to identify a method to solve this quadratic equation quickly and concisely. The best candidates usually used factorisation of $4x^2 - 32x + 63$ into $(2x - 7)(2x - 9)$ to solve the equation. Some candidates went no further than factorising the expression.

Question 5

Solving linear and quadratic inequalities and dealing with the issues involved when multiplying or dividing by a negative number is again a standard technique at this level so it was disappointing to see so few candidates score full marks on this question. However, a large proportion of candidates were able to gain some marks for identifying the critical values.

In part (a) most candidates were able to make some progress in solving the linear inequality often getting as far as $-2w < -3$ before making an error. Many candidates then stated that $w < \frac{-3}{-2}$, failing to identify the need to change the inequality sign when dividing by −2.

A simple check using a value which satisfied their answer to see if the original inequality was satisfied might have uncovered this error; candidates should be encouraged to carry out such checks.

In part (b) a large proportion of candidates successfully factorised $x^2 + 3x - 10$ and most of these candidates then identified the two critical values, −5 and 2 However, it was rare to see a correct inequality or inequalities given as a final answer.

A commonly seen incorrect answer was $x \le -5$, $x \le 2$. There was little evidence of candidates checking the sign of $x^2 + 3x - 10$ between the critical values, for example by using a sketch graph or using a sign test.

Question 6

Few candidates appeared to know the results sum of roots = $\frac{-b}{a}$ and product of roots = $\frac{c}{a}$ which would enable them to write down the answers in part (a) of this question.

Similarly in part (b) few candidates appeared to use the discriminant of the equation with confidence to derive the inequality $c > 9$ although more candidates gained some credit for their response than was the case in part (a). As in the previous question many candidates were under-confident in handling inequalities.

Question 7

This question was well done, particularly part (a) where nearly all candidates expanded and simplified the expression accurately.

Part (b) was well done by the majority of candidates. However, a significant proportion of candidates simply crossed out the x^2 terms in the numerator and denominator to give the answer $\frac{2x}{7x+10}$ whilst other candidates also crossed out the x in both the numerator and denominator and gave the answer $\frac{2}{17}$. This might have been expected from level 2 candidates or from many GCSE candidates but it not expected from level 3 candidates.

Those candidates who did understand what was required found that the expressions forming the fraction factorised easily.

Question 8

Only the best candidates were able to gain full marks for their responses to this question.

A significant proportion of candidates showed that they understood the link between the gradient of a line and a line perpendicular to it. Examiners were able to give some credit for this.

A much smaller proportion of candidates were able to use a correct method to find the equation of the line required and even fewer were able to express it in the form $ax + by + c = 0$ where a, b, c are integers. Much of the work seen was not well organised.

Question 9

This question was generally not well answered.

Part (a) was answered most successfully by candidates who started by subtracting 180 from both sides of the equation as their first operation.

Those candidates who stated their intention to multiply by x as a first step often failed to multiply the 180 by x and so failed to gain any marks for this part of the question. In part (b)(i) candidates generally substituted −6 into the formula to gain the first mark available but a surprising number of candidates evaluated $\frac{-6}{-4}$ as $-\frac{3}{2}$ or −1.5 thus losing the second mark.

In part (b)(ii) most candidates realised that they needed to multiply both sides of the formula by (t + 2) and correctly used brackets to obtain s(t + 2) = t.

A good proportion of candidates were able to complete the question successfully but a similar proportion of candidates multiplied out the brackets but then did not know what to do with the two terms containing t

Question 10

In part (a) many candidates drew a graph that was the general shape of a sine or cosine graph but the graph did not always pass through the origin. Often the graph seen was of $y = \sin 2x$ or $y = \sin \frac{1}{2}x$ rather than $y = \sin x$

The candidates who drew a correct graph usually failed to show that the maximum and minimum values of $\sin x$ were 1 and −1. Only a relatively small number of candidates knew the general shape of the graph of the exponential function $y = 2^x$. Of those who did have some idea, hardly any candidates showed clearly that the x-axis was an asymptote as $x \to \infty$.

Many candidates constructed a table of values and tried to plot points usually with limited success. Few candidates labelled the point where the graph crosses the y-axis. Weaker candidates often produced a sketch of a parabola.

Question 11

This question was one of the least well answered on the paper. Able candidates often produced fully correct answers to parts (a), (c) and (d) but sometimes were unable to sketch the graph of *d* against *v* in part (b).

Straight lines were often seen as a candidate's response to part (b) even when the rest of the question was answered correctly. Regrettably a large proportion of the candidates started off the question on the wrong foot. Many candidates appeared not to have read the question carefully and used the relationship "*d* is directly proportional to *v*" rather than "*d* is directly proportional to the square of *v*".

Some other candidates used the relationship "*d* is inversely proportional to the square of *v*". Mistakes such as this have serious consequences in a question with several parts based on working with the stated relationship. Candidates are advised to check their reading and understanding of questions before starting them.

Candidates generally coped well with the numerical nature of this question though a significant number of candidates stated the equation $6 = k \times 30^2$ in part (a) only to deduce that $k = 150$

Question 12

Most candidates were able to draw a tangent to the curve at $x = 1$. A common error seen was a sketch of the line $x = 1$. Some candidates drew both the tangent to the curve and the normal to the curve at $x = 1$ but failed to identify which line was the tangent. These candidates could not be awarded the mark available here.

Some candidates left part (a)(ii) unanswered. Of those who attempted the question most candidates did not have a clear understanding of what to do. Two approaches were seen. Candidates who tried to manipulate the equations often then drew the line $y = -1$ instead of the line $y = 1$ on the graph. Candidates who considered a translation of the graph usually used the correct translation and sketched the graph but a lack of accuracy often stopped candidates from obtaining both of the marks available.

Nearly all candidates could identify the two turning points on the cubic graph given in part (b) of the question. A few candidates mistakenly marked the points where the graph crossed one or both of the axes.

Question 13

Part (a) of the question was answered well and most candidates gave the answer in fully simplified form though 9×5 and $9 \times \sqrt{25}$ were occasionally seen.

Part (b) was also quite well done. The most common error seen was to express $\sqrt{98} + \sqrt{18}$ as $49\sqrt{2} + 9\sqrt{2}$ and give the answer as $58\sqrt{2}$ Estimates of the size of $\sqrt{98}$,$\sqrt{18}$ and $58\sqrt{2}$ might have alerted candidates to their error here.

Part (c) of the question was answered well only by the most able students. It appeared that most candidates were not familiar with the technique needed, i.e. to multiply both the numerator and the denominator of the given fraction by $5 + \sqrt{2}$ or a multiple of $5 + \sqrt{2}$. The use of $5 - \sqrt{2}$ or just $\sqrt{2}$ was commonly seen.

Question 14

While some candidates had a good understanding of the trapezium rule, stating it clearly and applying it to the situation with care, most candidates approached the question by finding the area of 3 trapezia or in some cases 3 triangles and 3 rectangles.

Candidates generally read values from the graph accurately and most candidates who attempted the question gained some credit for their answers. Similarly the calculations involved were usually executed successfully. Examiners commented on the poor presentation of some working. This sometimes made it more difficult to award marks for a correct method.

Question 15

Surprisingly few candidates added the equations in order to eliminate y in this question. It was more usual to see candidate try to substitute $x^2 - x - 7$ for y in the equation $2x - y = 3$ or for candidates to rearrange $2x - y = 3$ to make y the subject then equate $x^2 - x - 7$ and $2x - 3$

Candidates who took the former route often forgot to use brackets, writing $2x - x^2 - x - 7 = 3$ and so made sign errors in the manipulation of the equation obtained.

A good number of candidates produced concise and accurate work leading to the award of full marks and many other candidates could be awarded some credit for their attempts.

Question 16

It was unusual to see work from candidates who were clearly confident in their knowledge of arithmetic series. Many answers seen reflected candidates confusion between the formula for the *n*th term of an arithmetic series, $\{a + (n - 1)d\}$, and a formula for the sum to *n* terms of an arithmetic series, i.e. $\frac{n}{2}\{2a + (n - 1)d\}$ or $\frac{n}{2}\{a + l\}$. The formulae were often remembered incorrectly or not known at all.

Candidates were almost always able to identify the correct common difference for the series in part (a)(i) of the question but correct answers to part (a)(ii) were much less frequently seen. Some candidates resorted to writing out 26 terms and adding them.

In part (b) of the question, only a small proportion of candidates attempted to use simultaneous equations to find the first term and common difference of the series and then use the formula for the *n*th term of an arithmetic series to find the 15th term. A good proportion of candidates were able to analyse the situation, find the common difference by finding the difference between the second term and the sixth term and then divide by 4. These candidates often went on to write out terms up to the 15th term. A commonly seen incorrect answer to this part of the question was −58.

Question 17

Many candidates understood that a one way stretch needed to be applied to the graph in part (a) of this question. However this was not always carried out accurately and a significant number of candidates scored one of the two marks available here.

Candidates often drew the base of their shape at $y = 1$ instead of the correct $y = 2$. Equating the transformation with keeping the x coordinates the same but multiplying the y coordinates by 2 might have helped candidates with this part of the question.

A larger proportion of candidates were able to carry out the translation parallel to the x-axis in part (b) correctly though there were some candidates who translated in the wrong direction or by the wrong number of units.

Question 18

The first part of the question was quite well done with many candidates recognising that the equation represented a circle centre (0, 0) and radius 5 There were however a significant number of candidates who plotted points satisfying the equation but were unable to deduce that the graph was that of a full circle. Semi-circles and other arcs were seen quite often. The former demonstrated that candidates had failed to realise that two values of one variable resulted from substituting one value of the other variable into the equation.

Examiners were concerned to see that many candidates suggested that $x^2 + y^2 = 25$ was equivalent to $x + y = 5$ and so the equation represented a straight line. The best candidates produced a clear sketch of a parabola superimposed on a circle to deduce that the two curves had 4 points of intersection. However many candidates drew only part of a parabola with a consequent incorrect deduction about the number of points of intersection. Some candidates tried to solve two simultaneous equations but very few got far enough to make the correct deduction. Most candidates appeared to give up part way through the process.

Question 19

Most candidates used sensible scales on the time and speed axes in this question though a few went no further than 4 seconds on the time axis or 30 m/s on the speed axis. The question required candidates to realise that an acceleration of 30 m/s^2 applied for 1.2 seconds would result in an increase in speed of 36 m/s.

Most candidates drew a straight line from (0, 0) to (1.2, 30) and not to (1.2, 36) for the first stage of the rocket's motion. A number of candidates misinterpreted the information given in the question and drew a horizontal line for 1.2 seconds joined to the end of their first line. Many candidates gained some credit for ensuring that their graph ended with a straight line representing constant deceleration to (5, 0).

Summary

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

- ensure you have a good understanding of all topics in the specification
- make sure you can manipulate quadratic expressions and equations including factorisation, completing the square, and using the formula to solve quadratic equations
- learn the standard formulae for the sum and product of roots of a quadratic equation and for the nth term and sum of an arithmetic series
- practise your skills at solving a range of word problems using direct and inverse proportion
- check solutions of equations and inequalities with reference to the original question, for example by substituting a value.

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