Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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4MA1 1H January 2022 Principal Examiner's Report

Unusually for this January paper there was a significant number of poor responses on all questions indicating that some students might have been better entered for the foundation paper. This may be linked to missed teaching time over the past 18 months. This having been said, there were many students who were able to produce good solutions to most questions. The latter part of the paper assessing grade 9 was however challenging for even the most able students.

1 A familiar start to the paper saw students tackling a four part algebra question. The first three parts involved manipulating indices and (a) and (b) were answered very well with almost all students gaining one mark on each part. Part (c) required students to expand a bracket to the power 2 and this was generally done well. Of those who did not gain 2 marks for a correct answer, many gained one mark with their only error being unable to deal with the numerical coefficient; $16x^{10}y^6$ was often seen. Part (d) also saw plenty of success but dealing with the power 3 caused problems for some students with many attempting to divide by 3 or square root instead of cube root their rearranged expression. Many students gave their answer as $t^3 = c + 8v$.

2 It was disappointing to see many students struggle on this ratio question. Around half were unable to interpret the information in the question correctly with taking 196 as the total to be shared between all 3 people the most common misunderstanding seen – this could still gain SCB1 if done accurately. There were still a good number of students who appeared to have very little idea how to go about answering the question and proceeded to attempt some random calculations. Of those that did realise that the first step was to divide 196 by 4, most went on to gain the full 3 marks.

3 As is often the case with trigonometry questions at this stage of the paper, it is all or nothing in terms of marks gained. For those students who were able to set up a correct trig equation for AB, almost all went on to gain the full 3 marks; it was a shame to see some lose the accuracy mark for giving an answer of 7.6 when the demand of the question asked for 3 significant figures. Of those that gained 0 marks, many different incorrect attempts were seen including the use of the other trigonometric functions cosine and tangent.

4 The full range of the 5 marks were awarded in this problem solving question which involved fractions, percentages and costings. Many were able to successfully gain the first two marks for working out the number of small, medium and large mugs; some converted 2/5 into an incorrect percentage which cost them marks. The 3rd method mark was also frequently awarded as many were able to reach a total income of 1644 or profit of 504. It was at this stage of the method where significant differentiation of the cohort took place, with some able to go on to correctly find the percentage profit whilst others used 1644 instead of 1140 as the denominator in their method, losing the last two marks.

5 Part (a) was answered well with many able to interpret the information correctly and work through to give a correct list. For those that didn't, the 5th card (4th blank one) caused problems as some listed 8, 8, 20 and were then unable to deal with what should go on the final card. Other solutions not gaining full marks included labelling more than two cards 8 and being unable to label the 3rd and 4th cards so that their sum was 28. Part (b) was also answered well with many able to find the total points scored after 5 and 6 games and then find a difference of 33 for the answer. Some found one or both products but could go no further with their method and there were also a good number of methods worth 0 marks where it would appear students did not know how to start or began by dividing 21 by 5 and 23 by 6.

6 Part (a) of this algebra question saw students needing to solve a linear inequality. Many were able to gain the first mark for a successful first step in rearranging or giving an answer of 1.8 or x and 1.8 with an incorrect symbol (usually =). It was pleasing to see a good number gain 2 marks for the correct answer of $x \leq 1.8$. Part (b) also saw a good number able to factorise the quadratic expression correctly for 2 marks in (i) and then solve this equation correct in (ii). For those that did not factorise correctly, some managed to pick up one mark for a partially correct factorisation; two brackets with y and the correct values with incorrect signs was often seen. The mark in (ii) could still be gained even if (i) was incorrect as long as their answer in (i) was in the form $(y + a)(y + b)$. There were also some students who, despite attempting some algebra, didn't have a grasp of the concept of factorising a quadratic expression and gained 0 marks; attempting to factorise into one bracket was often seen.

7 For this set notation / Venn diagrams question each section of the diagram was marked independently. It was not uncommon to see the intersection correct but all other sections incorrect. Another commonly seen solution which gained one mark was for the 4, 6 and 9, 11, 12, 13 to be labelled in the opposite sections which gained a special case B1 for isolating these groups of numbers. It was pleasing to see a good number of students able to logically work through the information provided and label all 4 sections correctly.

8 This standard form question caused problems for this cohort. The magnitude of the powers meant that a calculator could not be used and this appeared to throw many; students should be aware that questions will be set where answers cannot be found simply by using a calculator. A good number were still able to gain M1 for an answer of 12.6×10^{121} but then could not complete the final step to change into standard form or did not even realise it was not in standard form.

9 The most common start to this question was to use Pythgoras' Theorem to find the perpendicular height of the triangle. Students then went on to use this height to find either the area of the whole triangle or the area of half the triangle (and then doubling) to gain an answer of 147. It was not uncommon to see trigonometry and this was done well by most who attempted this route. There were many different options but SOH CAH TOA followed by the use of the sine rule for area was seen often. Some students started by using the cosine rule but were unable to rearrange to make the cosine of the angle the subject. Some students were unable to make a correct start on this problem with attempts to find the area using 17.5 and 28 as the base and perpendicular height often seen.

10 In part (a) the first step required students to attempt to rearrange the equation to try and isolate y. If done correctly this could gain the first method mark and many managed to do this. To gain the A mark an answer of -3.5 or equivalent was acceptable; some students managed to rearrange their equation but could not extract the value of the gradient correctly. Some also gave answers of 3.5 or $-3.5x$, both of which gained one mark. Part (b) was correct answer only for (0, 5) and some were able gain this mark, generally following on from a correct answer in (a).

11 Many students were able to gain the first method mark in this repeated percentage change question for finding 1.8% or 101.8% of 200,000. The next stage generally saw one of two paths being taken, the correct one being to divide 209,754 by 203,600 and then square root, with the incorrect one being to treat the 2nd and 3rd years as simple interest, which, despite leading to an answer of 1.5 (the correct answer) was not credited. Some students used a trial and improvement method to find their multiplier and as long it was clear they were considering compound and not simple interest, a correct answer gained full marks. Another example of an incorrect method was to start by finding 18% instead of 1.8%.

12 The first two parts of this cumulative frequency question were generally answered well. There were some students who did not know how to start with (a) and this cost them the marks for the whole question, and some who completed the table correctly but could not draw their cumulative frequency graph, with bar charts and other box-type diagrams seen often. For those that did manage to produce a cumulative frequency curve, many were able to correctly read off the median to achieve an answer in range. There was less success in (d) as many struggled to interpret what reading they had to take, and some managed to take a correct reading but then failed to subtract their cumulative frequency from 80 and write as a fraction over 80.

13 In part (a), it was pleasing to see many students gain 3 marks for a correct expansion. Of those that didn't, many were still able to gain 2 marks as their method was generally correct but one error was made. There were still a good number of 0 mark methods and these generally involved students multiplying both brackets by $5x$. Students should be advised that they cannot divide through by a common factor at the end; it was a shame to see correct answers spoilt by being divided by 5 or x. Part (b) proved to be a challenge for this cohort and it was rare to see a fully correct solution. A good number were able to deal with the algebraic terms correctly and gain two marks for having the powers of y and w correct but could not evaluate $16^{-\frac{3}{4}}$ correctly.

14 Part (a) of this tree diagrams question was answered well with many able to gain two marks for correctly completing the empty branches. For those who gained 2 marks in (a), many were then able to go on and gain 2 marks in (b) too for finding a correct probability. Common errors seen were conditional probability used in (a) e.g. probabilities of 6/11, 5/11, 7/11, 4/11 seen on packet B's branches and the two fractions added instead of multiplied in part (b).

15 At this point in the paper many students began to struggle with making a correct start to the questions. For this inverse proportion question, many simply tried to play about with the numbers or treated it as direct proportion. For those who were aware of how to go about solving an inverse proportion problem, most were able to gain 3 marks by setting up an equation in A, k and C and going on from there. Some students, having worked with the correct relationship, and having found k, then incorrectly rearranged their equation $1000 = 90/c^2$ giving the answer as 300. A small number appeared to know how to start but ignored the power 2 on C, unfortunately gaining 0 marks.

16 This reverse arc length question provided many problems for this cohort. Many were unable to make a correct start. For those that did, a correct value for the radius or diameter was often reached if the student could set up a correct equation using the angle over 360 multiplied by the circumference. Some found the circumference and thought it was the diameter or radius. From there, students either went on to the correct answer or stuck with just the two marks, with finding the area of the minor sector commonly seen. Another common incorrect method was to treat the radius of the circle as 5 cm instead of the arc length.

17 Many students began their method by finding the scale factor for the lengths for the vases and unfortunately went on to use these whilst comparing the volumes. Some did realise that the scale factor for the volumes would need to be 1.5^3 and gained the first method mark. The remainder of the method was different to what has been seen in the past with students given the difference between the volumes rather than the volume of one of the vases; this generally led to students considering the volume of vase B as 1197 and no further marks were gained. There were a small number of students who interpreted the information correctly and these generally went on to score the full 4 marks.

18 The first mark for this question was for one correct bound and many students were able to gain this. The next mark proved more difficult as many struggled to deal with the negative fraction, in particular ensuring the fraction was as large as possible so that the overall result was a small as possible. The most common error seen was for the numerator to be 1.85^2 instead of 1.95^2. Many students gained 0 marks as they were unsure how to use bounds and simply substituted the original values from the question into the expression.

19 The quality of solutions to this question varied considerably. While many failed to score marks at all, either by making no real attempt or by not eliminating either of the variables, many others were familiar with the topic and produced good solutions. Common errors included errors in expanding $(2x - 3)^2$ or in dealing with $-x(2x - 3)$. This led to an incorrect quadratic, although correct work after this could lead to a total of 3 marks. A small number of students did not give their answers as pairs but listed the x values and y values separately.

20 This part of the paper is designed to test the understanding and skills of the most able candidates. Completing the square is a challenging topic, more so if the coefficient of the square term is negative. Many attempted to factorise e.g. put into two brackets. Some realised that the x^2 and x terms needed to be factorised together but taking out a $3x$ instead of -3 was a common incorrect step seen. There were a very small number of students who were confident with their method and managed to reach a correct answer. For part (b) correct answers were few and far between despite a follow through mark being available from their answer to (a).

21 There were many blank responses for this question. The lack of values given for the lengths ensured most students were unable to make a start on the solution. Of those that did manage to make some progress, use of algebraic expressions for the lengths were seen with *AE* being labelled as x or $2x$ being the most popular choices. This led to some students gaining the 1st and 2nd method marks for expressions for *AM* and the height of the triangle *HJK*. Many errors were made when attempting to find sides with expressions such as $(2x)^2$ and/or $(0.5x)^2$ written as $2x^2$ or $0.5x^2$ respectively. From here students generally needed to work with surds and this was rarely seen.

22 It was pleasing to see some students gain the 1st mark on this vectors question for a correct vector for *ON* or *NO* or *AM* or *MA*. From there a correct expression for *OP* needed to be gained and if two were found this could gain 2 more marks, it was not unusual to see one of these expressions gained, more commonly using *ON*. It was increasingly rare to see progress made beyond the 1st method mark but for those that did manage to set up two correct expressions for *OP* the full marks were generally gained. A small number tried to use the same letter as the scalar for both versions of the vector *OP*. The accuracy mark was dependent on M3 as the question demanded a vector method; some students gave the correct answer having gained 1 or even 0 method marks, presumably from guessing the scale factor of *OP* in relation to *ON* being a ½.

23 It was pleasing to see a good number of correct answers on both parts of this graphical transformations question. For part (i), those that did not gain B1 for an answer of $(-4, 7)$, common incorrect answers were (14, 7) and (14, 16). In part (ii), (5, 10) gained B1 but (8, 7) and (8, 10) were regularly seen. There were also plenty of blank responses showing that many students were not able to access this question.

24 It was not uncommon to see 1 or 2 marks gained on the calculus question. Some students realised that $(2, -6)$ needed to be substituted into the curve equation for C to establish an equation in a and b. Some also managed to find $\mathrm{d}y/\mathrm{d}x$ and also substituted $x = 2$ and made their resulting expression equal to 16. There was still plenty of work to be done and it was rare to see anyone make it beyond this point and go on to solve their simultaneous equations in a and b. The correct answer of 33 was dependent on M3 so the method had to include the above steps.

Summary

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Based on their performance in this paper, students should:

- Work with standard form questions where a calculator does not produce the answer.
- Be aware that e.g. squaring $2x$ leads to $2x \times 2x = 4x^2$.
- Give solutions to simultaneous equations as pairs of values e.g. $x = a$, $y = b$
- Learn the difference between compound interest and simple interest.

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