Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 1H

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PE report for 4MA1 paper 1H Summer 2019

Students who were well prepared for this paper made a good attempt at all questions. The question on arithmetic sequences, a subject new to the specification, was done very well.

Some students are over reliant on their calculators and when asked to show full working are unable to show all the steps involved. They also do not know the full working of their calculator and, for instance, the need to use brackets round a negative number in order to square it, such as for completing the table for the quadratic graph.

Some students get methods mixed up, for example finding the surface area when the volume is needed for question 6.

Question 1

Students found this to be a good opening question with most students able to access the first two marks by first converting the two mixed numbers to improper fractions and then either inverting the second fraction or writing both fractions with a common denominator. However students need to be aware that where they are being asked to 'show that' something is true then every small step needs to be shown particularly when a calculator can be used. Sadly many students missed out a vital step such as reaching $\frac{126}{30}$ but then going from this directly to the given $4\frac{1}{5}$ missing out the intermediate step of either $\frac{21}{5}$ or $4\frac{6}{30}$ thereby losing the final mark. It should be noted that those students who were able to cancel first to get $\frac{7}{1} \times \frac{3}{5}$ invariably gained the final mark.

Question 2

Part (a) was well answered although some students forfeited the mark because their shown calculations were incorrect. In part (b) nearly all students recognised they needed to draw a horizontal line from (12.00, 24) to (12.45, 24) but then some students were not sure where to join this final point to the Time axis.

The most common error in part (c) was to find the average of their 3 different speeds with (15 + 12 + 16) ÷ 3 = 14.3 a common incorrect answer. Others gained the first mark for getting a correct time of 3 hours 15 minutes but then failed to score further as they either wrote this as 3.15 hours or converted it to 215 minutes when it was clearly stated that the answer needed to be in km/h. Many failed to actually find a correct time value for their graph and did not take into account that they only needed to include the times that they were cycling

Question 3:

In part (a) the majority of students knew they should subtract the indices for division and in part (b) all but a very few knew to multiply the powers when one power was raised to another power.

Part (c) was attempted by all with the vast majority giving a fully correct answer.

Most of the incorrect answers scored M1, usually for three or four correct terms.

Most errors were giving the middle term as -7*x* or -7, after a correct expansion.

Occasionally the −18 found by multiplying 9 and −2 was incorrect.

In part (d) most students scored at least one mark for a correct partial factorisation, the most common answer here was $\boldsymbol{4cp(4c^3p + 5p^2)}$ with many receiving full marks for a fully correct expression. It was clear that a few students did not understand how to factorise, simply cancelling and, in some cases, multiplying the terms together instead with $\boldsymbol{36c^5p^5}$ a common incorrect answer. Other students only factorised the 4 out which was not enough to gain credit. The word "fully" should be highlighted in preparing students for the examination.

Question 4

Many students scored full marks for this graph question. Students generally scored at least 1 mark in (a) for 2 correct substitutions (usually for the positive values of *x*). For these students, substituting negative numbers into the quadratic caused the issue and it was common for them to think that squaring a negative value produced a negative answer. We would suggest that students should be shown how to use the table function on their calculators.

In part (b) the vast majority of students scored at least 1 mark for 5 values correctly plotted, following through answers to (a). Of those who scored full marks in (a), many went on to score both marks in (b) for a fully correct graph. Some students lost the second mark for a point plotted incorrectly or a carelessly drawn graph that did not go through the correct points.

The biggest issue for students however was a lack of understanding that a quadratic graph is curved and should have a minimum point somewhere between $1 < x < 2$ that falls below $y = -1$. For these students it was common to see a straight horizontal line joining the points (1,-1) and (2,-1).

A few students did not recognise the general form of a quadratic and were happy to draw bizarre result of incorrect points.

Question 5

This question was often done well.

Common scores were:

0 by those who did not realise that the sum of probabilities was 1

2 after forming the correct equation, most found $x = 0.07$

4 normally fully correct if they understood the need to multiply by 200 after finding 0.07

Of those who scored 0, a good proportion equated the sum to 200, whilst others tried to work only with the probabilities of the even numbers. When $x = 0.07$ was found, many were able to progress to find 0.46, and whilst some thought that they had now answered the question, the best students saw that this had to be multiplied by 200 to find the expected number.

The answer 92/200 was less common than usual in expected frequency questions.

A proportion of students saw this question as requiring an algebraic answer and so only found the formula to determine the number of times and made no attempt to calculate a value of x giving their answer as 0.4

A majority of students were able to score here with many reaching a correct value for x of 0.07, although the algebraic working was not always present. Students should be careful to distinguish between decimals and percentages as a minority of students failed to score by equating their set of probabilities to 100 rather than 1.

Of those who reached 0.07, most were able to calculate the probability of 0.46 for the even numbers but many failed to reach the third mark by not multiplying by 200 to get a frequency. If they are to gain full marks students should ensure that where a frequency is requested a fraction is not given for an answer.

A minority of students attempted to work with the individual frequencies of the even numbers but this approach did not have a high success rate.

Question 6

We saw many correct answers for this question.

Some tried 480/0.7 or even 0.7/480

A few students worked with surface area rather than volume of the cuboid as a start to the question.

Question 7

Part (a) was answered correctly by the majority of the students, with the wrong number of zeros being the most common error.

Part (b) was generally fully correct with some writing the answer as 4×10^{-3} or 4.0×10^{-3}

The most common errors were 4×10^{3} and 0.4×10^{-2}. Students should note that 4.10^{-3} is not an acceptable response for a number in standard form.

In part (c) we saw many fully correct responses.

Few benefitted from B1 for 320 000 since this step of working was often not shown. Students clearly choose to key the whole calculation into their calculators and hope for the best. A score of B1 for an incorrect answer in the form $5 \text{ x } 10^{n}$ was more common, especially for 500.
Some got mixed up with the number of zeroes needed in the answer.

Question 8

Many students produced a fully correct answer, often using the formula for compound interest. The remaining students generally scored at least one mark for finding 8% or 92% of £170000. Mistakes were then made when doing a 'build up' method, year by year, or for finding the value after two years or four years, rather than the three years stated in the question.

Other common errors which scored one mark, included the use of simple interest or doing a percentage increase rather than decrease, possibly due to lack of understanding of the word 'depreciation'.

Some students mixed simple interest and compound interest or attempted to divide by 1.08 rather than multiply, these approaches gained no credit.

Question 9

This question gave a good spread of marks with most scoring a mark for the area of the triangle, though it was not unusual to see students overlooking the most obvious method. A surprisingly common error was to consider the hypotenuse as the base and one other side as the height.

Pythagoras' theorem was done well with many giving the diameter as a surd. This avoided the rounding errors that were often seen, but also caused mistakes in the area of the semi-circle when $(3\sqrt{2})^2$ was written as $3\sqrt{2}^2$ and evaluated as 6.
Some mistakes were made using the diameter as the radius of the semi-circle, or forgetting to divide the area of the circle by 2. A few used 6 as the radius

Question 10

This question was very poorly answered by students and many left it entirely blank. Others multiplied by 8 but did not convert 8 into a product of its prime factors.

It was common to see students multiply each prime number by 8 or even raise each term by a power of 8. None of these approaches gained any credit.

To score the first mark it was necessary to see 8 written as 2^3or 2×2×2, something relatively few students were able to do. Even fewer were then able to combine their powers of 2 correctly; 2^{3n} and 2^4 were common incorrect answers.

Question 11

It was pleasing to see that most students scored at least 1 mark for a correct upper or lower bound for 6 cm (i.e. for 5.5 or 6.5) but many struggled to find the upper and lower bound of 15 (to the nearest 5) with 15.5 being a common incorrect upper bound and 15.5 − 5.5 = 10 being a common incorrect answer scoring 2 marks. A few students used 5.49 etc. for their bounds without indicating a recurring 9 and lost marks as a result.

Question 12

This question was well done by most students with the majority scoring both marks. For those unable to complete a correct factorisation, evidence of good practice was shown by attempts to ensure either a product of 6 for the number terms or a sum of $-7x$ for the terms in x. Students should be encouraged to check their answer to ensure there are no common factors within a bracket as an answer of $(2x - 4)(x - 1.5)$ was seen a number of times, scoring 1 mark. Quite a few students had decimals or fractions in their brackets and whilst this was taken into account when marking, it often did not reflect a correct factorisation. Others went on to try to find the value of x with $x = 1.5$ and $x = 2$ often seen on the answer line which meant at most 1 mark could be scored. It was also common to see students confuse 'factorise' with 'solve' as they attempted to use the quadratic formula with no attempt to factorise.

Many students gained all 4 marks for part (b) of this question, demonstrating an excellent understanding of, and ability to manipulate, algebra. Students often cleared the fraction and expanded the bracket in one step; this was to the detriment of some students who made mistakes in their expansion and were not clear in their intent to multiply both sides by 3. Mistakes also crept in when some students attempted to isolate their m terms, adding instead of subtracting or vice versa.

Students who used the alternative method given in the mark scheme and separated the left side of the equation into two fractions, were generally unable to do so correctly. It was common for students to divide only one term by 3, resulting in 4m + 3 =, and thus gain no further credit.

Too many students did not appreciate the importance of dividing both terms by 3 on the left or multiplying both terms by 3 on the right, resulting in one term inside a bracket being added or subtracted to the other side, or the constant term in the numerator of the fraction being added to the other side, with no understanding that a factor of 3 or 1/3 was missing. Some students were able to gain credit via the special case for a correct rearrangement following a partially correct expansion of brackets.

Many students found part (c) very difficult with some failing to realise the need to use fractional indices. $\sqrt[4]{y} = y^{-4}$ was seen occasionally and quite a common answer was $y^{-\frac{1}{4}}$.

Question 13

Part (a), completing the probability tree diagram was mostly done correctly. Some put integers on the tree (usually 6, 8, 3, 7), often continuing to complete part (b) correctly. A few made more significant mistakes, such as using 24 as the denominator for the probabilities, or using 9 as the denominator on the second branch as if choosing from a single group without replacement.

Part (b) was usually done well, sometimes taking advantage of the follow through from the tree diagram for M1. Those who used decimal probabilities usually lost accuracy. Just a few students added probabilities.

Part (c) was a much more difficult question and we saw plenty of incorrect answers but the question discriminated very well. Apart from those who did not understand how to go about the problem, the most common mistake was to add 2/5 to 14/39, instead of multiplying.
Students who had put the simplified probability of 4/7 on their probability tree frequently used 3/6 in their calculation, trying to do the right thing by reducing both numerator and denominator by 1, without thinking back to the original question. They scored no marks.

Question 14

For part (a) we saw many correct answers.

Some students were clearly not familiar with the set language and notation used and we saw answers showing that they were getting the union of sets and the intersection of sets mixed up. A few students thought that only even numbers were needed. Before seeing any responses we thought that we might see several Venn diagrams, but students chose not to use them on the whole.

For part (b) there was a fairly even split between correct and incorrect answers. Correct answers usually chose 2, 4 and 6.

Some listed all five possible elements, missing that the number of elements in set C was 3; these students lost the mark. 12 was sometimes included even though set A contained numbers less than 12.

Other mistakes showed little understanding of what was being asked and the subset symbol clearly confused some students.

Question 15

Many students scored full marks here with an excellent appreciation of the steps needed to convert recurring decimals to fractions. Two methods were commonly seen: working with 1000*x* and 10*x* and working with 100*x* and *x*. Most students scored both marks with this method, but a few did not give the intermediate fraction 25.2/99 or 252/990 or omitted the conclusion of 14/55 and thus lost the final mark.

Other students did not subtract two recurring decimals that would result in a terminating decimal or whole number. Some students lost marks because they did not demonstrate an appreciation of the recurring pattern – if they did not use dots or lines to demonstrate the recurring part of the numbers we needed to see values given to at least 5 sf, which some students did not do.

Students who were not confident on this topic, generally tried to use their calculators to demonstrate that the fraction and the recurring decimal were the same. This clearly scored no marks as the question clearly asked students to use algebra.

Question 16

Most students recognised that the *n*th term was $3n + 4$ but this was not sufficient to score the first mark. A few used this to get the correct answer by calculating (100 ÷ 2) (7 + 304). However, the most common (and successful) method was to use the summation formula

$S_n = \frac{n}{2}[2a + (n - 1)d]$ but unfortunately many then incorrectly substituted *a* as 3 and *d* as 4 or *a* as 4 and *d* as 3 scoring no marks. A few students tried to add all the numbers in the sequence staring with 7 and ending with 304. Very few of these students managed to get the correct answer of 15 550. Generally, this was a well answered question with many students gaining full marks.

Question 17

Most students scored the first mark in part (a) for a correct scale factor but then most of these students went on to use this scale factor with 960 (instead of first squaring it), with 1440 being an extremely popular incorrect answer. Surprisingly many of these students went on to write down the correct volume scale factor in part (b)! Writing the answer in terms of *A* was sometimes seen but those students who were able to get the correct volume scale factor tended to go on to score 2 marks. Some students split the triangle by dropping a perpendicular from P to RQ but this then had to be fully correct method for marks to be scored.

Question 18

Most students recognised that they had to use the cosine rule to find the length of *PR* and scored at least 1 mark for a correct first line. However, many of these students got the incorrect answer mostly because they did not get their order of operations correct. Students should be encouraged to show their answer to $17.8^2 + 26.3^2$ as 1008.53... and then show that 2(17.8)(26.3) cos 36° = 757.466... before they actually do the subtraction as this might then focus the student on doing the correct calculation. The vast majority of students who got to 251(.06...) went on to get the final mark by square rooting their answer. The most common incorrect method was using the triangle as right angled and writing to 26.3 sin 36° = 15.5 thereby scoring no marks.

Question 19

This question was generally answered very well, with many students scoring full marks. It was common to see the Frequency densities listed next to the table, although this was not necessary to gain credit. Despite having correct Frequency densities, some students lost a mark for lack of accuracy on the graph or with bars of incorrect width. This was particularly common with the last bar given a class width of 40-55 rather than 40-50 on the histogram.

There was minimal use of incorrect methods although there was the occasional 20/15 rather than 15/20 giving an incorrect first bar of 1.5 rather than 0.75.

Some students used an incorrect method to find the Frequency density, or plotted frequency (ignoring the given scale) rather than Frequency density; neither of these methods gained credit.

Question 20

Students struggled to find a correct start to this question. Many were thrown off by the quadrilateral to which they tried to apply the alternate segment theorem, stating incorrectly that *DAB* or *ABC* = 71. Even though they continued to reach an answer of 142 no marks could be gained as this was from incorrect working.

Students who recognised the need to add extra lines did so by adding one of *DB*, *AC* or *OD*, where *O* is the centre. This generally allowed them to gain at least 1 mark for a correctly stated angle.

Students who worked with triangle *BAD* often went on to reach the correct answer for *DCB* via a correct method. These students then usually gained B1 for a correct circle theorem associated with one of the angles, however for B2 full reasons had to be seen including those associated with triangles, for this method two such reasons were required and often one was missing.

Students using the other methods often broke down after being awarded the first method mark, often also gaining B1 for a correct circle theorem associated with the angle found.

Students who made assumptions, such as using *AC* as the diameter of the circle, gained no credit unless they first gave full explanations for their assumption.

The answer of 142 was commonly seen but relied on a correct method, which many students did not provide.

Many students scored the first 3 marks but often omitted one of the reasons entirely or else incorrectly stated or abbreviated the required reason, resulting in the loss of at least one B mark.

Students must use precise language when explaining reasons and avoid abbreviations in order to gain B marks.

A very few students achieved full marks on this question.

Question 21

The most common starting point was to score a mark for the correct volume of the hemisphere, although some did forget to halve the volume of the sphere. Others scored a mark for $h = 3r$ or, very occasionally, for $r = h \div 3$ but most students struggled to write down a correct equation with one unknown for the volume of the solid. Those who did, used a lot of incorrect algebra to find r often ending up with r^5 in their equation. When r was found to be 6 by some students, the most common answer was $6 \times 3 = 18$ rather than recognising that this was the height of the cylinder and that they needed to add on a further 6 cm to work out the height of the whole solid. Some students confused the relationship between r and h, substituting $r = 3h$ rather than $h = 3r$. Others failed to use the relationship at all and after much, often incorrect algebra ended up with insoluble equations containing both variables.

There were also students who wrote that r = 1/4 h and used this to substitute for r in their equation in their equation not realising that using h = 4r is the height of the whole shape and not the height of the cylinder.

Question 22

For part (a) it was good to see how many students scored on this question, with many gaining both marks. If only 1 mark was gained, it was generally for having a maximum value of 2 and a minimum value of −2. Translations of 30° to the left were less well done although students who failed to recognise the stretch scored the second mark for a point on their curve at (150, y) and another point at (330, y). Some students lost the final mark even though their curve had all the correct features of the stretch and translation because they drew their graph through (0, 0).

Students made a good attempt at part (b)(i) with many scoring at least one mark for completing the square with one value correct. Mistakes were often made combining the constants with $(x-3)^2$ + 19 a common response.

Many students omitted(b)(ii). Of those who did attempt it, many failed to spot the connection with (b)(i). Instead they incorrectly tried to use coefficients (-6 and 10) from the original equation with a translation, gaining one mark for recognising it was a translation.

Other students stated a combination of transformations or referred to a reflection or rotation.

Some students did recognise the connection between parts (i) and (ii) of this question but lacked correct terminology, especially in understanding how to write their answer in vector form. 'Shift's and move's' were commonly referred to for translation, as students wrote about the translation in words, rather than a column vector.

Students who mentioned 'translation' scored one mark here as did students who correctly stated the column vector but did not identify the transformation.

A small number of students achieved full marks for this question.

Question 23

This question was a good discriminator for higher grade students. It offers two relatively straightforward marks for the centre point and gradient, though there were mistakes in this work, and some failed to recognise the need to find either one or both of these results. The midpoint was often shown on the diagram with no working.
There was reasonable success in moving from the gradient of *BD* to that of *AC*, but -1.5 and 1/1.5 were common mistakes.

It was not unusual to see equations attempted using 1.5 as the gradient or either *B* or *D* as a point on the line. Many found the equation of *BD* and then assumed that the constant term would be the same for the perpendicular line. Those who did find a correct equation did not always transform it correctly to give the required form. Only the strongest students gained full marks.

Question 24

Some students did not recognise the need to use calculus, tending to substitute 3 in to the expression for *s* or trying to solve the cubic equation formed by putting *s* = 3. A minority tried to apply speed = distance /time by dividing through by t.

Those who used calculus invariably scored the first M1. Some stopped the calculus there and tried to solve *v* = 3, encouraged by the sight of a quadratic equation.

Those who differentiated twice usually scored full marks, and many managed this.

In general, a clearer understanding of the links between displacement, velocity and acceleration is needed.

Based on their performance on this paper, students should:

- Know the difference between compound and simple interest
- Show clear working at all times
- Learn circle theorems with the correct working and not shortened forms or abbreviations
- Work on probability, knowing when to use decimals and fractions and when to use the total of probabilities is 100%
- Practise the cosine rule and get the order of operations correct
- Know that if a questions says ‘factorise fully’ they should look for all common factors to be taken outside the brackets.
- Improve their knowledge of use of the calculator
- Practice non-calculator methods

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