Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2020

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 2H

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November 2020
Publications Code 1MA1_2H_1920_ER

GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Higher Paper 2

Introduction

The paper provided the majority of students with a good opportunity to show their mathematical understanding. Students were reasonably well prepared for the exam with the majority of students attempting every question.

Again, it is clear that students are getting more used to the response type questions with these questions being answered to a better standard than has been seen in previous series.

As has been the case in recent series, students continue to be well prepared for the exam in terms of equipment, with almost no cases of students lacking a calculator, although some need to ensure their calculator is in the correct mode.

Report on Individual Questions.

Question 1

In part (a) of this question most students were able to gain both marks for correctly writing 84 as a product of prime factors. Those who didn't typically gained one mark for either listing the prime factors, rather than writing as a product, or for a correct tree with an arithmetic error. Note that ending a branch with a composite number did not class as an arithmetic error. Including '1' in the prime factors was condoned for the method mark

In part (b) a majority of students were able to gain both marks normally by finding the prime factors of 60 first, although some did list multiples of 60 and 84. However, it was disappointing to see so many Higher Tier students not fully understanding the difference between factors and multiples, and listing factors instead.

Question 2

Part (a) tested students' ability to place values into a Venn diagram. The mark scheme awarded marks for correct regions. 1 correct region gained one mark, 2 correct regions gained two marks and all regions correct gained full marks. Most students were able to score some marks, with a large number getting at least two marks, for 2 correct regions. It was quite common to see the outer region missing altogether.

Part (b) allowed students to carry though mistakes in part (a) for their probability. A majority got at least one mark for a partially correct fraction with a good number gaining both marks for a fully correct probability.

Question 3

The first problem question on the paper and one that was generally answered well, with all marks being awarded. In the most common approach students had to first work with the ratio to find the number of small and large tins. Having found this they needed to find the number of boxes of each by dividing by their capacity of tins. The final step is to find the number of large boxes as a percentage of the total boxes or find how many large boxes 30% of the total is and compare this to Carlo's statement. If students did go wrong it was normally in the final two steps, with most students getting to the number of small and large boxes, but in some cases not then knowing what to do with these values.

Question 4

The cubic graph question was answered very well in both parts, with students obviously using their calculators to good effect. Where marks were lost it was often due to students getting confused between cubics and quadratics, therefore filling in the table using symmetry rather than calculating values, and often attempting to draw parabolas. There are a number of students who are unsure as to what a graph is and who draw a line of best fit as if completing a scatter diagram.

Question 5

This question was answered well by the majority of students and two marks were typically scored. Where this wasn't the case it was often down to students clearly not understanding trigonometry at all and using a mixed method. A number also mis-labelled their diagram and ended up trying to use cosine rather than sine. An answer of 94.2 was seen on several occasions, apparently coming from the calculator being in radians mode; students should ensure they reset their calculators at the beginning of an exam.

Question 6

Many students struggled with this question, and for a number of reasons. Some clearly did not understand that the vectors needed to be multiplied by the values, and some of those who did were unable to. Many also struggled with the negative combined with a subtraction on the second vector whilst others thought the vector with the multiple was a mixed number and proceeded to 'convert' it to a top heavy fractions. There were also a number of students who lost the accuracy mark due to incorrect notation, giving their answer as a fraction.

Question 7

The last of the common questions found most students being able to gain some credit. A good proportion of students realised that the first step was to use Pythagoras' Theorem to find the missing length of the right-angled triangle. However, to this end there were many students who used Pythagoras' Theorem incorrectly, adding rather than subtracting. The third process mark was available then for any student, even those unable to find the missing length, and it was good to see many examples of good exam technique to access this mark. Stating or using the correct formula for the area of a quadrant was all that was required and it was awarded to many students. The demand in the question asked for students to show all of their working and it was pleasing to see this instruction followed by this cohort.

Question 8

This reverse percentage question was generally answered poorly, with a large number of students simply finding 5% of the sale value and adding on, thus dealing with at a percentage increase rather than a reverse percentage. Those who gained the method mark for a correct method almost always then gained the accuracy mark as well.

Part (b) was a compound interest problem, made slightly more difficult due to the two different rates of interest. It was pleasing to see that the vast majority of students attempted the question using efficient multiplier methods rather than the more long-winded build up methods that often lead to more mistakes. Some students did struggle with the rates being non-integer and therefore multipliers such as 1.24 and 1.17 were common mistakes. There were a number of students who lost the final mark as they gave their final answer as the interest only, and thus did not answer the question asked. Students need to be reminded to read the question carefully.

Question 9

It was really pleasing to see so many good responses to this question. Most were able to recognise both errors, but almost all finding at least one. Here the two errors were in the plotting of the median and the upper quartile. To gain the marks it was not sufficient to simply state they were plotted wrong, but students had to explicitly quote figures relating to the error.

Question 10

This question, assessing basic algebra, was not answered particularly well. In part (a) many students gave incorrect answers such as 0 or $\frac{1}{m^2}$ therefore effectively raising to the power 1.

Part (b) was answered slightly better with more students gaining the single mark on offer. However, many tried to expand before simplifying and therefore went wrong. Students should be reminded that the number of marks on offer give a good indication to the amount of work required.

In part (c) with there being two marks available we saw more students gaining some credit. Many students did not understand the 3rd law of indices so didn't score, but those who did typically got the last two terms correct, but struggled with the numerical term, often giving an answer of 3 or 9 rather than 27.

Question 11

This problem relating to the product rule for counting was answered very well by a good number of students, with many getting the value of 6 and drawing a suitable conclusion. Those who went wrong normally used addition rather than muliplication to find the number of combinations. There were a good number of students who were able to pick up one mark for a correct start to the process such as 5×8 or $240 \div 5$ or $240 \div 8$, but then went no further.

Question 12

Students were often able to gain one mark in part (a) for a suitable method to find the gradient, although too many students divided the change in x by the change in y rather than the other way round. Unfortunately, too many students, even after getting an answer in range, missed the negative sign from their gradient and therefore lost the second mark. Part (b) was less often awarded any credit. In many cases students talked about the relationship between variables, or correlation rather than the interpretation of the gradient as a rate of change.

Question 13

At the point where the more demanding topics started, there was a notable drop in the quality of responses. Although a decent proportion of students were correctly able to apply the Sine rule, many simply didn't know what to do and we saw a mixture of those attempting to use right-angled triangle trigonometry and Pythagoras' Theorem, and those who tried to use the Cosine rule.
Of those who correctly identified the Sine rule there were a number who were unable to move from the initial substitution to the point at which side AB could be calculated, and further practice of the manipulation of algebra would be beneficial.

Question 14

This problem required students to first set up an equation based upon the areas for the two squares. This equation initially appeared to be quadratic, but simplified to a linear equation. It was in this first step that most students started to struggle. In many cases those who attempted to form an equation did so with one involving lengths rather than areas, and so were unable to score. Likewise, a large number of students attempted to guess values and proceeded with a trial and improvement method, normally with little or no success.
Those who were able to form a suitable equation normally went as far as gaining at least three marks for getting to the side length of one of the two squares. Those who got this far were split quite equally between those who gave these lengths as the final answer, and those who completed the last step and found the area of **B** to gain four marks.

Question 15

Many students struggled to score with this question, due to stating multiple transformations, and centres should remind students that these questions always ask students to describe a single transformation. The nature of the negative enlargement, caused many students to get confused and quote rotations of 180 degrees. It was also common to see translations combined with enlargements. It is worth noting for centres that students needed to quote the correct type of transformation with either the centre or scale factor to score one mark.

Question 16

This was a harder quadratic sequence than seen on previous papers and proved to be a struggle for most students. The first mark was for the students who were able to find a common 2nd difference and to then start to work with n^2. Most were not able to then progress to the second mark which required them to work with $3n^2$ and get as far as the sequence 7, 9, 11, …

Question 17

This question awarded a single mark for the student who understands the link between the completed square form of a quadratic and the turning point of its graph. Unfortunately, many students do not fully understand this, typically quoting the x coordinate as 12 not -12.

Question 18

This problem allowed a relatively simple first mark, that a good number of students gained, for finding the curved surface area of the larger cone. It was surprising how many did not take into any account the formula that had been proffered, though. To gain any further credit students had to be able to understand that the smaller cone is a similar solid and use the sloping lengths and proportionality to find the radius or diameter of the smaller cone. It was at this step where most students stopped gaining marks. Those who had some understanding often used the proportion $\frac{10}{25}$ rather than $\frac{15}{25}$ and therefore were unable to get the 2nd and 3rd process marks. Some students who were able to complete the entire process correctly, lost the final mark as they gave their answer as a number rather than a multiple of pi as requested in the question.

Question 19

Question 19 was a problem involving an iteration process, and many students struggled with the concept. The first mark on offer was for correctly substituting the given values into the formula, and in many cases this mark was not awarded. Students confused the time with the height and tried to substitute this instead. Those who did get this far often struggled to then complete the process to find K. This often involved either adding 20 to 1040 as a first step or adding 20 to 1200. If students were able to find K they then often went on to gain all four marks, however some only used the formula once rather than twice and therefore ended up losing two marks.

Question 20

Part (a) proved a real challenge to many students, especially those who went down an algebraic path as the question intended. For those who did this the first mark was normally the only one awarded. To gain the second would require an equation to be formed and any fractions cleared. However, a number of students didn't use an algebraic method and went along a path of reasoning. The mark scheme did allow for this providing the reasoning was complete.
Part (b) was typically answered poorly. Very few students were able to start the problem by forming two fractions based on the problem of non-replacement. It was often seen that of the first two marks, either both or neither were awarded. The final two process marks could have been awarded independently of the first two, meaning the student who worked with replacement, but still formed and solved correctly their quadratic equation was able to score the final two process marks. In fact, there were several cases where a student worked with replacement, made mistakes in the forming of their quadratic, but still scored the 4th mark for a correct process to solve a quadratic. The final answer was rarely seen but those who got this far generally understood that the answer could not be negative.

Question 21

In part (a) students were awarded two marks for a correct reflection in the *y* axis. A number of students knew this fact, but lost one of the two marks as they failed to take care and ensure that all key points were hit. Other students were able to gain a single mark for reflecting in the *x* axis, again providing all key points were hit. Unfortunately, the most common response was to see a rotation with the graph drawn in the bottom right quadrant.
Part (b) was again a difficult question for the vast majority of students. Typically, some element of substitution, normally of the value 3, into the given quadratic was seen and gained no credit. Very few students understood the effect of the translation on the function and therefore a correct response was rare. Simplification was not required, but some students did attempt this, and got it wrong, and this resulted in them losing a mark.

Question 22

The unstructured nature of this Grade 9 problem caused issues for many. However, it was really pleasing to see so many students attempting to draw diagrams to help them structure their response. Those who did often then started the problem by finding the gradient of the tangent and gained the first mark. In fact, a good number were able to find this gradient and the perpendicular gradient, and in a good number of cases the complete equation of either the tangent or the radius. This resulted in students gaining one, two or three marks. Some students also picked up two marks for a complete process to find the length of the chord between (−20, 0) and (0, 10) e.g. $\sqrt{20^2 + 10^2}$.
Very few students were then able to take the next step to find either the *x* coordinate of the point of intersection of the tangent and the normal or the length or *r*. This meant that a complete equation was rarely seen.

Summary

Based on their performance on this paper, students should:

- ensure they read questions carefully so they answer the question being asked.
- make sure they understand key terms like multiple and factor fully
- continue to use efficient calculator methods on a calculator paper.
- use formulae that are provided within a question
- further practise questions involving vectors
- have more practise at setting up equations from problems.
- include working out to support their answers, particularly in questions that state “You must show all your working”.

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