Examiners' Report
Principal Examiner Feedback

Summer 2022

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

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

Introduction

It was very pleasing to see that, despite the last two years disruption, students were well prepared for this exam and most were able to attempt the majority of questions, indicating centres are continuing to get their entry strategy correct.

Students seemed to be well equipped, especially with calculators and so none seemed to be impeded on those questions where one was required. Although, some students do need to improve on their use of a calculator.

Report on individual questions

Question 1

The first question on the paper assessed some basic algebra skills. Part (a) assessed the third law of indices and was generally answered correctly. The most common wrong answer being to add the index numbers rather than multiply.

In part (b) students had to expand a pair of single brackets and simplify. Most students were able to gain at least one mark, for expanding one bracket correctly. Errors tended to come in the collection of terms, and in particular the x terms, often leading to $18x$.

Part (c) was a factorisation question looking for the student to bring two terms out of the expression. A good proportion of the students scored at least one mark for a suitable partial factorisation of the expression, commonly taking out the factor of $3x$ rather than $3x^2$. There was however, a pleasing proportion of students that gained both marks for the correct factorisation.

Question 2

This description of a translation was, unfortunately, not answered as well as would be expected. Many students did not properly read the question and assumed the transformation was going from left to right, and hence had the wrong vector of $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$. It was also disappointing to see how many students were unable to give the correct transformation of translation.

Question 3

Students are clearly getting used to this type of question, and it was pleasing to see so many scoring both of the marks. There are misconceptions that persist, and was still quite common to see '80.5' as an incorrect lower bound, and '90.4' for the upper bound.

Question 4

Part (a) was the first problem question on the paper and was looking for students to compare the people per unit area at two festivals. To be able to do so students had to first find the area at one of the festivals. However, students could gain the second and third marks even if they were unsuccessful in finding this area. These two marks were for finding the area per person at one or both festivals.

Part (b) required students to understand the mistake made in the unit conversion. To gain the mark students needed to explain that, for the conversion from cm^2 to m^2, the conversion factor is 10000 or 100^2. This was done with varying degrees of success with a good number able to work with the correct conversion factor, often showing the correct conversion for $3m^2$ to cm^2 or $300cm^2$ to m^2. The most common incorrect answer was to show that $300 \times 300 = 90,000$.

Question 5

This problem required students to work with coordinates and a ratio to determine the coordinates of another point. A good number of students were able to gain credit on this question, with many gaining all 4 marks. Those who didn't score fully often only went as far as finding the vertical and horizontal distances, but then didn't add these onto the coordinates of *L* or *M*. Another common error was to use the ratio incorrectly, typically dividing by 3 and multiplying by 2, as was finding the equation of the line *LMN*, which could still gain P1 for the values of 8 and 7 within the gradient.

Question 6

This is a standard depreciation question and was generally answered well by most students. Common errors were students working with simple interest, which normally meant they were able to score the first mark for finding the decrease for one year. The other common error was to divide by 1.04 rather than multiply by 0.96. In this case they were not able to gain any credit at all. Those who had a correct method and gained 2 marks almost always gained the 3rd mark. The minority who didn't failed to gain this mark because they didn't use correct money notation of 2 decimal places or used the 'long way round' method by subtracting 4% year after year and so lost accuracy.

Question 7

This problem question required students to compare different volumes of petrol in different currencies. There are many approaches that could be used to answer this question.

Most students were able to score some marks. The most commonly awarded marks were those for converting volumes and for converting currency. It was often the third mark to get to the comparable figures that students struggled to gain. One common error was confusion with the currency conversion e.g. $27 \div 0.85$ instead of 27×0.85.

Question 8

Another familiar question, and another answered well by many. A significant number of students did struggle, and it seemed it was the denominator of the fraction including the fractional power that caused the issues. They could gain a single mark for a correct partial evaluation, but it was common to either see no marks or both marks.

Students need to make sure they are able use the power button correctly on their calculators so they are able to process complex calculations. There were many instances where just the answer was written down which lost possible marks for a partial evaluation. 1.43 was often seen as the cube root was taken of everything. Also 7.5 was multiplied by $\frac{1}{2}$ rather than to the power. Another common incorrect answer was 1.427... which came from taking the cube root of the whole fraction rather than just the denominator.

Question 9

This problem required students to use the given pressure formula to first find the area and then subsequently the length of the base of a cuboid. Most students were able to gain the first mark for substituting the force and pressure correctly into the formula. Unfortunately, many were then unable to rearrange the formula correctly to find the area. This meant that although they then divided by the width they couldn't gain the second mark as the process to find the area was incorrect. That said, there was still a high proportion of students who were able to complete the process correctly and gain an answer of 0.8 for 3 marks.

Question 10

This three-part question challenged students understanding of box plots. Part (a) dealt with the proportionality of box plots and like with many response questions, students often struggled to articulate themselves. To gain the mark in this question students had to explain that the difference between the quartiles represents 50% not just LQ = $\frac{1}{4}$ and UQ = $\frac{3}{4}$

Part (b) required students to draw a box plot. Students performed very well, the vast majority gaining 2 marks.

In part (c) a comparison of distributions was required. This is again a familiar question and most students were able to get at least one mark for a correct comparison of either the median or the spread. Most students continue to struggle to gain both marks as they are unable to contextualise these comparisons, misunderstanding what the median and range/IQR actually tell us. Other errors included the word 'average' used instead of 'median' and values being stated without comparison. Other incorrect answers saw students comparing the quartiles or the highest and lowest values.

Question 11

Inverse proportion is a topic that many students find difficult. The students who understood that this was inverse proportion rather than direct proportion, typically did well and gained all three marks. The remaining students struggled to gain any marks, normally dividing 14.5 by 13 or 6 as a first step, and were then unable to get any further. Another common error was to try a 'build up' method, e.g. recognise that if 6 workers take $14\frac{1}{2}$ days then 12 workers will take $7\frac{1}{4}$ days but they were unable to get to the time taken for 13 workers.

Question 12

This question was answered better than it has been on previous papers, with many students understanding the need to rearrange one of the equations, and in most cases being successful to some extent. The first mark could be gained by correctly moving one of the variables in either equation, or by correctly scaling one of the equations by multiplying or dividing by 5. To gain both marks the equations had to be manipulated enough for a comparison of coefficients to be possible, and for a comparison to be drawn – this was generally done well with the most common incorrect comparison being to state that the gradient was 10 when both equations were in the form $5y = 10x$ ...

Question 13

A higher tier enlargement, and one generally completed well. Many were able to deal with the negative scale factor and correctly complete the transformation. There were a significant number of students who were unable to and either mistook the negative for a fractional enlargement and made the shape smaller or ignored the negative altogether and enlarged the shape by a scale factor of 2.

Question 14

Petersen's Capture-Recapture method is one that is becoming familiar to students and as such most were able to start this problem by providing a suitable ratio for one mark. Many though were unable to form this into a correct equation, with most getting one of the fractions upside down, or struggling to manipulate the equation to correctly find the estimated number of fish. That said, a good number of students were able to correctly rearrange the equation to gain an answer of 1220 for three marks. Students should refrain from rounding numbers to 1sf, simply because they see 'estimate'.

Question 15

Many students struggled to start this problem. There were 2 main methods to solving this problem. The first method was to use the 2 ratios to form an equation, which could then be solved. This is the method that most tried to attempt but struggled to combine the different parts. The second more efficient method was to compare 12 : 10 with 13 : 11 and realise this means the £1.50 is worth one part of this ratio.

Students looking to earn the higher grades need to practice more with using equating ratios to form equations.

Question 16

This Venn diagram question allowed most students to gain at least some credit. However, this example was challenging so that only a minority of students were able to score all 4 marks. The region most often incorrect was B only due to the fact it was the region that required the most working out. 0 was often omitted which cost students a mark unless they had the other 7 sections correct.

Part (b) required students to pull values from the diagram. Many students scored 1 mark for a correct numerator or denominator (more commonly numerator). There was a follow through on this question, which meant that students could gain credit for pulling the correct values from their incorrect Venn diagram. Many students did not understand the 'given uses A' and had 100 as the denominator.

Question 17

This volume problem required students to work with a hemisphere and a cone. The first process mark was for a correct method to find the volume of the hemisphere or for a correct expression for the volume of the cone. Many students were unable to get past this point for 2 reasons. Firstly, they didn't halve the volume of the sphere to find the volume of the hemisphere, or they used 'y' as the height of the cone, which was unacceptable as 'y' was the height of the overall solid.

The second mark was for linking the 3 elements of the problem correctly. This was sometimes seen as an equation, but most commonly seen in multiple steps, normally subtracting the volume of the hemisphere from the total volume, and then equating to the volume. The third mark was for correct manipulation to find the height of the cone and was typically seen again in multiple steps of working. Those who correctly found the height of the cone scored 3 marks.

It was quite common to see students use 120 instead of 120π, but this was dealt with as a misread as per the general marking guidance. Common incorrect methods worth no marks were to use 7 or 4.5 (without showing where 4.5 had come from) as the radius.

Part (b) required students to understand the inverse proportional relationship between radius and height when the volume is constant. Many were able to do so, and thus gained this mark.

Question 18

This trigonometry question was again a familiar style and provided access to marks for a good number of students. It required students to first use the Cosine rule to find a missing length, and then the Sine rule to find another missing length. If a student didn't score the first mark for the use of the Cosine Rule, they were then unable to gain any further credit. Many who scored this first mark, didn't fully complete this process, often forgetting to square root. However, these students could then pick up the third mark (and therefore a total of 2 marks) for correctly using the Sine Rule for their incorrect value for QR.

Common incorrect methods seen were attempts to use Pythagoras and SOHCAHTOA.

Question 19

Part (a) was a simple substitution mark which many were able to score. Some students were put off by the function notation and didn't attempt the question.

In part (b) students were required to understand function notation clearly and realise in this case they needed to find the inverse of $g(x)$ before then substituting that into $h(x)$. This question posed a number of challenges. For many the notation alone was the stumbling block and they tried to put $g(x)$ into $h(x)$ and then find the inverse. Others struggled to find the required inverse function. However, these students were able to gain the second mark for correctly substituting their inverse function into $h(x)$. A few of those who gained method marks, were then unable to gain the accuracy mark as they left it as a fraction within a fraction, rather than simplifying fully.

Question 20

This circle theorem question proved to be challenging to many. There were 3 routes through this problem. The most common start was to find *BAD* and then *BCD* before moving into triangle *CDE*. Alternatively, a number of students found *BAD* and then *ABE* using angles in a triangle before finding *ADC*. The third method was to find the reflex *BOD* before moving to *BCD*. All of these methods were seen regularly, and successfully. However, many students struggled with remembering their circle theorems and either thought opposite angles in a cyclic quadrilateral are equal, or incorrectly thought that *OBCD* was a cyclic quadrilateral. Reasons were frequently not accurately stated; correct geometric terms must be used.

Question 21

Part (a) of this question required students to understand the effect of a reflection on a function and then reflect the graph in the correct axis. As is expected by this stage of the paper, this was very challenging for a great number of students. Some clearly did understand a reflection was required but didn't complete it with sufficient accuracy to gain the mark. A free-hand curve was acceptable, but students need to ensure key points are plotted correctly.
Part (b) was more in-depth as it required a thorough understanding of the graph of $\tan x$ and its key intercepts. It also required students to understand the effects of a translation on a function. Those who identified a horizontal movement of 270 were able to score one mark, as were those who applied the correct vertical translation to the function. Very few students were able to score both marks.

Question 22

This demanding question required students to solve two quadratic inequalities and then select the correct critical values to satisfy both. The mark scheme has 2 sets of 2 marks, a method and an accuracy, for the solving of each quadratic inequality. Students could gain the accuracy mark for both by drawing a suitable diagram, either inequalities on a number line, or a sketch of the quadratic with the correct regions drawn. However, to score the final mark students needed to state both linear inequalities that satisfy both quadratic~~s~~ inequalities.

A large number of students were able to gain one mark for a method to solve the first quadratic, normally by factorising, but typically didn't correctly state the solutions. The second quadratic proved much more challenging. Many were unable to factorise, and thus chose to use the formula. The problem with this was their substitution was often inaccurate, either with incorrect values or with missing brackets.

Summary

Based on their performance on this paper, students:

- should improve their use of calculators in general, but in particular when completing complex calculations involving powers, or fractions.
- learn correct geometrical terms and use these when giving reasons in geometry questions.
- work on more efficient methods when working with percentages when a calculator is available, and refrain from attempting to use 'non-calculator' methods.
- ensure they do not round prematurely in multistep calculations, as it often leads to answers outside of the acceptable range for the accuracy mark.
- check answers make sense in the context of the question.

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