Examiners' Report
Principal Examiner Feedback

November 2021

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Higher (Calculator) Paper 3H

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GCSE Mathematics 1MA1
Principal Examiner Feedback – Higher Paper 3

Introduction

Most students who sat this paper seemed to have been entered appropriately for the higher tier. There were many excellent scripts which contained fully correct answers to most questions on the paper. Students' work was generally clearly and logically presented. Where fully complete and correct solutions were not seen, examiners could often award some marks for a student's working.

The paper gave the opportunity for students of all abilities to demonstrate positive achievement. All questions were accessible to some students. In a few cases of questions later in the paper, a significant number of lower attaining students made no attempt to answer the question though there were not many scripts with a very low total number of marks. Questions 1 - 3, 6 - 8 and 11 were answered well by most students. Questions 14, 17 - 20 and 23 attracted fully correct solutions from a smaller proportion of students. Ratio questions 2 and 14 appeared to challenge a significant number of students at the ability levels they were aimed at and students are well advised to get more practice with these types of question.

REPORT ON INDIVIDUAL QUESTIONS

Question 1

Most students found this to be a good start to the paper and scored at least 3 of the 4 marks available. Nearly all students gained some credit for their answers.
For part (a), it was unusual to see an incorrect response but where the answer was wrong it was usually because a student had written (18, 100) instead of (100, 18).

Part (b) of the question was answered less well but nevertheless the majority of students gained the 2 marks available for giving an answer in the range of values accepted. Where this was not the case students usually scored a mark for either drawing a line of best fit or for drawing a vertical line from 370 on the horizontal axis.

In part (c) students could usually make a correct decision, that is "no" and give an acceptable reason. The most common accepted reasons were equivalent to stating that the outlier was an anomaly or that there was positive correlation when the outlier was ignored.

Question 2

This question was a good discriminator between lower attaining students taking this paper. Most students realized the need to work with the ratio 9 : 2 : 1 in order to calculate the weight of cheese in 6000g of potato cakes and scored at least one mark finding the total of 9, 2 and 1. However, a surprising number of students misguidedly divided 6000g (of potato cakes) by 175g (of cheese) as their first calculation. These students rarely realized their error and so could score no marks for their attempts to answer this question. On the other hand a considerable proportion of students scored full marks for a fully correct answer. Some students assumed that the cheese was sold in 175g packets and so rounded up the 5.71…lots of 175g to 6. These students were awarded full marks for an answer of £13.50. Nearly all students gave answers rounded to the nearest penny.

Question 3

A high percentage of students showed a good understanding of standard form.
In part (a) nearly all students were able to convert from a number in standard form to an ordinary number. A slightly smaller proportion of students could convert from an ordinary number to a number in standard form which involved a negative index.
Calculations in part (c) were usually carried out successfully but a significant number of students scored only 1 mark out of the 2 marks available because they did not convert 4730 to standard form or because they made an error in the conversion. The former error could have been avoided with a more careful reading of the question.

Question 4

A good discriminator, this question attracted many fully correct solutions but also many attempts which were awarded each of the marks available. There were a number of possible routes that students could take to solve the problem. By far the most common route taken was for students to work in litres and so to start off by working out the number of 8 litres in 2400 litres. Most students then showed the intention to work out the time for company A to fill the tank by multiplying 300 by 1 minute 40 seconds. These students usually scored at least 2 marks for their working. However, a significant number of students did not change their 1 minute 40 seconds accurately to minutes and examiners saw figures such as 1.6 and 1.40 used frequently. This inevitably led to otherwise successfully completed answers scoring 3 of the 4 marks available.
About one third of students obtained full marks for their solution to this question.

Question 5

This question rewarded students for finding the next term of the Fibonacci sequence but it also rewarded those students who formulated an equation to solve, even if they used an incorrect fifth term for the sequence. The most common mistake for the fifth term of the sequence was to give the term as "7*a*" instead of the correct "8*a*". Unfortunately, many students used only the four terms given to form an equation instead of the five terms demanded in the question. Again, a more careful reading of the question might have led to more students obtaining some marks for their answers.

Question 6

In part (a), nearly all students used the result that the probabilities in the table should add to one and so scored the mark for showing that the probability of taking a green or pink counter is $1 - (0.05 + 0.15)$. Fewer students were able to go on to complete the table successfully, many giving two probabilities which were not the correct 0.5 and 0.3 but added to 0.8.

Part (b) was answered well and and a majority of students scored 2 marks for a fully correct answer which they usually obtained by dividing 18 by 0.15. Few students used a method which involved finding the number of counters of each colour then adding them.

Question 7

This question was done well by a majority of students who were awarded all 4 marks. Some students found the area of the triangle and/or the area of the quadrant but could not complete the solution to get full marks. It was encouraging to see that nearly all students could recall how to find the area of a circle.

Question 8

In this question the great majority of students sketched a straight line from the origin to score the mark available in part (a).

Part (b) was less well answered with many students drawing another straight line but this time with a negative gradient. This did relay the idea that as the value of x increases then the value of y decreases. However, it did not accurately represent the inverse relationship and could not be awarded the mark available.

Question 9

For part (a) it was disappointing to see so many students use a directly proportional relationship and give an answer of 6.25 hours thereby implying that it would take 15 people longer than it would take 12 people to clean the same number of cars. There was little evidence of students applying a common sense check to their answers followed by a review of the processes applied to get their answer.

Part (b) was not generally answered well with examiners accepting any statement which might reflect that the time might change and which did not contain any contradiction. Further reasoning was not always required in order to access this mark. So, for example, “the time might increase” was accepted whereas it might have been preferred to have seen “if people worked at a slower rate, the time would increase”. However, examiners did not accept definite statements such as “the time will increase” without further qualification, so “the time will increase if they work at a slower rate” was accepted. Too many students had not properly understood the question and compared the amount of time taken by 15 people with the time taken by 12 people. This could not be accepted for the award of the mark.

Question 10

This question involving similar right-angled triangles was well answered by a minority of students. There were two main routes used by students who scored full marks. Some students used a scale factor together with Pythagoras’ rule while other students used trigonometry to find the size of angle B then went on to use trigonometry again to find the length of side CB. Of those students who could only be awarded partial credit for their attempts, most scored the mark for using Pythagoras’ rule correctly to find the length of EB. Unfortunately, they often then used a scale factor of 1.5 instead of 2.5 or failed to make any further progress.

Question 11

About a half of students scored both marks on this question. Where only 1 mark was scored, it was usually for the lower end of the interval and where the student had used 6.4 for the upper end of the interval.

Question 12

This question was not well answered and only about a quarter of all students scored one mark or more. Students who scored one mark usually scored this for giving the correct value for *n*. In general, little working was seen in the working space so it was rare for examiners to be able to award the process mark where both answers were incorrect.

Question 13

This question was generally not well answered. Many students did not attempt the question and there were many attempts where students started by calculating the gradient of the line joining point *A* to point *B*. Where students were more successful, there were some well presented and clear solutions showing the derivation of two equations together with their solution, usually to find the length and width of each rectangle. These students usually completed the question and scored the full 5 marks.

Question 14

Most students could make some progress with this question and gained a mark for finding the sum of the parts of each of the given ratios, 2 : 3 (=5) and 9 : 1 (=10). However, far fewer students could get any further. Students often tried to apply the fact that Olivia and Jessica had half as many sweets as Fran and Gary but then doubled the numbers relating to the wrong pair. Examiners were surprised that not more students assigned a given total number of sweets to one of the pairs, for example 100 sweets to be shared between Fran and Gary. Students could then have worked with this to find the number of sweets each student gets before writing them as a ratio in its simplest form.
Very few students attempted the question using algebra and where they did, they seemed to get confused because they used the initial letters of the names in their working.

Question 15

Higher attaining students often scored full marks for their answers to this question. Where tangents were drawn they were generally accurate and allowed them to be used to get a good estimate of the gradient. However there was a significant number of students who used the coordinates of the point on the curve at $t = 12$ and who simply divided the y coordinate by the x coordinate ($17 \div 12$) to get the gradient. Some of these students had already drawn a tangent to the curve at $t = 12$.

Question 16

Many students gave a concise, clear and accurate algebraic argument to score full marks for their answers to this question. Lower attaining students often made errors in the manipulation of the equations involved. It was common for examiners to award 3 marks for students completing the algebra correctly but not the fourth communication mark because the student had not made a statement to conclude their findings.

Question 17

It was relatively rare to see a fully correct solution to this question together with the award of 4 marks. However, many more students were able to access some marks for expressing the proportionalities between *x* and *y* and between *y* and *z* using symbols, by substituting the 2 given values in their equations and in some cases for getting as far as writing down an equation which would enable them to find the constant of proportionality for the relationship between *z* and *x*. Nearly all students used the same constant of proportionality for the relationship between *x* and *y* as they did for the relationship between *y* and *z*. This was condoned as far as it could be though students should be advised to use different constants in cases like this.

Question 18

There were many students who gained some credit for their answers to this question on vectors and a significant number of answers were fully correct and concisely presented. Of those students who gained some marks but who were not successful in getting a correct expression for $\overrightarrow{DE}$, many were awarded 2 marks for a correct expression for either $\overrightarrow{OD}$, $\overrightarrow{DB}$ or $\overrightarrow{BE}$ in terms of **a** and **b**. Less successful attempts at answering the question often involved the incorrect use of the ratios given, for example quarters and thirds were often seen instead of fifths in expressions for $\overrightarrow{OD}$, $\overrightarrow{DB}$ and $\overrightarrow{BE}$.

Question 19

This question was often not attempted though there were some excellent responses from higher attaining students taking this paper. However, it was clear that most students did not have a clear understanding of the notation used. Many students who did have some understanding used the incorrect relationship $3610 = k \times 4000$ and examiners were left wondering whether these students had thought they were dealing with successive years and not times which were 2 years apart. Examiners were generally unable to award these students any marks.

Question 20

This question was often not attempted but it also proved to be a good discriminator between the highest attaining students. Of these students, a good number were able to gain one mark for $\left(\frac{1}{2}\right)^n$, the probability of getting no heads (or all tails) in *n* throws or of getting no tails (or all heads) in *n* throws. Only the best students were able to get the fully correct expression $1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$ or equivalent for their final answer.

Question 21

A good number of students demonstrated how to estimate the area under the curve by using 3 trapeziums though some students used only one or two trapeziums.

Unfortunately, a large number of students were unable to access full marks for their answers because they used incorrect y values for $t = 3$ and/or for $t = 4$. Most students did gain some credit for a correct expression for at least one of the areas, usually for the trapezium between $t = 1$ and $t = 2$. It was encouraging to see students using the formula for the area of a trapezium rather than splitting the trapezium into a rectangle and triangle. These students were usually more successful in terms of the number of marks they got for their answers.

Answers to part (b) were often correct though there were a significant number of answers stating that the area represented either acceleration or speed. Units of measurement for the distance were not required but where these were given they were invariably correct.

Question 22

There were some excellent clear and concise answers to this question leading to the correct answer $\frac{1}{x(x+4)}$. Many students were able to show that to divide the algebraic fractions, inverting the second fraction and multiplying it by the first fraction was needed. Fewer students realised the need to factorise the denominator of the first fraction and much fruitless algebra was seen with students frequently multiplying out expressions.

Question 23

There were a small number of excellent answers to this question which was aimed at the best students taking this paper. These students invariably use the sine rule together with the result that $\sin y = \sin(180 - y)$ to prove the given result and examiners rarely saw the alternative approach using areas of triangles.
An error seen in many responses was to treat the triangles *ADB* and *ADC* as similar or congruent triangles. This is clearly not the case. Many other students tried to use the sine rule on two different triangles and wrote down incorrect statements such as
$\frac{BD}{\sin x} = \frac{DC}{\sin x}$

In Summary
Based on their performance on this paper, students should:

- carry out a common sense check on the answers to calculations, so for example in question 12 you should expect 15 people to take less time than 12 people to clean the same number of cars.
- practise less straightforward problems which involve working with ratio
- read questions very carefully in order to fully understand what is being asked for
- improve your skills in dealing with units of time and conversion between these units
- take care in interpreting the scales used on the axes in questions which involve the use and interpretation of graphs, for example question 21(a) on this paper

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