Examiners' Report
Principal Examiner Feedback

Summer 2018

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

Students seemed well prepared for the exam and in general were able to answer the questions in the allotted time. It was good to see students attempting all questions, and even though there were incorrect responses, a good number of students were able to score some marks on the higher grade questions.

From the evidence seen it is clear now that almost all students had access to a calculator although some seemed to lack a pair of compasses.

Compared to last summer, students seemed better equipped to attempt AO3 questions and as such there was good evidence of working that allowed markers to award method and process marks even when the final answer was incorrect.

Report on individual questions

Question 1

In part (a) all students scored full marks by using the first law of indices. When wrong answers were seen they were when students multiplied the indices rather than adding.

Part (b) provided evidence that students struggle most with the 3rd law rather than the others. When mistakes were made it was typically with either the 125 or the n^3 whereas most students got the p^9 correct. Commonly a 15 was seen where students multiply the 5 and 3, or many students don't really understand that n means n^1 so the sight of n rather than n^3 following the removal of the brackets was common. Thus, $5np^9$ was a common incorrect response.

Part (c) was answered better than (b), and the use of a fraction in the question rather than a division sign may have helped students. The common errors occured when students subtracted 4 from 32, or tried to divide the index numbers. In both parts (b) and (c) many students scored at least one of the two marks for two correct terms in a single product.

Question 2

Most students were able to score at least one mark in part (a), normally for two correct factor trees, although they could gain the mark for listing multiples of 40 and 56, or quite often a correct Venn Diagram was drawn. Although a large number of students gained full marks, a significant proportion chose the HCF (8) rather than the LCM.

In part (b), a good number of students were able to gain the mark here usually giving the answer as 60 rather than working directly with the prime factors only (although this was seen). However, many students gave answers such 2 or 4.

Question 3

This question differentiated well, with the full range of marks awarded. Those who scored zero normally failed to show any method for finding the gradient, although in some cases a triangle was drawn under the graph, but then the height and base were incorrectly read off. There were cases of one mark being awarded for either a correct method to find the gradient, or for correctly identifying the y-intercept. It is worth highlighting to centres at this point that many students worked out the gradient as -3, therefore showing they don't truly understand what it means for a linear graph to have a negative gradient. Students scoring two marks generally gained these from substituting their gradient into y = mx + c, or quite commonly for incorrect notation, such as L=3x − 6 or just 3x − 6. Not surprisingly at this grade a good number of students scored the full 3 marks.

Question 4

The first of the problem solving questions was answered well in general. Most successful students followed the processes in the order set out in the mark scheme. It is a little disappointing to see students making arithmetic errors on questions such as this, especially as they have access to a calculator. Typically, students were able to gain the first three marks for finding 10200, 6375 and 3825. A few thought 10% of 8500 was 85, and many didn't realise they had to add VAT on and subtracted 6375 from 8500. At this point it was split, some were unable to form a suitable ratio, 10200 was frequently part of an incorrect ratio. Many had a correct starting ratio ie 3825 : 6375, but very often students were unable to fully simplify it, often ending with 51 : 85, and thus failing to gain the final accuracy mark.

Question 5

Almost all students were able to score at least one mark for two correct figures (typically positive x values), and a good number scored two marks. It is clear however that a large proportion of students are unable square negative numbers on their calculator and centres should focus on this. Good advice with these questions is to encourage students to check they can get the values already given in the table. Some students showed knowledge of the symmetry of a quadratic equation but used this incorrectly by assuming that the symmetry must be in the middle of the table.

Once students gained a mark in part (a), almost all then went on to score in part (b). It was pleasing to see that most students recognised that this was a quadratic function and at least knew that a parabola should be drawn. A number of students did lose marks however for producing graphs that included line segments, normally seen with a graph with a "flat bottom". There are still students who try and plot their calculated values even if they don't fit on the axes. We would encourage centres to stress to students that if a point doesn't fit on the grid then they should try and recalculate their value.

Most students who were successful in part (c) did so by reading off the intersections with their graph from part (b) and y = 2, although in many cases the latter was either not seen, or was only partially seen. This meant in many cases students only scored one mark for one solution rather than two. There were a significant number of students who attempted an algebraic response to part (c). This almost always resulted in no marks as their algebra was incorrect, and possibly wasted a considerable amount of time. It is important that students are able to choose the most efficient strategy to solve each question; in this case the instruction to use the graph was given in the question.

Question 6

Another problem solving question, and one that was answered well by many students. Almost every student was able to gain the first mark for finding either the original or new pressure. There were lots of methods that were suitable to answer this problem, and the most common are seen in the mark scheme. One of the most popular was to decrease the 3.5 by 20% (and get 2.8) and then realise that the pressure had dropped further. However, some students misinterpreted this value and stated that "as 2.6 is less than 2.8 Helen was right".

Question 7

This was a really well answered question. Almost all students were able to gain at least one mark for a shape of the correct size and orientation, and a very significant number got the second for also having it in the correct position.

Question 8

Again, this question was answered well in general, with most students gaining at least three marks. It was evident however, that some students made their lives hard by using very inefficient methods. These tended to be students who didn't use a structure such as a two-way table or frequency tree. Having produced a correct diagram, it was disappointing to see a number of students give an incorrect fraction for their answer and thus lose the final mark; most commonly seen was $\frac{3}{60}$. Although a frequency tree or two-way table is the most efficient method of solution, students should be encouraged to write their subtractions in the working space as a single arithmetic slip leads to a lot of wrong numbers and clear working is needed in these circumstances in order to award method marks.

Question 9

This question differentiated well. Most students were able to access the first mark for getting the multiplier for year 1 (1.028). The weaker students then halved this value as the multiplier for year 2 and thus scored only 1 mark. More able students were able to extract the 2.8% from the multiplier and then half this to gain the interest rate for year 2. Many who got this far were then able to gain the third mark for a complete process. Some who calculated 1.4% used 1.14 as the multiplier not understanding that this equated to 114%.

Question 10

It was clear that many students have spent little time working with diagrammatical representations of vectors. Very commonly the vector -**a** rather than -2**a** was drawn, but the most common reason for dropping a mark was by missing the arrow on the vector. When drawing vectors it is essential to indicate direction.

In part (b), it was disappointing to see that even some of the more able students were unable to tackle this question. Many either failed to read off the correct column vectors from the diagram or to multiply **b** by 2. It was very rare to see the vector **a** + 2**b** shown on the grid.

Question 11

Most students knew how to substitute into the function correctly, but many dropped marks as they couldn't evaluate it properly on their calculators, meaning that -0.08 was a very common incorrect answer.

Students generally struggled with the composite nature of the functions in part (b). A good number scored a single mark for finding g(1) = 4, but were then unable to substitute into f(x). Incorrect order of operations saw $4 \times 1^3 = 4^3 = 64$ occur which shows a lack of understanding. The most common wrong approach where students only gained the first method mark was to find f(x) × g(x) or f(x) + g(x).

Question 12

Many students were typically able to gain one mark, usually for recognising the linear and quadratic graphs. However there were a significant number who mixed up all the functions. Pleasingly, over half of all students scored both marks.

Question 13

This was one of the first questions that really separated the most able students from the others. Many were able to score a single mark for finding one correct angle, normally one of the two right angles or for *BCD* = 180 - *y*. That was as far as many were then able to go, as to gain the second mark the process needed to be complete. There were a number of routes students could take but many got lost, either by assuming wrongly that *BAD* was an isosceles triangle, or quite commonly by stating that angle *BDE* was 90°. When students gained two marks, to get the third they had to correctly state the circle theorems they had used.

This part was answered better with many gaining the mark, usually for recognising that either *x* was acute not obtuse, or that *y* was obtuse not reflex. Quite a few used the fact that 200 was too big for a triangle and a small number used opposite angles in a cyclic quadrilateral. Students should be careful with clarity in their answers. In this case, some explanations appeared to have the right idea but did not mention *x* or *y*.

Question 14

This is the first time in this specification that this topic has been assessed. Commonly students read off the distance at time = 5 (28) and then worked out 28 ÷ 5. This obviously gained zero marks. Those who failed to recognise the need to draw a tangent were unable to gain any credit. Typically, those who drew a tangent went on to gain all three marks. Some work needs to be done in centres to recognise when a tangent is needed and when it is appropriate to find the area under a curve.

Question 15

This part was answered well with two marks frequently gained. Errors included getting the probabilities on the last set of branches the wrong way round and making an arithmetic error when subtracting 0.45 from 1.

When students chose to work with products but some added probabilities from the tree diagram instead. Those who found products typically went on to get all three marks although arithmetic errors were again in evidence. It was disappointing to see some students give a final answer that was greater than 1.

Question 16

At this level a significant proportion of students struggled, and this was one of few questions where a good number of blank responses were seem. There were some attempts at linear graphs and also quadratic graphs. However, a number of students recognised this as being the equation of a circle and although they were unable to get the correct radius, they scored a single mark for drawing a circle with centre (0, 0). There were many freehand circles, suggesting that many students had entered the examination without a pair of compasses.

As with Question 5, a number of students chose not to use the most efficient method, despite being given very limited working space and the use of the word 'hence', and attempted an algebraic approach. Of those who tried to use the graph it was common to see at least two marks awarded if not all three. Some students who only scored one mark in part (a) were able to score follow through marks provided their method in part (b) was correct and complete.

Question 17

It was pleasing to see a significant number of students gaining both marks in part (a) for correctly completing the frequency table. Completing histograms from tables, or tables from histograms is an area where improvements are being seen.

Part (b) was a challenge to many of students. Although most students attempted the question and it was rarely left blank, many students found the mean of the midpoints or found the median of the frequencies. Some students were able to gain a single mark for using $\frac{n+1}{4}$. Of those who did this, only some went to obtain the correct value, usually by using areas of the bars. It was common to see students using time rather than people to find the LQ (ie 50/4).

Question 18

Students generally find 3D trigonometry difficult, and that was the case with this question. A high number of students wrongly made the assumption that the base of the cuboid was a square, and tried to use Pythagoras's Theorem to find *AC*. Although done correctly, this was an unnecessary step so did not gain any marks. Some students were awarded the first mark for unambiguously identifying the angle *CAH* on the diagram as the angle to be found.

The students that were most successful showed clear working by identifying the correct right triangle from the cuboid and redrawing it in the working space. Centres should encourage their students to draw "intermediate" diagrams to help them get into a problem such as this.

There were a significant number of students who, rather than using standard trigonometry, used the sine rule either once or twice. Some students again chose inefficient methods by including an extra step, such as using Pythagoras' Theorem to find the length *AH* before using trigonometry.

Question 19

Unsurprisingly at this stage in the paper, many students were unable to gain any marks. However, due to the two part nature of the solution, many who struggled in the process to find the radius, were then often able to then score one mark for their work with surface area.

With the first part of the solution most students who dropped marks did so because they didn't work with the $\frac{1}{4}$, either by dividing the formula by 4, or for multiplying 576π by 4 OR they omitted the π from one side of the equation. Many students then struggled with the manipulation of the formula and were unable to find the value of *r*; in particular a number took the square root rather than cube root as a final step.

Few students managed to arrive at a radius of 12, even if a correct formula was used, as the manipulation of algebra in the rearranging of the equation was generally poor. Many took the cube root too early, or did not know how to deal with the inverse of 4/3. Worryingly, many seemed to think that the inverse of multiplication is subtraction. In the second part of the solution, many gained the third process mark for substituting their value of *r* into $\frac{4\pi r^3}{4}$ Many got no further as they either forgot to find include the flat surface areas or did so incorrectly.

Question 20

Those students who had a good understanding of surds did typically find the mistake and explained it clearly. Some thought the error was multiplying by $2 - \sqrt{3}$ However, many students had clearly used their calculator to find the final answer, and failed to identify the mistake. Giving the correct answer without identifying the mistake made did not gain the mark.

This was typically answered slightly better than part (a), with a good number realising than Sian had made her mistake in the simplification of $\sqrt{12}$.

Question 21

The final question on the paper really tested students understanding of bounds and accuracy although most students made an attempt. Many were able to score the first mark for correctly identifying at least one bound, although the less able students did not consider error bounds at all. Students struggled to find the bounds for mass where the figures given had been rounded to the nearest 5. Getting any bound wrong restricted a student to a maximum of three marks. The other bound that was typically wrong was the width, with many students giving these as 15.5 and 16.5. If a student made two mistakes on the dimensions of the cuboid they often gained no further marks. Of those who got correct bounds for the length, width and height, most gained the second mark for a correct upper or lower bound for volume.

A good number of students were able to gain the third process mark for correctly finding a bound for density with many students understanding that a quotient required LB/UB and UB/LB, although some had the wrong formula and multiplied. Many students got no further than here due to having at least one incorrect bound and this fourth mark being for accuracy.

A significant proportion of those who gained four marks were unable to gain the final communication mark as they either didn't round properly (it needed to be to 2 decimal places or significant figures, not 1), or even if they did, they didn't state the degree of accuracy to which they were working.

Summary

Based on their performance on this paper, students:

- should be encouraged to use the most efficient methods when there is more than one available.

- learn how to use calculators properly, especially in relation to the substitution of negative numbers into formulae that require them to be squared, and in working to a high degree of accuracy, rather than rounding too soon and losing accuracy.

- spend greater time practising new content such as vectors, functions and estimated speed from a distance time graph.

- continue to practise questions targeting AO3 (problem solving questions), and learn to structure solutions clearly.

- use correct mathematical language when giving reasons in questions targeting geometry.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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