Examiners' Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE
In Mathematics A (1MA0)
Higher (Calculator) Paper 2H

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Summer 2017
Publications Code 1MA0_2H_1706_ER

GCSE Mathematics 1MA0
Principal Examiner Feedback – Higher Paper 2

Introduction

The latter third of this paper proved to be too much of a challenge for most of the students. There were significant weaknesses in algebra and in geometrical thinking - typical Higher Tier skills. Successes included question design on a questionnaire, interpretation of scatter diagrams, currency changes and at a higher level, trial and improvement, the mean from a grouped frequency table and the calculation of compound interest. There was some evidence to show that students did not have a complete set of drawing instruments. Students were generally competent at communicating what they did know and could do and the improvement of geometrical vocabulary continues.

Report on individual questions

Question 1

This was generally well answered – most students included a time frame in the question and provided a set of exhaustive, non-overlapping response boxes. Use of inequality signs was rarely seen. Note that "How many days per week?" as a question meant both marks could not be gained.

Question 2

Students overwhelmingly went for 30% of 1295 and rounded their answer. Of those that did understand that the question was about finding 30% of a number given 70% of the number, most could work out the correct answer, although a few left it as 1850, the total number of people.

Question 3

Most students had a correct strategy to determine in which city the boots could be bought most cheaply. They generally used one of two methods: the more popular was to convert the foreign currencies to pounds and compare with £115. The second was to convert £115 to euros and to convert it to Swiss francs so that individual comparisons could be made. As London was the cheapest, this method was a valid one. Students who chose one of these two methods invariability chose London as the cheapest. A few students displayed a complete lack of comprehension and multiplied, for example, the Swiss price by the pound to Swiss franc conversion rate.

Question 4

This was generally well done – most students recognised and stated that the correlation was positive and were able to give an answer within the allowable interval, although there was evidence to show students could not read or use the given scales accurately. Many made a good attempt at drawing a line of best fit, with very few just drawing the diagonal of the grid.

Question 5

This was found difficult by the students. Although a respectable proportion found 30° for the value of x, it was very rare for examiners to award all four marks for a correct answer together with a full set of reasons. Since the most succinct approach had three steps with both alternate and corresponding angles this was perhaps not surprising. Many students were able to pick up one of the marks for reasons – usually by using the correct terminology for describing corresponding angles or alternate angles, although some students did not get this mark because of use of imprecise language such as "alternative". However, it was pleasing to see that "Z angles" has become relatively rare.

Another cause of mark loss was the use of "opposite angles" rather than the correct "vertically opposite angles" - this occurred with one of the more indirect approaches which used the top triangle.

Many students were unable or unwilling to use standard three letter notation for angles – this is important as a clear means of communication when describing angles. Many students sensibly put the size of the angles they had found on the given diagram.

Question 6

Most students could work out the difference in the costs but then stopped at (£)127 because they either misunderstood the question or were unable to carry out a suitable conversion to a percentage. Of those that did understand they had to reach a percentage, a number used a trial and improvement method starting with the (£)552 and finding successive percentages of this amount until they reached a value very close to (£)127. As the answer was 23%, this strategy, in this case, worked reasonably well, but its use should not generally be encouraged. Some students were able to carry out a correct percentage calculation with the (£)425 by calculating 425/552 × 100 = 77, but sadly failed to take the final step of subtracting the 77 from 100. Others expressed the difference as a percentage of the wrong cost (£425).

Question 7

Full marks for this question were rare. Many got one mark for an arc with the correct radius centred on B. Many students either did not understand what to do or did not have the drawing equipment in order to carry it out. Of those who realised they had to draw the perpendicular bisector of AB, most went on to score all three marks.

Question 8

Correct answers to this part (a) were reasonably frequent. However, there were substantial numbers of students who showed a complete lack of understanding of basic algebraic processes. Commonly seen were $5ab + ab = 5a^2b^2$, $6ab - 5g - 2g = 6ab + 7g$ as well as $6ab + 3g$ all displaying basic flaws in understanding that the student should have addressed earlier in their career. Part (b) was generally well answered. Part (c) was also generally well answered although a surprising number of students gave t^{24} as an answer. In part (d) many students scored no marks. It was clear that they did not have an understanding of what factorising meant (unlike part (b)) when the terms were more complex. Many answers had brackets in them – in some cases more than one pair, but the expressions were completely wrong or simply had the number "2" outside the brackets. Others simply ignored or misunderstood the mathematical instruction "factorise" and gave an answer of $6x3y^3$ from adding 4 and 2 and then adding the powers in the two terms.

That said there were some fully correct answers and also some good partial factorisations which scored a mark. One answer which was very close was $2xy(x + 2xy)$, displaying possibly a misunderstanding of the meaning of $4xy^2$

Many students scored no marks in part (e). It was clear that they did not have an understanding of what expanding in this context meant. Answers of the form $w^2 + 10$, $w^2 - 10$, $w^2 + 25$ and $w^2 - 25$ were common. Of those who carried out a correct initial expansion to get $w^2 - 5w - 5w +25$, this often became $w^2 + 25$ or $w^2 - w + 25$ or even $w^2 + 10w +25w$

Question 9

There were many blank responses to this question. This may have been due to a misunderstanding of what was required or to lack of appropriate mathematical instruments. Of those that did score, the bearing from A was more frequently correct, presumably as it could be drawn directly. It was also clear that some students knew what to do but were let down by inaccurate use of their protractor. Some used the wrong scale or put the 90 degrees line along the North line.

Question 10

This question proved to be beyond most students. Some did attempt an algebraic approach but this was not generally successful as they could not cast the problem into the form of finding the solution of an algebraic equation. This was usually because they had no clear idea of what their "x" stood for and how this could be used to express the final amounts Gemma and Betty had and so get a valid equation. For those attempting an algebraic method, $x - 24 = 5x$ was the most common approach, leading to $x = 6$ (sic).

A few students used a trial and improvement approach – if they found the correct final amounts for the two girls and clearly stated this they were awarded three marks and if they went to state the total, all four marks

Question 11

There are two sensible strategies to answer this question, both of which involve calculating the perimeter of the lawn. Then the number of rolls required to cover this perimeter can be found followed by their total cost. Alternatively, the coverage that can be bought for £35 can be calculated and compared to the perimeter. The first of these strategies was more common than the second.

Many students were able to use the expression $\pi \times d$ in some form, with d as 9 or 5. However, some did not halve their answers to get the arc lengths of the semicircles. Other students did do this but when attempting to work out the perimeter of the lawn failed to add the 2 m straight lengths. Many students did score further marks by dividing their perimeter by the length of one roll (2.4 m) followed by working out a total cost for their number of rolls. However, some students thought when calculating the cost they either had to use the £3.99 per roll or the 3 for £10; they could not mix the two prices, therefore did not calculate the cheapest way.

Question 12

Part (a) was quite well answered although many students went for the middle interval of 1.50 to 1.60. For part (b), it was pleasing to see that many students were able to apply themselves to this standard problem and get the correct answer. Of course, there were many who simply added the midpoints of each interval or who worked out an estimate of the sum of the heights of the girls, divided by 5 to achieve an "average" height of just over 10 metres.

Question 13

It was pleasing to see many correct or nearly correct answers to this standard question. Most students were able to use their calculator correctly to work out values of the expression $x^3 + x$ and to reach a value close to 21. As ever, many students settled for working out the value of the expression at $x = 2.6$ and at $x = 2.7$ and deciding on 2.6 because the corresponding expression had a value closer to 2.6. This reasoning is mathematically unsound. To arrive at the value 2.6 with confidence the most straightforward technique is to evaluate the expression at $x = 2.65$ and compare it with the value at $x = 2.6$ in this case. Many students lost a mark by continuing their trials and quoting a value of x rounded or truncated to 2 decimal places.

Question 14

This was also a question which many students showed good preparation. There were many who showed an efficient method of calculating the final amount for the account paying 2.15% compound interest. Sadly, many students used the same method for the simple interest account and so were only able to score half marks. Presumably they had not noticed that if interest is being paid by the same type of account for the same number of years 2.3% is going to beat 2.15%.

Some students either did not have a calculator or did not know how to use it to calculate percentages such as 2.3% or 2.15% and tended to use longwinded methods, often with errors. A few students also thought that as it was over three years, the £15 000 must initially be divided by 3.

Question 15

Many students worked out 360 ÷ 9 but were often unsure which angle of the polygon they had actually found. If they marked 40° as an internal angle then they were not awarded the mark. Those students who did find 140° as the internal angle did so from 180 – 40 or from 7 × 180 ÷ 9. It was very unusual to find students progressing further than this. Those that did so realised they had a trapezium with angles of 140 (twice) and 40 (twice). Few used co-interior (allied) angles.

Question 16

There were very few who could work their way through this question. Many students had a poor grasp of how to begin to work out the volume of the pool; attempts in which all the lengths were multiplied together or where the total surface area was attempted were not uncommon. Good students recognised that the cross section consisted of, for example, a 10 m by 1 m rectangle and a 1 m depth trapezium with parallel sides of length 6 m by 2 m. Other dissections were possible, but students were hampered through a lack of ability to calculate the area of a trapezium.

Students who got the correct cross sectional area usually got to the volume of the pool as 70 m^3. The next hurdle was to compare this with the volume of water available. The most successful students did this by noting that there was a gap of volume 10 m^3 at the top of the pool and concluding that the surface of the water would be 20 cm below the top of the pool (from 0.20 × 5 × 10 = 10).

Question 17

The level of algebra in this question was found too difficult by most students. A few were able to give the correct answer to part (a). For part (b), those that had some idea tried to multiply both sides by 5 to clear the fraction. Those that did so commonly failed to multiply both terms on the right hand side by 5 resulting in such equations as $15 - x = 3x + 55$. These students were able to earn a mark if they were able to rearrange the equation correctly.

The number of students who had a correct strategy for part (c) was very small. Some were able to square both sides correctly and a smaller number able to then multiply through by m.

Question 18

Most students either left this blank or multiplied the mass of each element by its density and then added. The formula relating D, M and V was sometimes visible, often in the triangular form analogous to the Speed, Distance and Time one. Even if it was seen, marks were often not awarded as students could not use it correctly. Some students did use it correctly to find the volumes of the two elements but could not make any further progress, often stopping after adding these two volumes together.

Question 19

Many students were able to pick up one mark and sometimes two marks for part a. The value 0.98 in the lower left hand branch was often seen. Often the upper right hand branches were correct but the lower ones sometimes had the 0.05 and the 0.95 reversed or the student repeated the 0.02 and the 0.98 seen in the left hand branches.

There were very few correct answers to part (b) although some students scored a mark by multiplying together two appropriate probabilities from their diagram. A common error amongst those who could do something in part (b) was just to work out the probability of exactly one faulty bottle instead of at least one. However many students simply added the two probabilities.

Question 20

Most students either left this blank or multiplied the 12 by 8 and then divided by 2. Some worked out 12 - 8 and added this to 0.5. Of those who did understand what was required the overwhelmingly common approach was to use the formula $T = \frac{k}{d^2}$ with d = 8 and T =12 to find k and then substitute d = 0.5

Question 21

It was pleasing to see that some students had mastered the use of the quadratic formula. Many of these students used it to good effect and found both roots correctly. Some students could get started but their method came adrift when they substituted $c = 7$ instead of $c = -7$ into the formula. They, of course, ended up with a negative discriminant and could make no further progress. A few managed to detach the 'b' in the formula from the rest of the expression and scored at most one mark

Question 22

Most students either left this blank or simply substituted the given numbers into the formula and worked it out. A few understood that they had to use bounds and picked up a mark for showing at least one correct upper or lower bound for any of the three variables. Fewer still realised that to get the upper bound of the given fraction they had to use the upper bound of the numerator and the lower bound of the denominator. A further complication was that to find the upper bound of the numerator the lower bound of u had to be subtracted from the upper bound of v.

Question 23

Most students either left this blank or added up the heights of the bars in the histogram. Some students were aware of the correct method and added the areas of the bars. Some of these students however, stopped when they had calculated the number of items with a weight of less than 100 grams leading to the speculation that they did not understand the meaning of proportion in this context.

Question 24

Most students left this blank. There were some successful students who found the gradient of the original line and then were able to find an equation for the perpendicular via use of $y = mx + c$. Some students used the equivalent form $y - y_1 = m(x - x_1)$

Some students did not take sufficient care over finding the gradient of the original line, assuming it was 4 and they lost half the marks for an otherwise correct process to get to an answer of $y = \frac{1}{4}x + 1$

Question 25

Most students left this blank. It was pleasing to see a few students getting full marks via the strategy - area formula to find angle B, cosine rule to find AC and then sine rule to find angle C. Some students seem to start promisingly by using $\frac{1}{2}ab\sin C = 19$ but failed to realise that they were in fact calculating angle B this way rather than the angle ACB. Others resorted to Pythagoras or right-angled trigonometry. Students should be aware that for a question to be assigned six marks as this one, a substantial amount of work has to be done.

Summary

Based on their performance in this paper, students should:

- Include the denominations when calculating conversions of currency
- Be aware of the difference between simple interest and compound interest, and be able to work out each
- Arrive in the exam room with a complete set of drawing instruments
- Be able to express one number as a percentage of another
- Be able to expand, factorise and collect terms of simple algebraic expressions

Grade Boundaries

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