Principal Examiner Feedback

Summer 2013

GCSE Mathematics (Linear) 1MA0
Higher (Non-Calculator)
Paper 1

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GCSE Mathematics 1MA0
Principal Examiner Feedback – Higher Paper 1

Introduction

Candidates appear to have been able to complete the paper in the time allowed.

Most candidates seemed to have access to the equipment needed for the exam.

The paper gave the opportunity for candidates of all abilities to demonstrate positive achievement.

Many candidates are setting out their working in a clear, logical manner though there are still some candidates whose performance on questions involving several stages of working might be helped if they improved this aspect of their work.

Candidates are advised to write down their method in detail, particularly in questions which focus on the quality of written communication.

The skill of estimating answers and carrying out checks to see if answers are sensible is invaluable. Many candidates would have gained several more marks if they had shown the ability and presence of mind to do this. For example, not only was estimating expected in question 8, but it could help candidates in question 1. Neither of these questions was particularly well answered. Checking of arithmetic may have helped many candidates avoid a loss of marks in questions 2, 5, 6 and 18.

Report on individual questions

Question 1

Part (a) of this question was well answered with over two thirds of all candidates being awarded the mark for a correct answer. Part (b) was poorly done even by some of the best candidates. Commonly seen incorrect answers included 17.93. An estimate (300000 ÷ 2) could have helped candidates with this part of the question.

Question 2

Most candidates found this question straightforward and scored full marks. The normal route taken by candidates was to work out 15% of 240 and ¾ of 240, add the answers and subtract from 240. Some candidates took the easier route and converted ¾ to a percentage, added 15% to 75% and so were left to work out 10% of 240 to get the answer. A significant number of candidates left the answer as "10%" Very few candidates worked in decimals. One of the most common errors see was "240 – 216 = 34". A check of their arithmetic might have helped many candidates to avoid a loss of marks here. Some candidates subtracted the 36 from 240 then calculated ¾ of their answer so 153 was a commonly seen incorrect answer. 51 (204 − 153) was also seen often as a final answer.

Question 3

This question was well answered by the great majority of candidates. The stem and leaf diagrams seen were generally accurate with a relatively small minority making an error, usually missing one weight out of their diagram. Some candidates did not order the data. Candidates are advised to check that the number of entries in the diagram corresponds to the number of pieces of data given in the question. Keys were nearly always given but a significant number of students left out the decimal point and so could not be awarded the mark for the key. Other candidates unnecessarily included decimal points in their diagram.

Question 4

This question was generally well answered with the majority of candidates obtaining at least 3 marks for their responses. Nearly all candidates were able to expand $3(2 + t)$ in part (a) of the question. In part (b) nearly all candidates scored at least one of the two marks with most candidates giving a fully correct answer. Commonly seen incorrect answers included $6x^2 + 15$ and $6x + 15x$, sometimes simplified to $21x$. Part (c) was also answered well with most candidates being awarded 2 marks though a common error was to write 13 as the constant term. Some candidates lost marks by making errors in trying to simplify $m^2 + 10m + 3m + 30$.

Question 5

Most candidates used the factor tree method in their responses to this question. Though candidates appeared to understand what they needed to do, regrettably many of their attempts were spoiled by their inability to find correct pairs of factors, that is, they were let down by weak arithmetic. Candidates who completed the factor tree diagram successfully sometimes listed the prime factors but did not express their answer as a product so could not be awarded the mark assigned for a fully correct answer. "1" was sometimes included as a prime factor.

Question 6

This question was answered correctly by most candidates. A trial and improvement approach was very common. This sometimes led to students leaving their answer embedded in a numerical expression rather than writing it on the answer line. Of those candidates who did not give a correct answer many were unable to express a complete method clearly, though a significant proportion of candidates were able to show that the "40" had some significance or that adding the 3 given numbers 12, 6, and 15 might help. A commonly seen incorrect answer was "17" (usually obtained from adding the 3 numbers given incorrectly) suggesting that a check might have led to fewer incorrect answers. (12 + 6 + 15) ÷ 4 was also seen frequently.

Question 7

This question was a good discriminator. The great majority of candidates translated the given shape in part (a) of this question, but a significant proportion of these candidates applied an incorrect translation, in many cases moving the shape by 2 places to the left and 5 units upwards or by only 4 units to the right. Of those candidates who used an incorrect transformation, rotation was commonly seen. Part (b) of the question was also answered well. Most candidates gave a single rather than a combined transformation as required. When candidates did give more than one transformation they usually combined a rotation with a translation. This scored no marks. Some candidates who gave a single transformation did not give full details of the transformation so only scored part marks. Other candidates used vector notation to express the centre of rotation. This was not acceptable.

Question 8

Candidates were presented with two challenges in this question. Firstly, they had to decide on the calculations needed to work out the number of bottles that could be filled with milk and secondly, to find an estimate of this. Most candidates gained some credit for their responses, usually for identifying an appropriate calculation. However, the number of candidates who took the easiest route to find an estimate, ie to round values correct to one significant figure then work out $\frac{20 \times 300}{0.5}$, was relatively small. Instead many candidates either failed to round any of the quantities or rounded only one of the quantities, usually 21.7 to 22. As a result they made calculations more onerous and prone to error. Division by 0.5 was confused with dividing by 2. This question clearly identified an area where candidates would benefit from more practice.

Question 9

This question was answered quite well and about two thirds of candidates scored full marks. Most candidates wrote out multiples of 50 and multiples of 80 in order to find the lowest common multiple – they were generally successful. Examiners were able to give some credit to candidates who showed a clear intention to do this but who made arithmetic errors on the way. Some candidates did not count the first pair of numbers and gave 7 and 4 as their answers. Candidates sometimes converted their times to minutes and seconds. This was unnecessary and made the task more difficult. A significant number of candidates identified 800 as their common multiple and went on to give 16, 10 as their answers. This gained partial credit. Candidates who expressed each of 50 and 80 as a product of prime factors often made no further progress; they could not use this to identify the lowest common multiple and subsequently give a correct solution.

Question 10

Not surprisingly this question was successfully completed by the more able candidates and there were many fully correct answers seen. These candidates had generally found the formation and solution of an equation straightforward. However, a significant proportion of candidates either formed an expression or equation involving the area of the rectangle or added the expressions given for the two sides to form the incorrect equation $4 + 3x + x + 6 = 32$. There were many attempts using a trial and improvement approach – these were often unsuccessful.

Question 11

This question was not well answered by most candidates with less than a third of candidates gaining all four marks. There were many possible approaches but by far the most common was to attempt to work out Debbie's speed so that it could be compared with Ian's speed. This was tackled with varying degrees of success. Most candidates recorded a pair of values for the distance travelled and the time taken by Debbie, usually 30 km in 24 minutes and were able to express the speed as 30 ÷ 24 but far fewer could evaluate this and ensure they compared the two speeds using the same units. A significant number of candidates extended the travel graph for Debbie's journey to find that she travelled about 38 km in 30 minutes and deduced that her speed, in km/hour could be found by doubling this figure. Other candidates noticed that 25km were covered in 20 minutes and easily converted this to 75 km/h. A minority of candidates drew the line representing Ian's journey and though this was often done correctly, candidates were not always able to gain the communication mark because they did not clearly draw the comparison between the speeds and the gradients of the lines. Candidates did not always show their method in sufficient detail in this question specifically targeting the quality of written communication.

Question 12

Many candidates taking this paper found this question to be straightforward and they often scored full marks. Lines almost always extended over the full range of values for x. However a significant proportion of candidates made errors when substituting negative values into the equation, when evaluating $\frac{1}{2}x$ or when using the vertical scale on the grid, for example plotting (1, 5.25) instead of (1, 5.5). Candidates who drew a graph which was not linear often failed to score any marks because they did not show a clear method.

Question 13

It is disappointing to report that many candidates could not show a bearing of 037° and so were unable to access the first mark in this question. Many students drew 053° (drawing 37° from the horizontal). However most candidates appeared to know what they needed to show and a good proportion of candidates drew the arc of a circle with radius 5 cm, centre C. Other candidates showed that a point on the ship's course would lie less than 5cm from C and explained that the ship would therefore sail closer than 500m from C. Explanations were usually given in a clear statement drawing on evidence from the candidate's accurate drawing. This was not always the case though and some candidates either left the question unanswered or provided inadequate diagrams, for example drawing lines 5 cm long from C without any explanation.

Question 14

Part (a) of this question was quite well done though some candidates were unable to use the correct notation, ie that of empty or solid circles, at each end of the interval. A relatively common error was for candidates to draw a line from −1 to 3. It would appear that these candidates assumed that the values needed to be integers but then drew a continuous line between the 2 values. Some candidates indicated the correct end points of the interval but did not draw a line joining them. In part (b) candidates often found the critical value 3.5 or equivalent and so gained one mark. However 3.5 alone or $x = 3.5$ was often written on the answer line and examiners could not give this full marks. Poor manipulation of the inequality was also commonplace with incorrect simplifications such as $2x \geq 1$ seen.

Question 15

Most candidates made a good attempt at this question. Their approach was usually to find the total thickness of the 500 sheets of paper and compare this with the depth of the paper tray. This was often done successfully with a clear statement made in conclusion. A common error was to write 9×10^{-3} either as 0.0009 or as 0.09. Candidates who had previously shown the product $500 \times 9 \times 10^{-3}$ had already gained some credit and could score a further communication mark but candidates who had just written 0.0009 or 0.09 could not access these marks. Few candidates used the alternative approach of working out the thickness of each sheet of paper if exactly 500 could be stored in the tray and then comparing their answer with the thickness of a sheet of paper as stated in the question.

Question 16

This reverse percentage question provided a straightforward test for many of the more able candidates who found the calculation routine. There was however a large proportion of candidates who did not understand what they needed to do and merely added 30% on to the sale price so £455 was a very commonly seen incorrect answer. Although candidates who equated £350 with 70% usually went on to get the correct answer, some of them then seemed to ignore the statement they had just written down and instead calculated 10% of 350 leading to an incorrect answer. Candidates who wrote £350 = 70% then £50 = 10% were generally more successful than candidates who attempted to calculate £350 ÷ 0.7 Candidates who gave incorrect answers such as £50 or £150 might have found their error if they had carried out a common sense check on the size of their answer after reading the question again.

Question 17

This proved to be a challenging question for the vast majority of candidates on this paper. Many candidates failed to show their working in an organised manner and they rarely made it clear exactly what they were working out. As a result examiners were faced with working scattered all over the working space with little explicit description of the strategy the candidate was using. It was often difficult to make out whether candidates were using volumes, areas or lengths. Some candidates employed methods involving the division of a volume or a rate by a length to find a time. Whilst a reasonable number of candidates were awarded some credit for their responses, only a small number were able to see the problem through to a successful conclusion. Some candidates worked with a cuboid rather than a prism.

Question 18

This question was quite well attempted. About one third of candidates gave a fully correct answer and about one half of candidates gained some marks for a correct method. Generally, the accuracy in working was good though many candidates made errors involving multiplication or division with negative numbers, for example $-19y = -57$ followed by $y = -3$ The alternative method of rearranging one equation and substituting into the other was rarely seen. Methods involving trial and improvement were more commonly seen but were rarely successful.

Question 19

Many candidates showed some understanding of the relative size of the powers of 5 in this question and were able to score at least one mark for ordering three or more of the numbers correctly or for evaluating 5^{-1} or 5^0 correctly. Unfortunately, a significant proportion of candidates evaluated either 5^{-1} or 5^0 incorrectly as -5 or 0.5 and 0 respectively and so could not be awarded full marks. A surprising number of candidates did not show that -5 was the smallest of the four numbers listed.

Question 20

The best candidates gave clear and concise solutions to this question. However most candidates were unable to make much headway in giving accurate expressions for the area of the square or for the area of the unshaded triangles or for the sides of the shaded triangle. A large proportion of the algebra seen was spoiled by the omission of brackets, for example by expressing the area of the square as $4x \times x$ or as $4x^2$ instead of $4x \times 4x$, $(4x)^2$, or $16x^2$ or in attempts to use Pythagoras rule. The square root sign was often used wrongly or ambiguously. These errors led to many candidates failing to score any credit for their attempts. Most candidates used the method of finding the area of the square and subtracting the areas of the three unshaded triangles but there were some excellent solutions harnessing Pythagoras rule to find the lengths of the sides *NM* and *BM* and then the area of triangle *BNM*. A significant proportion of candidates did not attempt this question.

Question 21

This question acted as a good discriminator between candidates. Well over a half of candidates were able to gain at least 2 of the marks for completing the cumulative frequencies accurately and making a good attempt at drawing the graph. However there is still a group of candidates who plot frequencies rather than cumulative frequencies and a surprisingly large number of candidates drew a bar chart. Despite the fact that it was stated in the question that the total number of students was 60, some candidates did not check their final cumulative frequency against this and so severely restricted the number of marks available to them for their responses. A minority of candidates plotted the cumulative frequencies against the midpoint or lower boundary of each interval instead of the upper boundary. Part (b) of the question was less well answered, particularly the part requiring candidates to estimate the interquartile range. Less than a half of the candidates gained any credit for their responses to this part of the question.

Question 22

This question was answered poorly by all but the best candidates. Candidates usually found the correct length of the larger prism but then also doubled the cross sectional area rather than multiplying it by 4, so answers of 600 with or without units were often seen. A small number of candidates successfully answered the question by working out the vertical height of the triangle *ABC*, doubling the dimensions of the prism then working out the volume of the larger prism. A large number of candidates were able to score at least one mark for stating the correct units.

Question 23

About one in six candidates scored full marks for their solution to this question with examiners awarding one mark to candidates who realised the need to express the denominator of the fraction as a product of factors and making a good attempt to do this. A good proportion of candidates began by expanding the numerator rather than factorising the denominator so, even if they did go on to factorise the denominator, they did not always identify the common factor.

Question 24

More able candidates often scored full marks on this question. Responses were often either fully correct or fully incorrect. Less able candidates drew diagrams with the heights of the bars proportional to the frequencies. A small proportion of candidates who were unable to produce a diagram deserving of any marks were awarded one mark for working out at least three frequency densities. Where part marks were scored for a diagram, errors seen often involved the bar representing the final class interval.

Question 25

This question was poorly answered. It was clear that only a small minority of candidates were well practised in the technique of completing the square. Candidates who realised what was required often went on to carry out this technique but then spoiled their responses by writing a = −4, b = 5. Other candidates wrote $(x + 4)^2 +5$ then $a = 4$, $b = 5$. This was clearly incorrect working and could not be awarded the marks. "8" and "21" were commonly seen incorrect answers. Part (b) was answered correctly by only a small minority of candidates with many of the more able candidates failing to see the connection between the two parts of the question.

Question 26

This question discriminated well between the more able candidates taking this paper. There were many good concise and accurate solutions to this question usually including the use of a tree diagram. Most of the candidates who recognised that a tree diagram was appropriate also realised that the problem involved non-replacement of the coins and so used fractions with denominators 10, 9 and 8. The focus of the question was not on simplification of fractions so answers where fractions which were not given in fully simplified form, for example $\frac{126}{720}$, were awarded full marks. Weaker candidates usually lacked a strategy to follow and often gave answers from little or no working.

Question 27

A significant proportion of candidates could express **SQ** correctly in terms of **a** and **b** though there were a substantial number of candidates who had no idea how to tackle this question. Pythagoras rule, the formula for the area of a triangle and other formulae were used to give incorrect expressions such as $a^2 + b^2$ and ½ab. Some candidates' responses in both parts of the question consisted of numerical ratios. There were some good answers to part (b) of the question but candidates often showed poor communication skills in writing vectors by omitting brackets – for example expressions such as $\frac{2}{5}$ – **b** + **a** + **b** were commonplace. Attempting to simplify vector expressions also caused difficulties for many candidates. It would seem that many candidates could benefit from further practice in the manipulation of vectors.

Question 28

This question proved to be a good discriminator between the most able candidates. In part (a) the most commonly seen incorrect answers seen included (1, 0) and (0, 90). In part (b) candidates were awarded the mark available if they convinced examiners through their sketch that they had applied a one way stretch, scale factor 2, in the direction of the y axis. Evidence looked for included the graph intersecting the x axis at the same points as the given graph together with a good attempt to show that the range of the graph should be $-2 \leq y \leq 2$ Candidates were not penalised for not labelling the y axis or the curve with the values -2 or 2 as long as the intention was clear. Translations of the curve by 1 unit in $+ y$ direction were often seen as were graphs similar in shape to y = cos $2x°$. This question was often not attempted.

Summary

Based on their performance on this paper, candidates are offered the following advice:

- Check arithmetic carefully
- Make sure you can estimate the answers to calculations
- Give an inequality sign as part of your answer on the answer line when asked to solve an inequality
- Read questions involving percentages carefully in order to decide whether the question involves the use of reverse percentages, for example, finding the original price of a sale item
- Make sure that in questions involving several stages you explain what you are trying to work out at each stage.

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