

# Principal Examiner Feedback

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Pearson Edexcel GCSE  
In Mathematics Linear (1MA0)  
Higher (Non-Calculator) Paper 1H

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# GCSE Mathematics 1MA0

## Principal Examiner Feedback – Higher Paper 1

### Introduction

This was a paper which allowed good candidates the opportunity to demonstrate their skills and it also allowed weaker candidates to achieve a reasonable level of success. Overall, the paper was done very well by the majority of candidates.

There were several questions in which basic arithmetic let many candidates down. Errors in calculations were particularly prevalent in Q1, Q7, Q10, Q11 and Q19 and numerous marks were lost due to careless arithmetic errors. Weaknesses in working with negative numbers were highlighted by Q4(d), Q12 and Q15

Candidates should be encouraged to check the reasonableness of their answers. In question 11, for example, £7.20 is clearly not a sensible cost for posting 120 letters at 60p each.

Centres should remind candidates that when units aren't given on the answer line they need to include them with their answer.

Candidates need to use the correct language in their geometric reasoning if they are to gain the QWC mark(s). Using "edge" instead of "circumference", for example, or "angles in a circle" rather than "angles around a point" or "a quadrilateral which touches all sides of the circle" rather than "a cyclic quadrilateral" is not acceptable.

While it was very pleasing that some candidates set their solutions out clearly and logically the poor presentation of working was a concern, particularly in Q10 and Q11. Too many candidates gave a variety of calculations scattered across the page which required much searching by the examiner in order to identify any relevant working. Candidates should consider the layout of their working as well as their calculations. They should be encouraged to set out working clearly and to communicate the meaning of their calculations.

### Report on individual questions

#### Question 1

This question was answered well with most candidates scoring at least two of the three marks. Marks were generally lost through arithmetic errors rather than for using an incorrect method. The calculations caused difficulties for some candidates, particularly if they were attempting to divide by 4 and then multiply by 6. An answer of 2 onions was only accepted if it was clear from the working that the candidate had rounded  $1\frac{1}{2}$  onions to 2 onions.

## Question 2

In part (a) most candidates plotted the point correctly. Errors were usually due to misreading the vertical scale and plotting the point two small squares above 15 or three small squares below 20. A few candidates failed to plot any point at all on the scatter graph.

In part (b) The correlation was described as "positive" by most candidates. Incorrect answers seen included "no correlation" and "negative" and describing the relationship, not the correlation, between the number of documents checked and the number of errors.

The vast majority of candidates in part (c) scored both marks with many having drawn a line of best fit. Candidates not scoring full marks could often be awarded one mark for drawing a line of best fit. These lines were generally too high and resulted in an estimate above 20.

## Question 3

The method of volume = area of cross-section  $\times$  length was well known and regularly quoted. If candidates remembered how to find the area of a triangle they generally went on to find the correct volume of the prism. The vast majority of errors came from candidates failing to divide by 2 in their area calculation for the triangle which meant that 240 was a very common incorrect answer. Centres need to ensure that candidates know how to find the area of a triangle and use it in a context. A few candidates attempted to find the surface area of the prism rather than the volume. Some candidates failed to give any units with their answer or wrote cm or cm<sup>2</sup>, losing the independent units mark.

## Question 4

In part (a) most candidates gained at least one mark for collecting either the  $x$  terms or the numbers correctly and many gave fully correct answers. Errors were often due to candidates failing to deal correctly with the  $-3$  and the  $+8$ .  $4y + 5x - 11$  and  $4y + 5x + 11$  were common incorrect answers.

Part (b) was generally well attempted. Many candidates managed to identify a common factor. Some gave a partial factorisation,  $x(9x - 6y)$  or  $3(3x^2 - 2xy)$ , as the final answer and others made errors inside the bracket. Incorrect answers included  $3x(3x + 2y)$ ,  $3x(x - 2y)$  and  $3x(3x - 2xy)$ . Some candidates attempted to factorise using two brackets.

In part (c) the vast majority of candidates were able to expand  $4(x + 2)$  correctly. A few incorrect answers of  $4x + 2$  or  $4x + 6$  were seen.

The majority of candidates in part (d) were able to gain at least one mark by expanding the brackets to give four terms and many went on to give the correct answer. Sign errors were frequently made in the four terms and some candidates added the  $-5$  and the  $+3$  instead of multiplying. Errors often occurred in the collecting of the  $x$  terms.

## Question 5

Part (a) was answered correctly by most candidates.

In part (b) many gained one mark for  $200 \times 0.75$  but a surprising number failed to evaluate this correctly. Some candidates over-complicated the calculation and attempted to use a long multiplication method. Other common errors were working out an estimate for the number of seeds that would **not** grow, giving  $200 \times 0.25 = 50$  as the answer, and misunderstanding the meaning of the word 'estimate' and working out  $200 \times 0.8$ .

## Question 6

In part (a) the vast majority of candidates understood what was meant by translation and many were able to translate the shape correctly. Incorrect answers were often the result of translations in the wrong direction or of the  $x$  and  $y$  movements being interchanged.

Part (b) was generally answered well with the majority of candidates being able to identify the transformation as a rotation. Common errors were to give the direction of rotation as  $90^\circ$  clockwise or to give no direction at all and some candidates failed to give a centre of rotation. A significant number of candidates failed to score any marks as they applied two transformations, usually a rotation combined with a translation, despite the question asking for a single transformation.

## Question 7

This question was generally answered very well. Candidates usually attempted it by listing multiples of 12 and multiples of 20. Arithmetic mistakes were surprisingly common and some candidates miscounted the multiples or transposed the two answers.

Some wrote the common multiple, not the number of boxes of each required, on the answer lines in part (i). Relatively few candidates expressed 12 and 20 as a product of prime factors although those that attempted this method were often successful.

Part (ii) was usually answered correctly, although some candidates did double their LCM to 120 and some halved it to 30.

## Question 8

Many candidates were unable to make any meaningful progress because they failed to spot that the triangle was isosceles and consequently this question was answered very poorly. Candidates who did recognise that  $AB = AC$  usually wrote the equation  $3x - 5 = 19 - x$ . Isolating the  $x$  terms and the non- $x$  terms in this equation proved a challenge for many with  $2x = 14$  being quite a common error. Those who solved the equation correctly almost always went on to work out the perimeter as 38 cm. There were a number of trial and error attempts to find the value of  $x$ . The majority of candidates worked out the perimeter as an algebraic expression which was usually simplified to  $4x + 14$ . This was often turned into the equation  $4x = 14$  (or  $4x = -14$ ) and solved to give  $x = 3.5$  (or  $x = -3.5$ ). Many candidates scored just one mark for this question for substituting their value of  $x$  into either  $4x + 14$  or into the three expressions and adding to find the perimeter.

## Question 9

It was encouraging that almost all candidates attempted this question and it was generally answered well.

In part (a) most candidates realised that there was an overlap at 25 in question 1, but a significant minority thought there was also an overlap at 15 and 40. Most candidates were able to write down one thing wrong with question 2. This was usually related to the lack of a time frame, the vagueness of the response boxes or the absence of a box for those who do not exercise. Some gave a reason for question 2 in the answer space for question 1. A few candidates found it difficult to express their criticisms in a coherent manner or were too vague in their answers.

The questions designed in part (b) were generally well presented and often gained full marks. Some candidates omitted a time frame or the units of time, e.g. hours, and some designed a question to find out how often people exercised instead of how much time people spend exercising. A small number of candidates wrote an appropriate question but failed to include any response boxes. Too many candidates are still losing marks by using inequality signs in their response boxes. These are not acceptable.

## Question 10

The majority of candidates were able to split the shape into two rectangles in order to find the total area. Some failed to calculate the missing lengths correctly and if no working was shown the opportunity to gain a second method mark was lost. Those using the 'missing rectangle' approach were generally successful though some failed to recognise the missing rectangle and just did  $16 \times 8$ , gaining no credit. Having obtained an area there was usually an attempt to find the number of tins of paint needed by dividing by 12. A common error was  $114 \div 12 = 12$ . Some candidates used 9.5 tins of polish and lost the accuracy mark as well as presenting themselves with some awkward calculations. Many candidates were able to gain the method mark for reducing either £19 or their total cost by 30%. Errors were often made (e.g. in  $1.9 \times 3$  or  $19 - 5.7$ ) but the mark could be awarded when a clear method was shown. A good number of candidates were able to communicate their conclusion in a suitable way to be awarded the final mark but a few just wrote "no" or "yes" which was not sufficient. Some candidates confused area with perimeter and thus limited themselves to scoring a maximum of one mark. As always, centres should try to impress upon candidates the need to set their work out carefully. The vast majority of those scoring full marks did so with well-structured answers and the minimum necessary working shown for calculations. This question showed lots of arithmetic errors being made but credit could be given for correct methods if they were shown.

## Question 11

There was a lot of information in this multi-stage functional question and candidates found sequencing their work a challenge. Many candidates used the ratio correctly although some took 120 to be the number of large parcels. A significant minority found 70% of 200 and ignored the small parcels. A build up method to find 70% was used by many candidates, with a mixed level of success. The majority of candidates multiplied their totals by the correct unit price and added. Many responses exhibited basic arithmetic errors, both addition and multiplication. Some errors could have been avoided if candidates had considered if their answer was reasonable, e.g.  $120 \times 60p = \text{£}7.20$ . Some candidates set their solutions out clearly and logically, often gaining full marks, but too many gave a mixture of calculations in no particular order without any explanation of what it was they were attempting to work out. Candidates should be encouraged to set out working clearly and to communicate the meaning of their calculations.

## Question 12

The majority of candidates gained 3 marks for plotting and drawing the correct line segment. It was very encouraging to see a substantial number of correct tables of values prior to the drawing of the graph. Most errors in the table were incorrect values of  $y$  for negative values of  $x$ . It was disappointing that relatively few candidates managed to get the additional mark for correctly scaling and labelling the axes. The absence of 0 at origin or the absence of  $x$  and  $y$  on the appropriate axes or the use of a non-linear scale meant that this mark could often not be awarded. When the scaling on the axes was inconsistent further marks were usually lost as it became difficult for the candidate to draw the correct line segment through the points plotted. It was disconcerting to see a small proportion of candidates drawing axes on the left of the grid and at the bottom instead of drawing axes that intersected at the origin.

## Question 13

One mark was often awarded for  $35 \times 10$  ( $=350$ ). Some candidates went on to work out  $33 \times 11$  and to then find the difference between their two answers. Many failed to gain full marks because they made arithmetic errors. Errors in the evaluation of  $33 \times 11$  and in the straightforward subtraction were very common. Candidates must be encouraged to check their answers, as working such as  $33 \times 11 = 330$  and  $363 - 350 = 10$  went unnoticed. Some candidates worked out both  $35 \times 10$  and  $33 \times 11$  but got no further. Many candidates worked out  $\frac{33}{11} = 3$  and  $\frac{35}{10} = 3.5$  which lead nowhere and some subtracted 33 from 35 and gave 2 as the answer.

## Question 14

In part (a) many candidates did not know the meaning of the word 'reciprocal'. A variety of incorrect answers were seen with the most common being 25.

Part (b) was poorly answered. The most common incorrect answers were  $-9$  and  $0.03$ . Some candidates with the right idea failed to evaluate  $3^{-2}$  and gave the answer as  $\frac{1}{3^2}$

In part (c) Many candidates were able to gain one mark for evaluating  $9 \times 10^4 \times 3 \times 10^3$  as 270 000 000 or as  $27 \times 10^7$ . The difficulty for many was changing their answer to standard form. Many thought  $27 \times 10^7$  was in standard form and failed to do the final step. Candidates who first converted the numbers in the question to ordinary numbers often ended up with too many or too few zeros. Some evaluated  $9 \times 3$  incorrectly.



### Question 15

Many candidates appeared familiar with simultaneous equations and were able to achieve a pair of equations which they could add or subtract to eliminate one of the variables. However, simple errors in multiplication, addition or subtraction and a failure to deal correctly with the negative numbers involved hampered many. Candidates who tried to eliminate  $y$  first were usually more successful as they had to add the equations rather than subtract although  $51 \div 17$  caused problems for some. Those who attempted to eliminate  $x$  often struggled with subtracting  $-9y$  from  $8y$  or vice versa. Some of the candidates who successfully eliminated  $x$  could not deal with  $-17y = 17$  (although  $17y = -17$  seemed to pose fewer problems). Having found one value, candidates usually went on to substitute their value into an equation to find the other value. There were many candidates who had a correct first answer (mostly  $x = 3$ ) who substituted their value but then couldn't rearrange the linear equation correctly. Candidates should be encouraged to substitute their answers into one of the original equations to check they are correct. Only few candidates attempted the substitution method and generally these candidates were not as successful as those using the elimination method.

### Question 16

Only a minority of candidates gained full marks in this question. Most worked out the scale factor as 6 but the majority then proceeded to use this as their area factor giving an answer of 1800. Some candidates treated the shape as a rectangle measuring 20 cm by 15 cm which they then enlarged into a rectangle measuring 120 cm by 90 cm to get the correct answer. A very common incorrect method was  $300 \div 20 = 15$  followed by  $15 \times 120 = 1800$ .

### Question 17

A significant number of candidates did not attempt this question. There were few clear strategies used and many correct answers showed no working at all. Many candidates did get at least 2 of the 3 numbers correct. Brackets were often omitted from the answer but this was not penalised. Common errors were to try to find the midpoint of the two sets of coordinates given or to give the differences between  $A$  and the midpoint as the final answer.

## Question 18

In part (a) many candidates correctly read the value of the median from the cumulative frequency graph. Incorrect answers were usually due to misreading the scale. Both 64 and 69 were common wrong answers.

Most candidates gained at least one mark in part (b) with many giving fully correct answers. The most common approach was to read from the graph at 60 seconds (28) and compare this with 25% of 80 (20). Some candidates worked out 25% of 80 but failed to obtain a comparative statistic. Sometimes candidates stated 'yes' without providing sufficient evidence to show why.

Part (c) was attempted by the majority of candidates and most were able to produce a box and whisker diagram and show an understanding of the five measures required, even if they failed to read the scales correctly. Most errors were made with the two quartiles.

## Question 19

Overall, this question was not answered well with a large number of candidates unable to use an appropriate method. It was rather disconcerting that many answers were greater than 1. Drawing a correct tree diagram seemed to be the key to success. Most candidates made an attempt at drawing a tree diagram and many recognised the need to find  $1 - 0.4$  and  $1 - 0.7$  though very few actually wrote these calculations down. Not all candidates, though, recognised that the probabilities of 'not fruit' and 'not vegetables' were relevant and tree diagrams were often used with all branches having 0.7 and 0.4 on them. Candidates with a correct tree diagram usually attempted to multiply their probabilities in some way. Some candidates obtained probabilities for 'fruit', 'vegetables' and 'both' from three correct products but failed to add them and gave three answers, thus losing 2 marks. Those that did add them often went on to get the correct answer but some made arithmetic errors ( $0.3 \times 0.6 = 1.8$ , for example). Of those scoring full marks, the vast majority added the probabilities of the three favourable outcomes with surprisingly few candidates using  $1 - 0.3 \times 0.6$ .

## Question 20

The majority of candidates made an attempt at this question and most managed to gain the first mark for multiplying out the bracket. Many, though, were then unable to rearrange the equation correctly. Common errors were to add 8 to both sides before multiplying by  $3x$  or to subtract  $3x$  from the RHS. Some candidates who did multiply both sides by  $3x$  to give  $32x - 8 = 10 \times 3x$  then subtracted  $3x$  from  $32x$ . Those who did get as far as  $32x - 8 = 30x$  usually completed the solution to  $x = 4$  and gained full marks. A few candidates slipped up when multiplying out the bracket (e.g.  $24x$  or  $36x$ ) but then rearranged correctly to get two marks.

Those candidates who were able to attempt part (b) often gained the first mark for using a common denominator of  $(y + 3)(y - 6)$  or  $y^2 - 3y - 18$ . Many of the candidates who used the correct denominator gained the second mark for dealing with the numerators correctly. At this stage the subtraction was often written as two separate fractions. A very common error was to then simplify  $2(y - 6) - (y + 3)$  to  $y - 9$ . It was a shame that some candidates with the correct answer lost the accuracy mark because they went on to do further incorrect algebra. Inappropriate cancelling was a feature of many candidates work.

## Question 21

Many of the attempted solutions demonstrated that candidates were not conversant with this part of the specification. A large proportion of candidates used  $y = kx$  leading to an answer of 60 and gained no marks. A minority understood that  $y \propto x^2$  or  $y = kx^2$  was the essence of this problem and most of these candidates gained full marks. Some, however, correctly worked out  $k = 4$  but then went on to multiply 4 by 5 instead of by  $5^2$  and lost two possible marks. Some candidates doubled the value of  $x$  and then squared to get the correct answer of 100, i.e. using  $y = (2x)^2$ .

## Question 22

This question was not answered very well and many candidates did not even attempt it. Many candidates appeared unable to cope with an angle of  $y$  and although some knew that angle  $ADC$  was half of  $y$  they were unable to express it as such. Often candidates gave  $y$  a value and worked with numbers. These candidates gained no credit even if their reasons were correct. Those who did attempt to answer it using algebraic terms often gained one mark for identifying angle  $ADC$  as  $y/2$  with some also then working out angle  $ABC$  as  $180 - y/2$ . Fewer candidates used the solution involving the reflex angle  $AOC$ . Many candidates incorrectly thought  $OABC$  was a cyclic quadrilateral leading to an answer of angle  $ABC$  being  $180 - y$ . Some thought that angles  $BAD$  and  $BCD$  were  $90^\circ$ . It was pleasing to see candidates using the correct terminology but there were still many who lost the QWC marks through the use of the wrong words. Angle at the 'edge' rather than at the 'circumference', and 'arrow' or 'arrow head' occurred regularly. Many quoted 'quadrilateral' and not 'cyclic quadrilateral'. Some candidates listed any theorem or rule they could think of that related to angles or circles in the hope of finding the right one without actually offering an expression for  $ADC$  or a final answer. These candidates gained no credit since the QWC marks could only be awarded if the reasons given were appropriate to the method shown.

## Question 23

This was a challenging question that was attempted by most candidates but poorly done by many. Those who drew guide lines from the correct centre often got full marks. Many of the incorrect responses were due to candidates using the wrong scale factor (often  $\frac{1}{2}$ ) or using the wrong centre of enlargement.

## Question 24

The biggest difficulty for those who made a serious attempt at part (a) was getting the direction signs of the vectors correct. Relatively few candidates chose to write a simple vector equation such as  $ON = OA + AN$  or  $ON = OB + BN$  as their starting point. Candidates who worked with  $\mathbf{a} + 2/3AB$  were generally more successful. Those who started their path with vector  $\mathbf{b}$  frequently used  $\mathbf{b} + 1/3AB$  instead of  $\mathbf{b} + 1/3BA$ . Difficulty in expanding brackets or omitting brackets altogether prevented some candidates from gaining marks even though their reasoning appeared to be correct.

In part (b), relatively few candidates achieved any marks. Some candidates were able to find a correct expression (usually simplified) for  $OD$ . A smaller number were able to give a correct expression for  $ND$ . Often, however, unsimplified or incorrectly simplified answers for  $ON$  meant that candidates were unable to prove a straight line relationship. Those candidates obtaining all 3 marks were generally very coherent in their justification though few were actually explicit in their recognition of a common point. Some explanations were unclear with candidates mentioning "gradient" or "same amounts of  $\mathbf{a}$  and  $\mathbf{b}$ " rather than stating that one vector was a multiple of the other. Some candidates set about proving  $ON + ND = OD$ .



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