# Principal Examiner Feedback

# Summer 2012

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

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# GCSE Mathematics 1MA0
# Principal Examiner Feedback – Higher Paper 1

## Introduction

This was the first examination of the 1MA0 linear specification in which there were substantial questions which assessed problem solving and communication in mathematics.

This paper provided the opportunity for candidates of all abilities to demonstrate positive achievement.

Candidates generally responded well to the questions testing *quality of written communication* (qwc). However, not all showed all necessary working in an ordered fashion. It is important in all questions (not just those testing *qwc*) that working is set out appropriately. Where a question needs a final decision it is important that this decision is clearly communicated as well showing the calculations done in reaching this decision. When the answer to a question includes geometric reasons these must be given in full with correct mathematical terminology used.

Whilst much correct arithmetic was seen there were still many solutions that were spoilt by careless errors. Such errors included simple counting errors (see question 13) and errors in the four arithmetic operations. The most common arithmetic error was the wrong value attributed to 1% of 60 in question 10. Where candidates employ a build-up method for percentage calculations then it is vital that they get their first value correct. Without this correct value or a correct method see to find this value, no marks can be awarded.

Candidates should be encouraged to consider the reasonableness of their final answers, especially in the more functional type of questions. For example, it was not uncommon to see a credit card charge of over £100 when booking a £60 ticket and to see probabilities greater than 1 in question 19.

## Report on individual questions

### Question 1

Surprisingly, part (b) was answered correctly more often than part (a). In part (b) the majority of candidates generally recognised that the sample was too small or the age range too narrow. In part (a), despite the fact that a data collection table was asked for in the question, a significant number of questions suitable for a questionnaire were still seen. The modal mark scored was one as either a column for tallies or the frequency column was often omitted.

## Question 2

Part (a) had the instruction 'You must show your working', within the demand. When this instruction is present it is vital that candidates do show all their working; in this case a correct answer of 'yes' with no correct supporting working scored no marks. The vast majority of students did show working. There was frequently confusion over conversion between metres and centimetres and, more frequently, between $cm^2$ and $m^2$. Provided all other working was correct, candidates were only penalised for either inconsistent units or incorrect conversions in the final mark. There were two favoured methods of solution. One of these was to work out the area of the patio and the area of the 32 slabs. In this method the most common error occurred when attempting to find the area of the 32 slabs, $32 \times 60$ rather than $32 \times 60 \times 60$ was frequently seen. Accuracy in arithmetic was also a problem with $60 \times 60$ seen as 1200 and $0.6 \times 0.6$ given as 3.6 on many occasions. The most successful method was to find the number of slabs needed by dividing the corresponding lengths but, again, the necessary arithmetic did cause some problems.

Many different methods to carry out the necessary multiplication were seen in (b). When candidates choose to use a build up method for their calculation it is important that they check that they are working out $32 \times 8.63$; frequently the complete calculation was actually for $20 \times 8.63$ or $24 \times 8.63$ or $31 \times 8.63$ or $30 \times 8.63$ in which case no marks could be awarded. Candidates who attempted to partition the numbers prior to calculation sometimes made errors in dealing with the decimal place and used 8 rather than 800 so came out with a very wrong answer.

## Question 3

Part (b) differentiated well. It was also a question testing the *qwc* so it was essential that a method was shown. The more able candidates realised that drawing a graph to show Ed's costs was the most efficient method of solution. Candidates who took this approach then generally made a correct statement that referred to 20 miles (the break-even point). Less able candidates used the information given and the graph to find the delivery costs for a particular distance and then either made a comment or just left the calculations as their final answer. It was not uncommon to see calculations which failed to refer to distance or Bill or Ed. Some failed to gain any marks as they just focused on comparing the fixed charges or cost per mile or a combination of these in a general way. Others were confused by Bill's £10 fixed charge and added it on twice, eg if he went 10 miles then they said that he charged £30 (£20 plus his £10 fixed charge).

## Question 4

The construction of stem and leaf diagrams is clearly well understood. Many students chose to draw an unordered stem and leaf first, to help them towards the final answer. The most common error was the omission of a key. Otherwise, the stem and leaf diagrams seen were generally correct with the occasional omission of one or more piece of data. Candidates should be encouraged to count the number of pieces of data given in the question and in their stem and leaf diagram to try to prevent omissions.

## Question 5

Many correct answers were seen. Candidates who failed to give the correct final answer generally fell into one of two categories; they either made arithmetical errors or substituted into the given formula incorrectly. Arithmetic errors were generally writing 30 × 40 as 120 or, having found the correct answer to this initial calculation, then a wrong (or no answer) to 1200÷150. The most common error in substitution was to add rather than multiply the numbers in the numerator. Another, less frequently occurring error, was to substitute numbers other than those given into the formula. Quite a few candidates thought that it was acceptable to divide by 100, divide by 50 and then add the answers together as a way of dividing by 150.

## Question 6

Part (a) was generally very well answered. Those candidates who attempted to find the amount of milk for 1 shortcake and then scale up did, however, often make arithmetic errors. In part (b) the usual method employed was to find the number of quantities for each ingredient and then work with the found scale factor. Some candidates forgot to multiply their scale factor by 12 and just gave the answer as 5. Other candidates gave 120 or 600 as their answer from the number of shortcakes that could be made from the other ingredients, not realising the need to use the lowest of the scale factors. Another common error was to add the scale factors 10+5+5+50=70 clearly not understanding what had been found. Some also found the amount of ingredients for one shortbread and then proceeded no further. Again, arithmetical errors were frequently seen.

## Question 7

Most candidates realised that they had to find the LCM of 20 and 24. One approach was to use the numbers 20 and 24, the other was to work with times from 9am. Those who used times, frequently made errors in their list with the common first error being for the 10:12 time. Another error was to produce two correct lists of times but then fail to realise that 11am was a common time in each list. Some found LCM of 120 and then thought it was 1 hour 20 minutes resulting in time of 10.20

## Question 8

Part (a) was generally well answered. The most common errors were either to forget to multiply the 5 by 3 resulting in 6y - 5 and to add the 3 and 2 resulting in 5$y$ - 15. In part (b) the demand asked candidates to 'Factorise completely' despite this, many gave a correct partially factorised expression so only gained one out of the two available marks. Those who showed a method in part (c) rather than just attempting to write down an answer were generally more successful and scored at least one mark. However, too many candidates just gave an answer which was frequently wrong; as the two stages were not shown it was not possible to award any marks. A significant number incorrect answers included a subtraction rather than a division, probably coming from candidates not recognising $gh$ means $g \times h$ and so the inverse operation would be division.

## Question 9

The question asks for a single transformation. Answers that gave more than one transformation, quite commonly seen, automatically gained no marks. Common errors were using the word 'turn' rather than 'rotation', writing the centre of the rotation as a vector rather than a coordinate and getting the angle of rotation wrong. It is expected that candidates give the turn in degrees rather than as a fraction of a turn.

## Question 10

This question was testing quality of written communication so it was pleasing to see the vast majority of candidates supporting their decision with working. Most working was well laid out but there was still some confused working in evidence which made the awarding of marks more difficult. Many struggled with finding 2.25% of £60; often the starting premise was incorrect with a statement linking, for example, 1% of £60 with 6. When a build up method is used for percentages it is vital that candidates either get their initial statement correct or show full working if they are to gain any method marks. More success was evident with the calculation of 1.5% of £60. The starting point of 1%, 0.5%, 0.25% was more successful than 10%,5%,2.5%. In questions testing quality of written communication where a decision needs to be made, this must be communicated by means of a written statement, it is not sufficient to circle the right answer. The vast majority realised this and concluded with a statement that was correct for their figures.

## Question 11

There were a number of possible equations that could be formed from the diagram. Generally speaking those who managed to form a correct equation went on to score at least two marks. Some candidates experienced difficulty in carrying out the final division, usually 351 ÷ 9. As the answer was an integer value it was necessary to give the final answer as 39 rather than a top-heavy fraction. The most popular method of solution was to find an expression for the sum of the angles and then equate this to 360. A large number of candidates did find the correct sum of the angles but then either equated this to zero or 180 or tried to solve $9x = 9$, none of these approaches enabled any marks to be awarded. A minority of candidates realised that a more efficient method of solution was to equate the opposite angles or sum the co-interior angles to 180. There was very little evidence of the checking of final solutions which may have helped come candidates to reconsider their answer.

## Question 12

It was good to see a whole range of methods being used to successfully answer this question. Some candidates chose to find the volume of drink in the carton and then divide by the area of the new face in contact with the table. However, more popular was the use of scale factors taking into consideration that the area of the new face in contact with the table was twice the area of the previous face in contact and therefore the height of drink in the carton would halve. A very few candidates got the faces the wrong way round and ended up with an answer of 16 cm. Provided this answer was supported by correct working two marks were awarded. However, many candidates started off by either working out the volume of the container and were then unsure how to proceed further.

## Question 13

There was a great deal of confusion evident in working as to whether 360 divided by the number of sides gives the interior or exterior angle. In order to gain the method marks available in this question it had to be clear, with no contradiction in either the overall method or by angles calculated and subsequently marked on the diagram, which angles were being calculated. Unfortunately some potentially good solutions were spoiled by candidates using 5 rather than 6 for the number of sides of the drawn hexagon or 7 rather than 8 for the octagon. Poor arithmetic frequently caused candidates to lose the accuracy mark; 360÷8 worked out as 40 or 40.5 was the most common of this type of error. Some did attempt to work out the total sum of the interior angles of one or other polygon but it was common to see wrong formulae used here. It was encouraging to see some candidates go back to basics and divide a polygon into triangles in an appropriate way to find the sum of the interior angles.

## Question 14

Part (a) was well answered. The common error in (b) was to give the angle between the North line at *H* and the line *HL*. In part (c) candidates were more likely to get the distance from *H* correct rather than the bearing. A significant number of candidates measured the bearing in an anti-clockwise rather than clockwise direction, others assumed that it would be along the line joining *L* and *H* or measured from L rather than from *H*. A very common mistake was incorrect use of the protractor to measure 40deg from the horizontal. Some candidates were clearly disadvantaged by not having or using the appropriate measuring equipment.

## Question 15

Those candidates who understood the concept of finding the median from a cumulative frequency graph were generally successful in part (a) although some did use 64 rather than 60 as the total frequency and so used the wrong value on the cumulative frequency axis in their attempt to find the median. Others gave a value of 30 from 'half-way' up the cumulative frequency axis, failing to read across and down to the weight axis. With a boxplot already drawn in part (c), most candidates realised in (b) what sort of diagram they were aiming for but were unsure where to get the appropriate figures from. Indeed some candidates ignored the given max and min values and took 160 and 190 from the graph instead of using the given minimum and maximum values for the 'whiskers' which was enough to gain one mark. The most common loss of a mark in this question was an inability to read the upper and lower quartiles from the graph.

The demand in part (c) was to compare the distributions of the two groups. Some candidates misinterpreted and gave statements regarding the effect of the fertilizer on group A. There were two marks available - one to compare the range or inter-quartile range and the other to compare a specific value (eg. the median). Many candidates did do this and gave two correct comparisons but some failed to answer the question and just quoted, for example, the two medians without making an attempt to compare them in any way. Candidates should ensure that they use correct mathematical language when answering questions that require distributions to be compared. Responses such as 'distribution is spread out, 'heavier because of average', 'group A bigger as they had fertilizer' all hat scored no marks.

## Question 16

In part (a) the common error was to add or subtract rather than multiply the indices. Those candidates who knew how to factorise a quadratic expression generally gained both available marks in part (b) although $(x - 5)(x + 2)$ was frequently seen as an answer. A popular error was to factorise the first two terms to $x(x + 3) - 10$.

## Question 17

At this stage in the paper it was disappointing to see, in part (c), candidates who were able to deal with the multiplication of numbers in standard form but were unable to work out $3 \times 9$ correctly, 18 was a popular incorrect answer for this multiplication. Another error that was seen was to write the initial answer as $27 \times 100^{13}$ or $27^{13}$ rather than $27 \times 10^{13}$ showing a lack of understanding of the relevant index law and/or standard form.

## Question 18

The most common method used that lead to the correct answer was to enlarge the triangle and then find the area of the enlarged triangle. It was, however, disappointing to see many candidates successfully enlarge the triangle and then fail to find its area. Those candidates who started with the area of the given triangle invariably divided by 2 rather than $(2)^2$ to find the area of the enlarged triangle. It was very rare indeed to see the area scale factor being used. Equally disappointing was the number of candidates who tried and failed to find the correct area of the given triangle. A significant number of students who drew the enlarged triangle did not understand that a scale factor of $\frac{1}{2}$ would result in a smaller triangle.

## Question 19

In part (a) the vast majority of candidates were able to get the value 0.6 correct but there was less success with the second set of branches. Many candidates had the correct values for the lower set of the right hand branches but had these values transposed. As usual, part (b) proved more problematic. The correct method of 0.3 × 0.4 was frequently followed by the incorrect answer of 1.2 with candidates seemingly having no qualms of giving a probability greater than 1 as their final answer. However, 0.3 + 0.4 was a very commonly seen incorrect method.

## Question 20

Candidates who have had experience of solving simultaneous equations were generally able to show evidence of using a correct method although this was frequently spoilt by arithmetic errors either in the initial multiplication or in the addition or subtraction of the multiplied equations particularly where negative numbers were involved. In order to gain any marks in questions of this type, candidates must show a complete method including using the correct operation to eliminate one of the variables with a maximum of one arithmetic error. Trial and error was frequently seen; this approach scored no marks unless correct values were given, as a final answer, for both variables.

## Question 21

When asked to give reasons in a geometry questions, reasons must be correct and must use correct mathematical language. Reasons given in responses seen to this question were often incomplete or not completely correct. 'Angle between tangent and circle is $90^\circ$' and 'angle at origin is twice the angle at the edge of the circle' are both examples where a communication mark was not awarded as the statements were not accurate enough. It is also important to ensure that the final answer is communicated properly. In this case the value of the angle had to be linked with the angle itself so sight of Angle $BCD = 65^\circ$ (or similar) was expected rather than just to see a $65^\circ$ somewhere amongst the candidate's working. Very few candidates used the alternate segment theorem as part of their explanation.

## Question 22

When candidates are drawing histograms they should be encouraged to show their frequency densities or key. A number of candidates went straight into drawing a histogram but, when their chosen scale was very small or some bars of the wrong height it was difficult to award marks without sight of their overall method. Candidates who realised that area had to be taken into consideration rather than just the heights of the bars generally did go on to gain full marks in part (a). In part (b) some candidates who had not drawn a histogram in (a) still gave the correct method and answer from using the given frequency table. Those who mistakenly drew a cumulative frequency diagram in (a) were able to use this successfully in order to answer part (b). A small minority of students found answers to this question which were above 24 which was the total for the interval.

## Question 23

In both parts of this question there was clear evidence of incorrect cancelling. This was also seen at the conclusion of a solution, often following the correct answer, in which case the candidate could not be awarded the final accuracy mark. In part (a) the numerator was correctly factorised more often than the denominator. Those that factorised both correctly generally went onto gain full marks. Except for those candidates who spoilt a correct answer by incorrect cancelling, most of those who found the correct common denominator in part (b) went on to score full marks. The exception to this were those candidates who wrote down the common denominator incorrectly straight away as $x^2$ - 2 without showing $(x - 2)(x + 2)$ and others who made errors in expanding brackets, particularly where this involved negative numbers. A significant number of students calculated the numerator correctly, but failed to give a denominator at all.

## Question 24

Candidates who were able to recognise that the given recurring decimal was 0.28181… rather than 0.281281… gained a generous first method mark. In order to gain the second method mark a full correct method had to be seen. Unfortunately, many attempted the subtraction of 281.8181… and 0.28181… which is an incorrect method. Some got as far as $\frac{27.9}{99}$ or $\frac{279}{99}$ but were then unable to finish their solution correctly to arrive at the correct answer of $\frac{31}{110}$ . There were many incorrect guesses of $\frac{281}{1000}$ and $\frac{281}{999}$ seen.

## Question 25

The most common error here was to substitute $2x$ for the radius but to forget to use brackets so ending up with $2x^2$ rather than $4x^2$. This error was condoned for the two method marks as the candidate was automatically penalised at the accuracy stage. The use of 9 rather than $9x$ was not condoned. Many candidates correctly substituted into the formula for the volume of a cylinder but then failed to equate to the formula for the volume of the sphere. Occasionally the formula for the surface area of a sphere rather than that for the volume of a sphere was used.

## Question 26

Candidates generally had more success with part (a) than part (b). In part (a) when an attempt at a translation in the $x$ axis direction was seen it was as likely to be that of $y = f(x + 3)$ as that of the required $y = f(x - 3)$. Some sketches were rather too rough to be able to award any marks. Candidates would be well advised to look for those points where the graph passes through integer coordinates and transform these points carefully. In part (b) the transformation of $y = f\left(\frac{1}{2}x\right)$ was clearly confused with the required transformation of $y = 2f(x)$ and $y = f(x) + 2$.

**Grade Boundaries**

Grade boundaries for this, and all other papers, can be found on the website on this link: