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Principal Examiner Feedback

Summer 2012

GCSE Mathematics
(Linear) 1MA0

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Summer 2012

GCSE Mathematics 1MA0
Principal Examiner Feedback – Foundation 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.

The vast majority of candidates had time to attempt all questions however a significant number of candidates failed to give full and correct reasons to justify their working.

There were a few questions where a comparison had to be made but often candidates did not compare like with like and frequently did not make a conclusion. A high proportion of candidate responses comprised the answer alone, with no working. Where working was shown, it was often difficult to follow as there was little or no explanation of what was being calculated.

Where candidates are required to draw diagrams with a pre-printed grid, they should be advised to make sure that pencil lines are very clearly visible over the grid.

Report on individual questions

Question 1

This proved to be a good starter question with nearly 90% of candidates scoring all 3 marks. The most common error in part (a) was 300.8 and in part (b) the few who got this incorrect tended to write 62 or 6.4. Plotting at 38 was the most common error in part (c).

Question 2

Majority of candidates were able to measure the line correctly. All recognised the need to put their answer in cm rather than mm.

A lack of a protractor did not stop nearly all candidates writing an answer in part (b). However, it was evident that many candidates did not have a protractor as many wrote 45° as the size of the angle. A significant number used their protractor incorrectly with 145° being a common incorrect response. Only 63% of candidates gave an answer between 33° and 37°.

It was pleasing to note that many candidates could draw a circle using a pair of compasses. Two thirds of candidates successfully produced circles that fitted within the overlay, even when the circles were drawn freehand. Quite a few drew a circle with a diameter 5 cm instead of a radius 5 cm. Quite a few attempted to use a protractor to draw the circle. Many only drew a radius.

Question 3

Part (a) and part (b) were well done. There was a good understanding of what was required for tally and frequency and most scored the mark in part (b) for 7 or a follow-through mark from their table. 'Banana' proved a popular incorrect response to part (b).

In part (c) the vast majority of candidates drew a bar chart. A considerable number of these lost a mark for not labelling the vertical axis. A few also lost a mark as they started the numbering from 2 instead of zero or numbered the gaps on the vertical axis. Candidates need to be made aware that bars of unequal width are not acceptable. Other diagrams such as pie charts and pictograms were also acceptable although it was extremely rare to see an accurate pie chart drawn.

Overall, quarter of candidates scored all 6 marks with half scoring 5 marks generally losing the mark for not labelling the vertical axis in (c) correctly or not labelling it at all. A further 16% scored 4 marks.

Question 4

Majority of candidates were able to start by showing an attempt to add £1.18 and 94p and scored 1 mark. The most common reason for losing the second method mark was a failure to take into account the 30p change. There were also a significant number of arithmetic errors; candidates seemed to have great difficulty in subtracting as well as dividing. Candidates did not set their working out in an orderly manner and many calculations were shown, some of which were relevant and some of which were not. Only half the candidates were able to score more than 1 mark with 36% scoring all 3 available marks.

Question 5

It was pleasing to note that nearly all candidates scored all 3 marks. Part (a) proved to have very few incorrect responses. Errors were mainly in reversing the coordinates e.g. (3, 2) instead of (2, 3).

In part (b) the majority of the responses were correct. Some candidates also neglected to mark the cross with a *C* as requested in the question.

Question 6

Majority of candidates correctly answered part (a). The most common incorrect responses were 0, 1 and –4. Some incorrect answers arose from the candidates using the top line of the table only.

The most common answer to part (b) was the correct answer of 6, although the correct answer of –6 was not uncommon. Common incorrect answers included 5, –2 and 2.

Candidates found it harder to work out the minimum temperature on Sunday with only two third of candidates arriving at the correct answer, usually without the need for working.

Question 7

Those who approached this question systematically were more successful in obtaining the complete set of combinations without repeats. Those who did not use a system appeared to randomly write down combinations until they thought their list was complete – this often resulted in missing or repeated combinations. Several simply wrote e.g. P – B, S, L which was not sufficient to score the marks as the combinations needed to be listed as individual pairs. Only a few candidates chose two mains or two starters as a pair. Overall, 87% of candidates scored both marks with a further 8% scoring 1 mark.

Question 8

Virtually all candidates could identify that most of the students walked to school.

Part (b) was well attempted by many candidates. Two thirds of candidates correctly found that 6 students cycled to school. Those who did not arrive at this correct answer seldom scored the method mark as they did not attempt to write the 90° which they had identified as a fraction of 360°. Those who arrived at the correct answer showing working either divided correctly by 4 or divided by 2 and 2 again. A few continued to divide by 2 again obtaining an incorrect answer of 3.

Question 9

Part (a) was successfully done by 64% of the candidates. There were only a small number of blank responses seen. Too many candidates lost marks through careless drawing of the vertex. Many candidates found it hard to draw a triangle if they started with a base that was odd in length. The most common incorrect response was a right angled triangle that was not isosceles.

In part (b) nearly all of candidates were able to score at least one mark for drawing a rectangle of any size and two thirds of candidates scored both marks for a rectangle with area 12 cm^2. A significant number of 2×4 rectangles were seen with annotations, showing confusion between area and perimeter. A very small minority drew a triangle instead.

Question 10

Nearly all of candidates were successful in part (a). However, in part (b), only 53% of candidates were able to mark the probability scale correctly (within 1 cm). Many put **B** at either $\frac{1}{2}$ or 1.

Question 11

In part (a) many candidates knew that the square root of 81 is 9. Unfortunately many wrote their answer as 9 × 9 which lost the mark. Only half of candidates scored the mark in part (a).

Many errors were made by candidates in part (b). The most common error was to give an answer of 7^5 where the candidates felt they needed to apply the multiplication rule of indices and seeing the addition sign between the integers they thought that they had to add those integers as well. Another common error was to give an answer of 31. This they found by $5^2 + 2^3 = 25 + 6$. However, by correctly squaring 5 and getting 25 these candidates gained

1 mark. Another error frequently seen was to see 2^3 as 16 with a final answer of 16 + 25 = 41. This highlighted the fact that many candidates were weak on powers/indices. Overall, 29% of candidates scored both marks with a further 13% scoring 1 mark.

Question 12

Part (a) was very poorly answered. Not many grasped what the question was asking. It was clear that many candidates struggled to visualise what shape would need to be added to make a cube. Had they realised that 27 cubes were needed in total then many more correct answers would have been seen. Many answers were low such as 6 or 3 indicating that only one layer had been considered. Nearly all candidates entered a number, but there were few in the region of 20, indicating that conceptually or visually this was too challenging.

A greater proportion of candidates scored in part (b). Many drew the required shape indicating that they understood what was required. A few drew a 2-D shape from the side, and a few added an extra cube. A number drew a 3 dimensional drawing of a cube or some cubes, indicating that they were not aware of the requirements of this topic.

Question 13

Only half of candidates scored both marks in part (a) with 15% failing to score. Some misread the timetable to give a time for the next train (arrival at 07 58). Wrong answers were often times not found in the timetable, as if they were extrapolating to find a missing time for first train. In part (ii) some attempted a "normal" subtraction, unaware that they were dealing with time!

Part (b) was answered correctly by two thirds of candidates. The most common incorrect answer was 08.22 which was also written in various formats.

In part (c) 74% of candidates gave the correct arrival time in Stansted. The main errors came from the candidates not being able to add 27 and 28. The other error was to convert the hours to minutes and then forget that they can only have 60 minutes in an hour.

Question 14

Most candidates who managed to get the perimeter of 20 went on to get a side of 5 cm. A large number of students showed confusion between perimeter and area, finding the area of the rectangle (8 × 2) and then going on to divide 16 by 4 to get an answer of 4. This was a very common error. A small number of candidates did not have equal lengths for the square. On very rare occasions, candidates failed to divide 20 correctly by 4 and gave an answer of 4. Also seen was a square length of 2.5 where only two rectangle sides were added, but still divided by 4. Overall, 45% failed to score and half scored all 4 marks.

Question 15

In part (a) nearly all of candidates could correctly write down the correct distance James should sit from the screen. However, part (b) proved more challenging with 43% failing to score and quarter scoring 1 mark for identifying that they had to find the difference between 4.75 and 9.5. Whereas many were able to subtract 4.75 from 9.5 many could not. Many used 9.05 rather than 9.5. Those who tried the decomposition method often arrived at 4.85 or 5.25, both due to a failure to deal with the initial 0 in 9.50. Others counted on and their common error was in dealing with 0.5 as if it were 0.05 often leading to 4.30 or at times 5.30. Clearly time could be well spent in a classroom on such calculations; both formal and informal methods can work if used carefully.

In part (c) when incorrect answers were seen the error was usually arithmetic. There quarter of candidates scored 1 mark on this part.

In part (d) multiplying by 4 was normally seen to be the required approach to this question, but there were alarming arithmetic errors, mostly $4 \times 12 = 44$ and $4 \times 12 = 36$. A few candidates divided by 4. Those who looked at an attempt of adding 0.5 for every two inches, frequently had omissions in their patterns. Two third of candidates scored both marks and a third failed to score.

Question 16

Two third of candidates could not write down the mathematical name for the quadrilateral. The most common incorrect answer was 'rhombus'.

It was clear that a significant number of the candidates were unfamiliar with tessellation with 66% of candidates failing to score. Some drew 6 unconnected trapezia, often of varying sizes. Others drew a pattern which amounted to a combined tessellation of the given trapezium and a rhombus. Some did a rotation pattern (resembling a saw blade). It was obviously not a concept many knew as random drawings of rotated trapeziums or enlargements were seen or some simple drawings of every shape they could think of! Some drew rather casually but others were very precise and went well beyond 6 to form an elegant pattern. Only 32% of candidates scored both marks.

Question 17

Candidates seemed to be aware that they needed to convert to a common format, with the most common method being to convert all the marks to 'out of 40'. Many candidates found either the 14 or 15. The most problematic conversion was finding $\frac{3}{8}$ of 40 with the common error seen being 3×8, giving Wendy a winning score of 24. Errors in calculating 35% of 40 came from attempting to multiply by 35 then divide by 100. More popular, and for many it proved easier, was to calculate 35% by doing 10% + 10% + 10% + 5%. Any errors here were in finding the 5%. Percentage comparison was the least seen method, and was done with little success.

Working and conclusions were generally well presented, although some did not make clear which mark went with which person. In some instances candidates found the marks for Salma or Wendy, failing to realise that a comparison could only be made when all three had been converted into the same form.

Overall, 24% scored all 4 marks and 50% failed to score. 11% of candidates scored 1 mark for showing a correct method for one conversion.

Question 18

Many candidates were not able to interpret the given graph correctly with only half of candidates providing the correct fixed charge.

Few candidates drew a graph for part (b) preferring instead to use substitution to calculate prices. Many did not seem to understand the term ‘fixed charge’ and some stated that Bill charged £11 per mile. The majority only compared one distance for Ed and Bill rather than several distances so that they could not compare long and short distances. Not many candidates found that 20 miles was the same price for Ed and Bill and as a result very few were awarded full marks. Overall 80% of candidates failed to score in part (b), 9% scored 1 mark (generally for a correct method to work out Ed and Bill’s delivery cost for a particular distance) and a further 10% then went on to score 2 marks for providing a general statement.

Question 19

It was pleasing to note that most candidates did show their working on this question. There were many ways to work out which pack gave the better value for money but two third of candidates could not provide one of these methods. The most popular method was to work out 4.23 ÷ 9 and 1.96 ÷ 4 which scored 2 marks. Unfortunately arithmetic errors in this division meant that the final mark was lost. The most common totally incorrect method was to work out the cost of 2 packs of 4 rolls and then just provide an answer of 9 pack or 4 pack, neither of which scored. Only 14% of candidates scored all 3 marks with a further 15% scoring 2 marks for a fully correct method with arithmetic errors.

Question 20

Two thirds of candidates provided the correct answer to part (a) with 5 being the most common incorrect answer.

In part (b) 40% of candidates could find the median speed. Many counted the number of cars incorrectly when finding the median hence arriving at 43, 45, 43.5 or 44.5, etc.

Part (c) was well answered with half providing a range of 31. Many confused median with mean and mode. Many candidates did provide the two numbers involved in calculating the range, but either did not know what to do with the two numbers or could not do the subtraction correctly.

Question 21

This proved rather difficult for the vast majority of candidates with full marks being very rare. Some assumed the triangle was equilateral and identified the angles *DAB* and *DCB* as 50. A fair number did realise that the first stage was to calculate (180 –50) ÷ 2, most then getting 65. Of these about half then were able to identify x as 45 or provide the working for this. A surprising number calculated 180 – 65 – 65 = 50 and then quoted angles on a straight line add to 180, indicating a misapplication of this theorem. Few scored well for the two quality of written communication (QWC) marks. There were many statements such as ‘a triangle is 180’ or ‘a straight line is 180 degrees’. Of those who put reasons that were correctly expressed few identified equal base angles in an isosceles triangle.

There were a few candidates who managed to calculate x correctly but they were then unable to use the correct mathematical language to earn marks for their reasons. Others provided an answer of 45° without any working shown or any angles identified on the diagram. As this is a QWC question unless working is shown no marks can be awarded for $x = 45°$. This is a concept which needs to be taught strictly in schools as mathematical language must be used properly to gain communication marks. 11% of candidates scored 1 mark for either a correct method to calculate the base angles in triangle *BCD* or for getting this incorrect but then going on to provide a correct method to find x. 15% of candidates scored 2 marks. Candidates should be encouraged to write their reasons alongside the actual calculations rather than have a list at the beginning or the end.

Question 22

Many found this a challenging question even though part (b) was a straightforward long multiplication. Over 50% of candidates failed to score on either part with a further 12% scoring just 1 mark often for 3.6 × 3 in (a). A common misconception by students was to calculate 32 × 60 as the area of the slabs with an answer of 1920 often seen. Quite a few candidates gained 1 mark in (a) for 6 and 5 or 10.8 but could not get any further.

Candidates were usually more successful in part (b). Many candidates used a grid but often made arithmetic errors. The most common 'grid methods' error was to try to incorporate the decimal point in their grid which led to conceptual errors with no marks scored. A significant number calculated 10 × £8.63 × 3 and added 2 × £8.63 but addition errors often occurred. The method involving breaking down 8.63 and 32 was very popular but in some cases there were place value errors by using 8, 60 and 3 which were not corrected afterwards. Overall, only 12% of candidates scored more than 3 marks over both parts.

Question 23

In part (a) many candidates got the answer 30. Of those who did not, the process to get from the given recipe to one 2.5 times as big floundered on finding half of 12! Many wrote 12 + 12 + 5. Others wrote 27 simply not using the amount of milk per shortcake, and doing 25 m*l* – 10 m*l* = 15. Others applied a build-up process 12, 24, 30 but then added all.

In part (b) many candidates wrote correct scale factors, often by the side of the recipe items, but then many failed to recognise that they needed to choose the smallest scale factor and gave 120 or 600 as their answer. Alternatively, all 4 scale factors were added and the result multiplied by 12. Scale factors were sometimes achieved by writing out the division calculations, but more did so by writing out the converse multiplication calculations.

Overall, 14% scored all 4 marks, a further 20% scored 3 marks, 20% scored 2 marks and 36% failed to score.

Question 24

The vast majority of candidates found this question accessible, knowing the method to use and were happy to list either multiples or times. However, many made errors when going up in 24 s with the most common error being 10 02 rather than 10 12 from adding 24 to 9 48. Some failed to acknowledge during their addition, that time has base 60 and calculated with 100 minutes in an hour. If they managed to get the times written accurately they were generally able to identify 11 a.m. as their answer. It was far more common to list times rather than multiples with LCM method rarely seen. A significant number of responses listed correct times well past 11am, and missed this as the next mutual time, as they did not line up in the two lists. However, over half of candidates failed to score, 16% scored 1 mark and 24% scored all 3 marks.

Question 25

The success rate for part (a) was disappointing with only 37% expanding the bracket correctly. $6y - 5$ was a common error and $6y + 15$ was also seen a number of times.

Factorising is a challenging concept at this level and many answers to part (b) were blank. A number of attempts were made at adding or multiplying the two terms with only 4% scoring both marks and 8% scoring 1 mark. Of those who formed a bracket $8(x^2 + 2xy)$ was a common mistake. Of the rest partially factorising with 4 or $2x$ was the most common error. A few identified 2 as a common factor but went no further and so scored no marks.

In part (c) it was clear that the vast majority of candidates did not know how to answer this question and did not possess the required algebraic manipulation skills. It was rarely attempted and even rarer to see the correct answer with only 2% scoring 2 marks and 1% scoring 1 mark.

Question 26

In part (a) many candidates missed the "twice a day" instruction, and went on to give an answer of 30.

In part (b) although many candidates recognised that 30 and 40 needed to be substituted into the given formula, many added the two values which meant they failed to score. For those who managed to multiply 30 and 40 together, reaching 1200, the challenge of dividing this by 150 proved too much.

Overall, 6% scored 4 or 5 marks, 25% scored 2 or 3 marks and 26% failed to score.

Question 27

The last and most challenging question on the paper had only had 4% of correct responses with many not attempting the question at all. Of those who did answer, trial and (little or no) improvement was the most popular attempt, resulting in chaos on a page and rarely getting a correct answer A very small minority realised that adding all the expressions was probably required but they were either unable to add them correctly or stopped at 9x + 9 with no idea how to form an equation with 360. Of those candidates that formed an equation, most used the sum of the angles of a quadrilateral but there were candidates who used the other properties of the parallelogram. At the other extreme, some candidates could recall that the sum of the angles should be 360, but they lacked the algebraic confidence to express this in the form of an equation. A very small number formed the equation, and solved it, correctly but this was very rare and very few method marks were awarded. 84% of candidates failed to score.

GCSE Mathematics 1MA0
Principal Examiner Feedback – Foundation Paper 2

Introduction

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

It was pleasing to see that many candidates had been well prepared and were able to demonstrate strategies for solving problems. Candidates were particularly successful in dealing with problems that involved money. However, many candidates were handicapped by the lack of a calculator or were unable to use it profitably, for example when calculating the percentage of an amount.

Report on individual questions

Question 1

All parts were generally well answered. The most common errors were 78 000 on part (b) and 3600 on part (c).

Question 2

Candidates found a variety of names for these two 3-D shapes apart from the correct ones. In part (i) there were a lot of rectangles mentioned and on part (b) many prisms, triangles and triangular pyramids. Incorrect spelling was accepted provided the meaning was clear.

Question 3

Most candidates recognised that Monday was 24. Similarly, very many candidates were able to spot that Wednesday was 8 + 2 = 10. However there was a sizable minority who gave the answer to part (b) as 12, either because they could not find one quarter of 8 correctly or because they did not read the question carefully enough and wrote down the answer to Tuesday.

Answers to part (c) were generally correct although some drew 3 circles and a quadrant for Friday.

Question 4

Candidates tackled this question in a variety of ways. The most sophisticated method seen was 10 ÷ 0.79 followed by 12 × 0.79 and a subtraction from £10. Candidates had then to write their answer using correct money notation. A more common approach involved use of the calculator to multiply 79 or 0.79 until the answer became more than 1000 or 10 respectively. This was then followed up by a subtraction from 1000 or from 10. Candidates who had no calculator were usually reduced to adding 0.79 s or 79 s and were rarely successful.

A substantial number of students misunderstood the question and gave an answer of 12, the number of packets that could be bought for £10. Others were not precise about money notation and wrote 0.52p.

Question 5

Most candidates knew that the angle in a square was 90°. They were less successful in marking an obtuse angle on the diagram where the acute angle was often indicated and even less so in identifying two lines that were perpendicular where very often parallel lines were marked or the letters were put on the diagram in ambiguous positions.

Question 6

Part (a) was well answered as $3c$. The most common miswrite was c^3.

Part (b) was also dealt with well.

Part (c) proved more of a challenge, although some candidates who got parts (a) and (b) wrong managed to get it right. Common wrong answers included $7p – 5t$,$11p + 5t$, $11p – 5t$ and even $7p$ $5t$. A few candidates went on from the correct $7p + 5t$ to write $12pt$ so losing a mark.

Question 7

Most candidates drew the two lines of symmetry - sadly many of these also put in additional lines that looked like diagonals.

Part (b), the idea of rotational symmetry was not well known with a wide variety of wrong answers, including 360° and 5.

Question 8

Both parts were fairly well done but with the typical errors seen on F tier papers. The most common was confusion between perimeter and area so the answers appeared reversed in parts (a) and (b). The other error sometimes seen was where the squares on the extreme corner tips of the shape were counted giving an answer of 28 cm for the perimeter.

Question 9

All parts of this question were very well answered.

Question 10

Most candidates were able to find x because they knew that $x + 60 + 140$ had to come to 360. They were less successful in part (ii) where many simply showed there working or said that they took 60 and 140 away from 360. An acceptable reason was that the sum of the angles around a point is 360^{o}, with markers looking for the three key elements of ‘angles’, ‘point’ and ‘360’. Another reason accepted was ‘The sum of the angles in a full turn is 360°’ emphasizing the dynamic nature of the concept of ‘angle’. ‘Angles in (or round) a circle’ was a common unacceptable response.

Question 11

Very few candidates could not read the time; generally those that failed had confused the hour and minutes hand. Similarly there were many good answers to part (b), although some spoiled their response by writing 16:10 p.m.

Part (c), a time problem was quite well done. One common strategy was to add 15 mins, 10 mins and 1 hour to get 1 hour 25 mins and then subtract from 8 15. Although sound, some candidates were let down by working out 8.15 – 1.25 = 6.9. A second strategy was to start with 8 15 and subtract 10 mins, then 1 hour and then 15 mins. Some candidates probably spotted they could make the working easier if they subtracted the 15 mins first. A large number of candidates had an idea of when to start (say 6 30) added on the 10, the 15 and the 60 (misn). When they found they got to 7:55, they tried to adjust (sometimes successively) to a later time. However, there was a significant number using this approach who started at 6:45, added on the 1:25 to get 8:10 and left their answer and working as this. Possibly they were interpreting the question in a sense that 5 minutes early is on time.

Question 12

Part (a) was well answered. Part (b) proved a challenge as there was no direct way of reading from the graph to find the answer. The most common successful method was to read off at 6 km and multiply the number of miles found (about 3.75) by 10. Some candidates had a clear idea of the required method but scored only 1 mark because they could not multiply a decimal by 10 correctly. Answers of 30.8 (from 10 × 3.8) and 30.7 (from 10 × 3.7) were often seen often without any working at all. A less common strategy was to use the 8 km = 5 miles conversion from the edge of the graph and put down a number with a value between 7 × 5 and 8 × 5. However, this conversion was used incorrectly a number of times, with the candidate working out 60 × 1.6, giving an answer of 96.

Question 13

Most candidates could readily identify the mode for part (a). Although the correct answers were often seen for parts (b) and (c) many candidates were confused over precisely what they had to do. So in part (b) a common answer was to add the scores to get 34 and write that on the answer line. Many candidates also confused the mean with the range. Of course there were others who found the median for the answer to part (b).

Question 14

Many candidates knew that they had to substitute in the expressions for the values of x and y. Part (a) was commonly correct as the evaluation of the expression 3.5 × 12 – 5 was written in the order that the multiplication would naturally be carried out first. Some candidates were unaware that $3.5x$ implies multiplication and thus worked out 3.5 + 12 –5.

Part (b) proved to be more of a challenge because of the difficulty some had with negative numbers.

Question 15

Most candidates could draw pattern number 4 on the grid although not all shaded in the relevant squares. The remaining two parts of the question proved more of a challenge. In part (b), some candidates sketched out what they thought pattern number 10 should look like, whilst others started the sequence 4, 7, 10.... Many candidates counted the white space in the middle as a tile and so used the sequence 5, 9, 13,… to end with 41. Other methods of greater insight or sophistication were seen - for example, the use of $3n + 1$ showed that some students had learned how to find and use the nth term of an arithmetic progression. A particularly insightful analysis seen occasionally was that the numbers of grey tiles in the top and bottom rows of the pattern were the same as the pattern number and that the number of grey tiles in the middle row was 1 more than the pattern number. A common incorrect answer was 32 which probably came from assuming that the number of grey tiles in pattern number 10 was double the number in pattern number 5.

Similar lines of reasoning were used to answer part (c).

Question 16

This proved to be a well answered question as most candidates knew what a factor was and could find 4 factors of 60. Generally as well as finding 4 factors candidates were able to select 4 which had a sum greater than 20 but less than 35. Very occasionally the sum of the factors turned out to be 20. The other common mistake which still earned marks was to use 8 in the list of factors of 60. Quite often there was little evidence of working, such as a list of possible factors. Weaker candidates often wrote down a list of multiples of one of the factors (often the factor 6)

Question 17

Part (a) was found to be a more challenging question because of the fact that 120 is not a multiple of 84, so a unitary method has to be used. Virtually all the successful candidates worked out the 12° represented 1 medal, and then were able to spot 10 for the number of gold medals. Part (b) was answered correctly by a minority of candidates who were aware that the pie charts showed only the relative number of medals won within each of the two countries.

Question 18

This standard probability question was generally well answered. Some candidates gave both a correct probability and a word, for example "$\frac{0}{18}$, impossible". This was allowed for the mark, but not just the word on its own. Some candidates gave answers as ratios or odds. These did not gain marks.

Question 19

Parts (a) and (b) were generally well answered although many candidates confused the order of operation in (a) and gave an answer of 5, presumably from 12 – 7. The fact that the solution of the equation in part (c) was 2.25 meant that it was not easy to spot so candidates had to resort to some lengthy trial and improvement or had to use a proper process such as subtract 6 from 15 and then divide by 4 in some cases accompanying a flow chart.

Question 20

This type of problem has become more common. There are a variety of strategies available and the candidate has to select one. The most common method by far was to attempt to find 42% of 250, then $\frac{2}{5}$ of 250 and subtract the two answers from 250. Many candidates had technical difficulties with finding 42% of 250 and were only allowed a mark for a build up method if each part were correct - for example 25 four times and two lots of 2.5. They also had difficulties with $\frac{2}{5}$ of 250, often working out 250 ÷ 5.

Some candidates occasionally worked with percentages so were able to convert $\frac{2}{5}$ but often left their answer as 18% rather than trying to find 18% of 250. A few candidates were able to find 42% of 250 (105), then took it off 250 (145) and found $\frac{2}{5}$ of 145.

Question 21

Many candidates were unaware of the idea of an algebraic graph and thus did not attempt the question. Of the remainder, some knew that the answer was a straight line, but often joined the points (–1, 3) and (3, –2), presumably focussing on the numbers given in the equation and in the range of values of x. Of course, many knew that they had to work out a set of values of y and used sensible integer values of x. Of these that did this, some candidates made an error on the value of y when $x = –1$. Surprisingly, there were many cases of correct values of y being found but a really incorrect set of points being plotted - often in a vertical line. There were some cases of 5 points being plotted correctly but not joined up.

Question 22

This question was found challenging as it was not making the common demand of sharing an amount in a given ratio. There were three successful strategies used. Firstly, some candidates turned it into a problem they were more used to and looked for a number which when shared in the ration 2:5 gave a difference of 45. As they had calculators this could be done fairly quickly. Secondly, some candidates started with the ratio 2:5 and built up through 4:10, 6:15 and so on until they reached 30:75. Thirdly, some candidates carried out the most efficient method of dividing 45 by 3 and then multiplying the resulting value by 2. Many candidates treated the question as a 'divide in the ratio' and scored no marks. Others gave an answer of 18 obtained from 45 ÷ 5 × 2.

Question 23

This was a quality of written communication (QWC) question and as such a candidate was expected to display sufficient and clear working to enable them to reach a decision and state it unambiguously to answer the demand of the question. Generally, candidates answered the question well. The main strategy used was to notice that 5 × 2.5 kg = 12.5 kg. So by multiplying the supermarket price by 5, this gave a price that was directly comparable with the farm shop price. If the candidate went on to state that the farm shop was better value then all 4 marks were awarded. (Note it was insufficient for the communication mark to just refer to the 12.5 kg.)

Another method often employed was to find the cost of 1 kg from the farm shop and 1 kg from the supermarket then compare these and state ‘farm shop’. Because a comparison was being made in this question candidates had to be careful about using consistent units or at least making clear what the units of cost were, £ or p. Some candidates who knew they had to compare common quantities worked out 12.5 ÷ 9 and 2.5 ÷ 1.83.

They usually made the wrong choice of sale outlet by selecting the smaller number as being the best value. A few candidates chose a different weight to compare, with 25 being the most common.

Question 24

Both parts of this were standard transformation tasks. There was some confusion in the minds of many candidates as to which was the *x*-axis; many gained 1 mark by carrying out a reflection in the *y*-axis. Although most candidates drew a reflection there were a few rotations and even translations.

Whilst many candidates scored 2 marks on part (b) there were a lot who did not understand the idea of enlargement and simply extended a couple of sides, usually the bottom and left hand. A few candidates carried out an enlargement with scale factor 2.

Question 25

This proved to be a well-answered question. On part (a) most candidates multiplied 200 by 25.82. However, after that they were less clear with answers of 5164, 5100, 51.64 and 52 often seen. Part (b) was well answered generally by dividing 400 by 25.82 although some candidates used their calculator to good effect and found 15.50 by trial and improvement.

Question 26

Part (a) was a standard one word answer question. Qualifications of ‘negative’ such as ‘strong negative’ were allowed. Descriptions of a relationship were not as the question asked specifically about correlation. Many candidates were able to get an allowable answer to (b) either by drawing a line of best fit or by estimating directly from the graph.

Question 27

This was a QWC question. As such, candidates were expected to show clear working and to reach and state a conclusion based on their calculations. The conclusion had to be the correct number of boxes for the area of grass they had calculated and to earn the mark the candidate had to display enough working to allow at least 1 method mark to be obtained. The most successful candidates were those that had a clear idea of what to do and set out there working in a systematic manner.

There were many pleasing attempts at the question although few achieved all five marks, mainly because they could not work out the area of the pond. In fact, many candidates thought that the area of the pond was 3.8, not realising that the 3.8m above the double arrowed line was the diameter. In addition many worked out $\pi \times 3.8$ for the area. A common error, when faced with an answer of, for example, 5.3 to their calculations, was to round down to 5.

Question 28

The last question on the paper was also a QWC one. In order to gain full marks, a candidate had to work out the total annual cost of water used, add £28.20 to it and then state a suitable conclusion relating back to the demand. Candidates were allowed to use an approximate number of days in a year - the most common approximations being 364 (from 7×52) and 360 (from 12×30). The approximation 336 (from $7 \times 4 \times 12$) was felt to be too far off 365 and so lost a mark.

Many candidates made a good attempt at this question. They clearly understood what processes were involved and the need to state a conclusion. However, many candidates lost at least one mark from not spotting that cost was given in pence per 1000 litres and so calculated costs in the several thousands of pounds.

Candidates were awarded a mark for an answer between £87 and £89 which allowed for sensible approximations. They were also awarded a mark if they were clear what units of cost they were using when comparing with the £107 and stating the appropriate conclusion based on their calculation.

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 × 60 rather than 32 × 60 × 60 was frequently seen. Accuracy in arithmetic was also a problem with 60 × 60 seen as 1200 and 0.6 × 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 × 8.63; frequently the complete calculation was actually for 20 × 8.63 or 24 × 8.63 or 31 × 8.63 or 30 × 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 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 9 a.m. 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 $5y – 15$. 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 40 degrees 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 part (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 (e.g. 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 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 3×9 correctly, 18 was a popular incorrect answer for this multiplication. Another error that was seen was to write the initial answer as 27×100^{13} or 27^{13} rather than 27×10^{13} showing a lack of understanding of the relevant index laws 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°' 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 $BCD = 65°$ (or similar) was expected rather than just to see a 65° 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 $\frac{3}{110}$.

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 $y = f(\frac{1}{2}x)$ was clearly confused with the required transformation of $y = 2f(x)$ and $y = f(x) + 2$.

GCSE Mathematics 1MA0
Principal Examiner Feedback – Higher Paper 2

Introduction

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

This paper gave candidates ample opportunity to demonstrate their understanding. Some very good attempts at the paper were seen. The performance of candidates on the questions which assessed AO2 and AO3 was generally very pleasing.

The majority of candidates showed working out to support their answers and this was often well set out and easy to follow. One problem that was evident on this calculator paper was the use of premature approximation. Many candidates rounded values at intermediate steps in their calculations which resulted in a loss of accuracy in the final answer and a loss of marks.

Several questions on this paper (e.g. 10(b), 14(b) and 20) highlighted the problems that many candidates have when required to manipulate algebraic formulas and equations. In algebra work, candidates also need to be more accurate in their use of brackets as poorly written algebra can lead to marks being lost unnecessarily.

Candidates must take note when questions are labelled with an asterisk to indicate that quality of written communication is to be assessed. They should always make sure that full working is shown to demonstrate their answer to the question set and present this working in a logical manner. When geometric reasoning is involved candidates must use the correct terminology.

Report on individual questions

Question 1

Many candidates gained two marks for finding x = 133 but disappointingly few candidates achieved the third mark for giving correct reasons. Many either wrote no reason at all or, most commonly, just wrote one reason e.g. 'angles on a straight line add up to 180'. Most candidates were not able to give full clear statements with the correct naming of the types of angles. The minimal phrases that were often used were insufficient to gain any credit. Some candidates used the terms 'F angles', 'Z angles' and 'C angles' in their reasons rather than 'corresponding angles', 'alternate angles' and 'co-interior angles'. These terms are not acceptable. A small number of candidates thought that x was 47° despite the fact that it was clearly an obtuse angle.

Question 2

Most candidates were able to score at least one mark in part (a). Those who were most successful often worked out the numerator and denominator separately and then did the division. Candidates who did the entire calculation in one go often forgot the need for brackets and lost both marks. Part (b) was not answered so well. An answer to 1 decimal place rather than 1 significant figure was frequently seen. Rounding or truncating to the nearest whole number was also commonly observed as were 40.0 and 4. Another common mistake was to include all decimal places, e.g. 40.000.

Question 3

Many fully correct responses were seen in part (a). Candidates clearly know what to look for in this type of question and most managed to describe two things wrong with Pradeep's question, usually answering succinctly and correctly. In trying to explain that the boxes were not exhaustive some candidates stated that there was no box for those who don't play sport, failing to recognise that this was covered by '0 to 1 hours'. Part (b) was also answered well by most candidates. The vast majority included a question and at least three response boxes. The main error was failing to include either a time frame or, less commonly, a time unit with the question. Some candidates who identified a particular 'error' in part (a) did not go on to rectify this when designing their own question in part (b). A few candidates lost one mark by phrasing their question to ask 'how often' people played sport rather than 'how much time' they spent playing it. The response boxes needed to be either non-overlapping or exhaustive and most candidates managed to have at least one, and often both, of these criteria in their boxes. Examiners reported that some candidates used inequalities with their response boxes. Centres should note that this is not accepted. It was pleasing that very few candidates used a data collection approach.

Question 4

This question was answered very well with many candidates drawing the correct straight line between $x = -1$ and $x = 3$. An accurate table of values was often seen, but not always; substitution of $x = -1$ proved to be the most challenging. Some candidates plotted the points correctly but failed to join them up to produce the straight line required. Candidates who attempted to use $y = mx + c$ often failed to take into account the different scales on the two axes and gained one mark for drawing a straight line through the point (0, –2) with an incorrect gradient.

Question 5

Many candidates had learnt to work systematically through this type of question, setting out their working clearly and remembering the requirement to add a sentence at the end. Decisions were generally well made following the working shown, with almost all candidates remembering to round up rather than down. Most mistakes were made with the calculation of the area of the circles, with candidates using an incorrect value for the radius or using the formula for the circumference instead. These candidates usually managed to gain three out of the five marks if they worked out the correct number of boxes that would be needed for their area.

Question 6

There were many varied methods employed in this question to good effect with most candidates understanding the concept of 'better value'. Those that chose methods that led to the price for an equivalent amount, e.g. how much 12.5 kg of potatoes would cost at the supermarket, were the most successful, nearly always managing to reach the correct conclusion. Those who worked out the number of kg that could be bought for £1 at the farm shop and at the supermarket generally reached the wrong conclusion. In some cases the QWC mark was lost, not for the incorrect conclusion, but rather that candidates failed to state in words ‘farm shop’ or supermarket’, choosing instead to indicate their answer by drawing arrows, circling or writing ‘this one’. A question that assesses the quality of written communication requires candidates to communicate their conclusion clearly.

Question 7

Part (a) was answered extremely well with the vast majority of candidates able to identify the correlation as negative. A few candidates described the relationship between the distance and the engine size. Most candidates answered part (b) correctly, often without drawing a line of best fit. Centres should encourage candidates to show a clear method on the graph as, without this, answers just outside the required range cannot be awarded any marks.

Question 8

Part (a) was generally answered very well. The majority of candidates who failed to draw the triangle in the correct position did at least draw it in the correct orientation. A small number of candidates rotated the triangle 90° anticlockwise or 180° rather than 90° clockwise. Candidates were not quite as successful in part (b). It was clear that the majority of candidates understood that scale factor 3 increases each length threefold but enlarging from a given centre was not as well understood with candidates often plotting the bottom left vertex at (1, 2) or at the origin. Two marks for an enlargement of scale factor 3 in an incorrect position were frequently awarded. When candidates had used an incorrect scale factor this was most commonly scale factor 2. Some candidates did not use the same scale factor for both the base and the height.

Question 9

Most candidates answered this question correctly and gained all 3 marks. For the majority the first step was to change £200 into koruna by multiplying 200 by 25.82. Common errors were to give 51.64 as the final answer or round it to 50 or 52 instead of to 51. Few candidates used the method that started with 100 ÷ 25.82 successfully. A few divided 200 by 25.82 and there were some who misread the number 25.82.

Question 10

The vast majority of candidates gained at least one mark in part (a) and many listed the five correct integers. The most common error was to leave out one value (most commonly 3) and some candidates gave an extra value (most commonly –2). Some candidates clearly confused $<$ and $\leq$ as they included –2 and omitted 3. Seen less often, was writing the values in a non-numerical order and missing one out, usually 0 or 1. The term ‘integer’ was generally understood. Candidates were less successful in part (b). A significant number of candidates wrote ‘3.25’ on the answer line, in some cases after showing $x < 3.25$ in the working. Many approached solving the inequality by treating it as an equation which meant that they usually failed to use an inequality sign in their answer. Isolating the x terms and the non-x terms proved to be a problem for many candidates and $10x$, 5 and –5 were often seen. Some of those who got as far as $4x < 13$ did not go on to complete the final step of the solution.

Question 11

Many candidates set out their working well and obtained a fully correct answer. A significant number of candidates, however, lost the final mark by not giving the answer correct to 1 decimal place. Another common error was to carry out trials at $x = 4.6$ and $x = 4.7$ and then look at the differences from 72. This is not a valid method to establish an answer to 1 decimal place with certainty. Candidates needed to carry out a further trial to establish the fact that the value of x was between 4.6 and 4.65. A few candidates scored no marks either because they wrote 'too big' or 'too small' without showing the result of each trial or because they evaluated an incorrect expression such as $x^3 – 6$.

Question 12

This question was generally answered very well with most candidates choosing to multiply 400 by 0.3. Some, though, gave the answer as $\frac{120}{400}$, which only gained one mark. Commonly seen incorrect methods included $400 \div 0.3$, $400 \div 3$ and $400 \times 0.3 \div 6$.

Question 13

The responses to this question were very mixed. When candidates knew how to tackle the question the use of the mid-interval values was very much in evidence but there were still some who used either the upper or the lower values of the class intervals. A significant number of candidates worked out the correct answer but then felt the need to round this to 28 on the answer line or to give the answer as the class interval itself. Those who had shown 28.25 in the working were not penalised for doing this. Some candidates realised that 'fx' could be involved and did the appropriate calculations but then decided not to use these results, choosing instead to divide the total of the frequencies by the number of class intervals (a very common incorrect method) and gaining no marks.

Question 14

Candidates were generally quite successful in part (a). Most candidates appeared to know a method for expanding two sets of brackets with many achieving at least one mark. Methods seen included FOIL and the use of a grid. Common errors included ignoring the signs of the terms ($–4p$ was often given as $4p$) and adding the final two terms instead of multiplying. Simplifying the four-term expression sometimes resulted in errors, e.g. $–4p + 9p$ being simplified to $13p$ or $–5p$ or to just 5.

Part (b) was not answered so well. Most candidates realised that they needed to multiply both sides of the equation by 3 but many weren't sure how to carry this out. $15w – 24 = 12w + 6$ was seen often and the RHS was sometimes given as $4w + 6$ or $12w + 2$. Some candidates were able to rearrange their four-term equation correctly but many made errors when attempting to do this. Some candidates who got as far as $14 = –7w$ were unsure of how to deal with the minus sign.

Candidates who recognised the expression in part (c) as the difference of two squares almost invariably found the correct answer but there were many who gave the answer as either $(x + 7)^2$ or $(x – 7)^2$. Others tried to find a common factor and $x(x – 49)$ was a common incorrect answer.

Part (d) was answered less well although a good number of candidates did successfully apply the laws of indices to get either a fully correct answer or to gain one mark for having two correct terms within a product. Many candidates did not know that the power of $\frac{1}{2}$ indicates square root and $9^{\frac{1}{2}}$ was commonly given as '4.5' or left as '9'.

Question 15

The better candidates coped well with the demands of this question and gained full marks but there were many who completely mixed up the units and the various possible methods of working by day and by year. By far the most successful were those who compared the annual running costs. A lack of awareness of what units they were working with was the biggest source of error for candidates. In some cases this resulted in bills of over £6000 because candidates multiplied the number of cubic metres by 91.22 pence and didn't convert to pounds before adding the standing charge of £28.20. It is disappointing that these candidates didn't realise that their answer was out of all proportion to the context of the question and thought that not having a water meter would save Henry almost £6000.

Question 16

Those using the direct method of cosine usually managed to work through to a correct answer. The most common mistake was to round 0.666… to 0.6 and to find $\cos^{-1}(0.6)$. This resulted in an answer of 53.1 which meant that the accuracy mark had been lost. Those using Pythagoras (which gained no marks until a correct statement for sin or tan was seen) frequently lost their way in the calculations and here again early rounding too frequently resulted in a loss of accuracy. A few candidates worked in radians or gradians but these candidates could still to get two of the three marks available.

Question 17

This question was well attempted and the majority of candidates gained at least one mark. The use of 6200×1.025^3 was not as widely used as might have been expected and the question was often made much more "labour intensive" than it needed to be. Many candidates chose to work out each year individually and this frequently resulted in small mistakes that prevented full marks being awarded. Incorrect answers were often due to poor rounding either at the end or at the intermediate stages. Common errors included finding only one year's interest and using simple interest instead of compound interest. There were very few responses in which the candidate had found the total interest instead of the total amount in the account.

Question 18

This question required the candidates to first find the side *BD* and then to use that to find the length of the side *CD*. Many got off to a good start by correctly using Pythagoras to find *BD*. At that point a number of candidates stopped, possibly believing that they had answered the question, and so lost the remaining three marks. Of those that realised they needed to continue, a good many managed to use a correct trigonometric expression to gain the third mark, although incorrect rearrangement often meant that they gained no further marks. Those that chose to use 'tan' often missed out on the remaining method mark for not realising that they had worked out the side *BC* and so still needed to do one further calculation. Candidates who used Pythagoras incorrectly in the first stage were still able to gain the two marks for the second stage if they used their value for the length *BD* correctly. Early rounding of the length *BD* to 10.6 in this question was not penalised as it still gave an answer within the range. Candidates should, however, be reminded not to prematurely round answers to 1 decimal place at the intermediate stages of calculations.

Question 19

Many candidates made hard work of this question which could have been done so easily with the correct use of a calculator. Many converted the values to ordinary numbers to do the calculation, producing cumbersome strings of zeros, often resulting in an answer not given in standard form or causing them to lose their way. Some candidates were able to evaluate either the numerator or the denominator correctly but not both. A very common error made by those candidates who did get to 2.38×10^{-9} was to overlook the fact that they needed to take the square root to get to the final answer, thus gaining two of the three marks. A number of candidates merely gave an answer with no working; candidates need to be made aware that if an answer has been rounded or truncated to outside the acceptable range and no working is shown then the examiner will not be able to award any marks.

Question 20

This question was a good discriminator with a range of marks awarded. Most candidates began by attempting to expand the brackets. These expansions were generally correct although some candidates reached $2d - t$ rather than $2d - 2t$ and some candidates multiplied both sides by 2. Dividing by 2 as a first step was seldom seen. Progress after this first step was patchy. A large number of candidates were unable to isolate t correctly and failed to gain any further marks. The most common error was to move terms from one side to the other without a change of sign while some candidates could not cope with operations involving directed numbers, e.g. subtracting $-2t$ from $4t$ and getting $2t$. Those candidates who obtained $7 - 2d = -6t$ often lost the minus sign when dividing through by –6. There were very few answers involving decimals rather than fractions.

Question 21

The majority of candidates had no understanding of what was required in this question. Candidates either attempted the proof by substituting various values of n into the expression $(2n + 3)^2 - (2n - 3)^2$ or they made no attempt at all. A significant number of those who did know what was required lost marks by failing to use brackets or by incorrectly writing their algebraic expressions. It was not uncommon to see '$4n^2 + 12n + 9 - 4n^2 - 12n + 9 = 24n$' which is an incorrect statement. This question was an algebraic proof and required the algebra to be correctly written at all times. Many candidates gained one mark for the correct expansion of either $(2n + 3)^2$ or $(2n - 3)^2$ but were then unable to proceed any further. Some expanded $(2n + 3)^2$ as $4n^2 + 9$.

Question 22

Candidates who realised that they needed to use the quadratic equation formula were usually able to score the first method mark. Some, though, did not extend the dividing line between the numerator and denominator the full length of the formula. Candidates often only scored one mark as they were unable to deal successfully with the negative signs; $b = -4$ created problems for the correct evaluation of both $-b$ and b^2. Candidates sometimes failed to obtain the final mark because they did not give both answers to the required degree of accuracy, e.g. writing –0.39 instead of –0.387. Some candidates showed little working and wrote their final answer with incorrect signs. Few attempted to use the completing the square method and those who tried "trial and improvement" were invariably unsuccessful.

Question 23

In part (a)(i) the correct definition of a random sample was rarely seen. Many candidates talked about choosing at random with a whole host of suggestions about how to do this but never actually mentioned the notion that 'every member has an equal chance of being chosen'. Some candidates stated that a random sample was one where every member had an even chance of being chosen. This is not acceptable as the use of the word 'even' implies a 50/50 chance. Part (a)(ii) was reasonably well answered with the most popular answer being to write the names of the students on pieces of paper and pick them out of a hat. Some candidates talked about using a random number selector but sometimes failed to mention that each student had to be given a number first of all. There were many incorrect answers such as 'stop people at random' and 'ask the first ten people that you meet'. Part (b) was generally answered quite well. A common error was to round 20.96 to 20 instead of to 21. Some candidates, though, obtained the numbers 1140, 239 and 100 but had little, or no idea, how to link them together to work out a stratified sample. It was not uncommon to see answers such as 139 which were bigger than the sample size of 100.

Question 24

This question was often omitted and it was generally not well done by those who did attempt it. A number of candidates treated the triangle as right angled and used cos, sin or tan to find one of the sides. Those who used the sine rule were mostly able to find at least one side successfully. Many candidates found both missing sides which was unnecessary. Most knew that they had to use $\frac{1}{2}ab \sin C$ for the area but sometimes did not use the angle included by their two sides.

Question 25

This question was a good discriminator. Many of the weaker candidates were unable to make a good attempt at it but the more able candidates often gained full marks. Most candidates used a tree diagram with mostly correct branches and the majority recognised that there was no replacement. Some went on to include a third set of branches or had 18 as the denominator for the second set of branches. The most common approach was to add six products with most candidates selecting the correct pairs of probabilities. Arithmetic errors did occasionally lead to loss of the final accuracy mark. Far fewer candidates attempted the quicker method of working out the required probability, 1 – (probability of two of the same type). Those who used replacement often earned both of the two marks available for this approach and some scored one mark for having at least one correct product. Most candidates used fractions throughout and gave their answer as a fraction or converted it to a decimal at the end. Some converted to decimals at an earlier stage and often lost accuracy as a result of premature rounding. For the weaker candidates the tree diagram was often all they managed; they did not know what to do with the probabilities and some added rather than multiplied the probabilities.

Question 26

Many candidates have a lack of confidence when it comes to working with vectors and this question was frequently not attempted. Those who did attempt it often gained at least one mark as part (a) was generally answered quite well. In part (b) correct expressions for the vector *AP* were much more common than correct expressions for the vector *BP*. Those trying to use *BP* often failed to recognise that the change in direction required a change of signs. Candidates with some idea of what was required often scored one mark for a suitable 'vector journey' although sign errors were often apparent. Some candidates lost marks by failing to include brackets. Those who scored the first two marks for a correct expression for *OP* were often unable to simplify their answer to gain the final accuracy mark. Misunderstanding of ratios led a considerable number of candidates using $\frac{1}{3}$ instead of $\frac{1}{4}$. Responses to this question were often confused and difficult to follow making the marking of them more challenging for examiners.

Grade Boundaries

GCSE Linear Mathematics 1MA0
June 2012

1MA0			**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
1F	Foundation tier	**Paper 1F**								
2F	Foundation tier	**Paper 2F**								
1H	Higher tier	**Paper 1H**								
2H	Higher tier	**Paper 2H**								

(Marks for papers 1F, 2F, 3H and 4H are each out of 100.)

1MA0		**A***	**A**	**B**	**C**	**D**	**E**	**F**	**G**
1MA0F	Foundation tier				130	106	82	59	36
1MA0H	Higher tier	164	128	90	52	13			

(Marks for 1MA0F and 1MA0H are each out of 200.)