Examiners' Report
March 2013

GCSE Mathematics 1MA0
Higher (Calculator)
Paper 2

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Introduction

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

The early questions (Q2 and Q7(b)) testing quality of written communication (QWC) were generally well done with the majority of candidates showing ordered working. It was noticeable that some candidates had the correct working present but then made the wrong decision or forgot to include units with their answer or decision. It is equally important that all working is shown in other questions as well, not just in QWC questions.

Disappointingly, some candidates showed a lack of understanding of three-letter angle notation in Q13(b). In a similar vein, the usual problems arose when the formula for the circumference of a circle was needed in Q5 and the area of a circle in Q19; it is clearly important that these formulae are learned by candidates.

There are still occasions when it is difficult to read candidates' writing and digits. For example, it is sometimes hard to distinguish between a 4 and a 7; it is incumbent on the candidate to write clearly.

Report on individual questions

Question 1

The drawing of a stem and leaf diagram is clearly well understood. The majority of candidates were able to give a correct diagram with the key complete. However, candidates would be well advised to count the number of leaves in their final diagram; this would help to cut down on instances of the most common error of omitting one or two values. Incorrect notation in the key caused some to lose a mark.

Question 2

It was encouraging to see well-presented working with a concluding statement from the majority of candidates. Some lost the final mark through not including units with their final answer. It is important that, where appropriate, units are included with answers.

The most common methods used were to work out that 500 g of flour would be needed or that the given amount of flour was enough to make only 19 cakes. A minority of candidates did produce correct working but followed this with the wrong conclusion. Some candidates found the amount of flour needed for 18 cakes and stopped there; this approach did not gain any marks.

Question 3

The vast majority of candidates gave the correct answers for parts (a) and (b).

Part (c) was also well done. Common errors included using six squares rather than five squares for the horizontal line and showing the wrong amount of time for the journey home. A few continued away from home while others went back in time to (2pm, 0). Nevertheless, it was pleasing to see that a large majority used a ruler to draw the lines.

Question 4

Many candidates demonstrated a good understanding of probability in part (a) and scored full marks. Some were able to demonstrate the correct method but made an arithmetic error. Another common error was to leave 0.7 as the final answer. Sometimes the correct answer was seen in the table but a different answer was written on the answer line; in this circumstance the answer on the answer line had to be considered as the candidate's final answer.

A common error in part (b) was to work out 0.35×200, using the answer from part (a), rather than 0.1×200. Another equally common error was to give an answer of 50 from $200 \div 4$.

Question 5

The most common error was to use the formula for the area of a circle and then multiply by the cost per metre or just to multiply the diameter by the cost per metre. Neither of these approaches gained any marks. Those candidates who were able to recall the correct formula for the circumference of a circle generally went on to gain full marks, although a small minority did divide rather than multiply by the cost per metre.

Question 6

A significant number of candidates worked the question all the way through in pence but then failed to realise the necessity to convert to pounds at the end, giving an answer of £41 496 rather than £414.96 – it was disappointing to see this error occurring so frequently on the Higher paper. Other candidates did realise the need to work in pounds but did not always carry out the conversion from pence to pounds accurately.

There is still a high number of candidates who find 5% by finding 10% and then halving their answer. If correct values are given for 10% and 5% then full marks can be awarded; however, in the event of the values for 10% and/or 5% being incorrect, no marks can be awarded unless a full method is shown. There were also many candidates using multipliers for 5% rather than for 95%. One consistent error was to stop once 5% had been found, not realising that this amount had to be subtracted from the original cost.

Accuracy was often lost by premature approximation, especially by those resorting to the 'build up' method for multiplying or finding percentages.

Question 7

Part (a) was well answered. Common incorrect answers were 0.4 (from $6 \div 15$); 9 (from $15 - 6$) and 90 (from 15×6). A number of candidates changed 6 hours into minutes.

Part (b) was testing QWC. Candidates were reminded in the question to show all working but not all remembered to do so and thus failed to gain full marks. All working, no matter how trivial, should be shown in QWC questions.

On the whole, this part of Q7 was well tackled, with most candidates gaining full marks. Those who had the correct decision with a distance of 24 km or 12.5 miles but failed to show working gained 1 of the 2 marks available. Occasionally, the wrong decision was made following correct working or no decision at all was given. Additionally, candidates sometimes failed to include units, which caused them to lose marks, and some confused km and miles following correct working. Candidates who changed 20 km into miles were more likely to reach a wrong conclusion.

Question 8

The vast majority of candidates showed all their supporting working. Typical reasons for failing to gain full marks remain the same as in previous series. The most common error was showing correctly evaluated trials for $x = 2.8$ and $x = 2.9$, then concluding that the correct answer was $x = 2.9$ as this trial gave a value closer to 15. This is an incorrect method for a non-linear function. Candidates must carry out a final appropriate trial (for example, in this case, at $x = 2.85$) in order to gain full marks. Other frequent errors included giving the final answer to more than one decimal place and giving the result of the evaluation rather than $x = 2.9$.

Question 9

It was disappointing to see a significant number of candidates fail to gain full marks in this question through not being able to find the area of a relatively straightforward compound shape correctly. In order to find the area of the cross section, it was necessary to work out at least one missing length. Candidates would be well advised to show any length that they calculate on the diagram so that it can then be followed through in subsequent calculations. Many just used the measurements given on the diagram in some way and so gained no marks. It was common to see attempts to work out the total surface area or the sum of all the edges rather than the volume. A common mistake was to calculate 7 × 11 × 20 and stop there.

Question 10

Descriptions such as 'moved six to the right and one down' and incorrect notation gained no marks. In questions where the demand is to describe a transformation, there is always 1 mark available for the correct mathematical description of the transformation; translation in this case. When the transformation is a translation the second mark is for the correct vector, which must be given in a vector form $\begin{pmatrix} 6 \\ -1 \end{pmatrix}$.

A common error was to give the vector $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$, which came from moving from the top right-hand vertex of **P** to the top left-hand (rather than right-hand) vertex of **Q**. A significant number of candidates used coordinates instead of a column vector. There were also many who included a fraction line in the vector.

Question 11

Success in all three parts of this question was very variable.

The most common error in part (a) was to fail to expand both brackets correctly. Of those who did expand correctly many seemed unable to simplify, with 12 and −2 being combined incorrectly to give −10.

In part (b), candidates who knew how to find the product of two linear expressions frequently made arithmetic errors when simplifying, with $-8x + x$ often being simplified to $9x$ or $-9x$ rather than the correct $-7x$. Another common error was to give −3 as the product of 1 and −4, adding rather than multiplying the numbers.

In part (c), some candidates failed to factorise fully but did gain 1 mark for a correct partially factorised answer. A significant proportion of incorrect answers occurred when candidates tried to factorise into two brackets.

Question 12

In Q12(a), the two common errors were to omit the number 1 or 0 from the list of integers or to include −3.

Q12(b) was about solving an inequality; it was therefore vital that the final answer was an inequality. Failure to write the final answer as an inequality, instead writing $p = 6$ or just 6, meant that the accuracy mark could not be awarded. There was much evidence of poorly organised work, even on those responses where the correct answer was obtained.

Question 13

Part (a) was answered correctly more often than part (b).

The common error in part (a) was to apply Pythagoras' Theorem incorrectly, adding rather than subtracting the squares of the lengths.

In part (b), it was evident that a significant number of candidates were unable to identify angle *RPQ* correctly and, instead, attempted to find angle *RQP*. Candidates at this level are expected to be able to use three-letter notation for angles. The majority of candidates who realised that they had to use cosine in part (b) went on to gain full marks.

Many candidates used Pythagoras' Theorem, finding the missing length and giving this as their answer, clearly not understanding the need to use the trigonometric ratios to find angles. Other candidates did complicate their answer by using Pythagoras' Theorem correctly to find the third side and then used sin or tan correctly; in this case the final accuracy mark was often lost due to premature rounding.

Question 14

Those who carried out the substitution into the formula rather than going straight into calculations without showing an equation were generally more successful in getting to the correct answer in part (a). The most common error seen was to subtract 8 from 100.

Part (b) was poorly attempted by candidates, largely because of an inability to deal with the square root. Some candidates arrived at the correct answer from flawed algebra; such approaches gained no marks. The common error was to start by multiplying by 4 rather than $\sqrt{4}$ to get $4m = \sqrt{k+1}$ and then make a second error in squaring to get $4m^2 = k + 1$; candidates who made one or both of these errors gained no marks. Candidates who used a flow chart approach to identify the order of operations usually gained full marks.

Question 15

The most common error made in using the formula for the area of a trapezium in part (a) was to use the adjacent sides of length 4 cm and 10 cm as the parallel sides rather than the correct lengths of 4 cm and 12 cm. Thus, 84 cm^2 was a common incorrect answer, possibly because the trapezium was not in the same orientation as the trapezium on the formula sheet.

Some candidates failed to answer the question because they did not know the formula for a trapezium despite the fact that it was given on the formula sheet.

Some candidates were finding the area of the trapezium by splitting it up into a rectangle and a right-angled triangle. This actually proved to be a more successful strategy than using the formula for the area of a trapezium, which a large number did incorrectly.

The most common correct method seen in part (b) was to draw a line from Q parallel to TS and use the 'top' triangle with triangle PQT to come up with a scale factor of $\frac{1}{2}$ and then the correct answer. The majority of candidates made no progress in part (b) although some were able to write down a correct scale factor, usually 3 or $\frac{1}{3}$ although this was then frequently used incorrectly to give the common incorrect answer of $3.\dot{3}$.

Question 16

The majority of candidates were able to gain a mark in part (a), most often for working out the profit. Following this, some candidates successfully used a 'build up' method to arrive at 3% but many were unable to make further progress. Some just divided 4500 by 100 and gave an answer of 45%; others worked out 150 000 ÷ 4500, giving 33.3% as their final answer. Some responses reached 103% but stopped there, failing to realise that this was an increase of 3%.

In part (b), many used simple rather than compound interest, for which they gained 1 of the 3 available marks. Evaluating 154 000 × 0.04^2 was seen from some candidates rather than the correct 154 000 × 1.04^2. The most common approach, however, was to calculate the interest year by year.

Question 17

The most common incorrect answer was 1.04, which resulted from candidates forgetting to put in a bracket after the 60 in tan(60) on their calculators and, in effect, working out $\sqrt{\frac{\tan 61°}{\tan 59°}}$ rather than $\sqrt{\frac{\tan 61° + 1}{\tan 60° - 1}}$. The main misconception arose when candidates took the square root of the numerator rather than the whole quotient. Marks were available for the correct intermediate steps. There were a number of incorrect responses with no working out that might have otherwise gained a mark.

Question 18

In part (a), it was common for candidates to draw a box plot with the correct minimum and maximum values. The median was correct more often than the lower and upper quartiles.

In part (b), it was common to see very general comments rather than comments comparing the medians and the ranges or interquartile ranges. Specific mathematical language should be used. Many responses compared numbers from within the datasets rather than comparing the distributions, eg 'the median at Rose's was 25 and at Green's it was 21' should be presented as 'the median at Rose's was higher'. Some candidates used incorrect terminology, eg the word 'average' instead of 'median' for comparisons, so did not gain the mark.

Question 19

Errors included using 30 cm as the radius rather than 15 cm, dividing the area of a circle by 6 rather than 12 (focusing on 180˚ rather than 360˚) and using the formula for the circumference rather than the area of a circle. A common error was to divide the total circle area by the angle 30 rather than multiplying by $\frac{30}{360}$.

Candidates tended to earn either no marks or full marks. Of those using the area formula correctly, a significant number failed to attempt any division, giving their answer as 706.(...), so failed to gain any credit.

Question 20

The most common correct method seen was the use of the cosine rule; other candidates used the sine rule successfully; others dropped a perpendicular line and used the two right-angled triangles. The majority of candidates who could see an appropriate method to use went on to gain full marks. Those who used the sine rule method often substituted the numbers correctly, but were unable to proceed further. The most common incorrect method was to attempt to use Pythagoras' Theorem.

Question 21

Many candidates who started with a correct method of using area focused on the middle three blocks and gave an answer of, usually, 32.4, not realising that this is not a proportion. Some candidates who would have scored full marks spoiled their answer by taking incorrect readings from the y-axis. Many merely read the column heights and added these.

Question 22

A popular incorrect method was to evaluate $\frac{1}{3} \times \pi \times 15^2 \times 20$. Some candidates were able to write down a correct expression for the volume of the large cone but then did not realise that the radius of the smaller cone was 7.5 cm and so failed to make further progress. There was evidence of the wrong formula being used for the volume of a cone despite this being given on the formula sheet at the front of the paper; formulae for the volume of a cylinder or surface area of a cone were commonly seen. It was common to see the volume of the large cone being found correctly, and then halved for the volume of the frustum.

Question 23

Those candidates who knew how to work out the number in a stratified sample generally gained full marks although some candidates gained the method mark only if they failed to give an integer for their answer. The most common incorrect answer was 8, resulting from rounding the answer to 50 ÷ 6.

Question 24

Many candidates simply substituted the given value into the formula and so gained no marks. Those who showed an understanding of bounds generally gained at least two marks for showing a correct upper and/or lower bound for each of the variables. Some candidates then found all four possible combinations using their upper and lower bounds, not appreciating that only the combinations leading to the upper and lower bound for the calculation should be considered. A further error was to give the correct degree of accuracy after finding the mean of the upper and lower bound rather than considering the accuracy to which they agreed. Many candidates who understood how to find upper and lower bounds of an individual number did not realise that the upper bound for the quotient required the upper bound for s combined with the lower bound for t, and vice versa.

Question 25

At this level in the paper it was disappointing to see some candidates who realised that they had to find an expression for the area of each triangle fail to give the correct expression for the area of the right-angled triangle; it was common to see the $\frac{1}{2}$ forgotten. Candidates who did give and then equate two correct expressions then frequently made algebraic errors and so arrived at the wrong quadratic equation. A significant number of candidates who used the correct expression for the area of the first triangle did not evaluate $\sin 30°$, making manipulation and simplification much harder.

Summary

Based on their performance in this paper, candidates should:

- include units with their answers, particularly in QWC questions
- show all necessary working in all questions
- learn the formulae for the circumference and area of a circle
- be able to identify angles using the three-letter angle notation (eg Angle *ABC*)
- use vector notation when describing a translation
- use mathematical language (eg 'median', 'range') when comparing distributions
- ensure that they are able to use the trigonometric ratio keys on their calculator
- be able to find the area of a trapezium.

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