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# Examiners' Report
# March 2013

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

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# Introduction

Questions that were tackled with the most success were Q2, Q3, Q4, Q8, Q11 and Q12; questions that were less successfully completed were Q10, Q13, Q17, Q18, Q21, Q22 and Q26.

It was disappointing to see so many candidates not performing well on some of the more straightforward questions on this paper. Many candidates could not perform basic algebraic operations correctly and it was surprising that on this Higher level paper there was a poor standard of numeracy and, particularly, a weak knowledge of tables.

There were many imaginative non-calculator methods of working out situations where multiplication or division was needed; however, many were unsuccessful.

Questions where explanations or proofs were required were not often answered well, nor were questions where more advanced algebraic techniques were being tested.

Many candidates' working was far from clear, and was often disorganised and hard to follow. Several lost marks because they were unable to read their own writing.

# Report on individual questions

## Question 1

This question was poorly answered with only a third of candidates gaining all 3 marks. As is usual in this type of question, a wide range of different methods were used. The most successful candidates were those who used a structure to facilitate their calculations, particularly the traditional long multiplication method.

Among the more interesting ways seen were those examples where the candidate worked out 1.83 × 100, then 1.83 × 50, then subtracted 1.83 × 3.Those using the 'table' method were less successful because they used the figures 1, 80, 3 instead of 100, 80, 3.

If candidates were able to show a complete method, they could earn 1 mark; as one multiplication error was condoned, about a quarter of candidates were able to gain this mark.

Two marks were awarded to candidates who wrote either the correct digits (8601) or the incorrect answer from their correct method to two decimal places.

Some candidates thought that the question was about estimation and wrote statements such as 2 × 50 and scored no marks.

## Question 2

This question was well answered with three quarters of candidates gaining full marks. Part (a) was almost always correct with part (b) being well understood, although many candidates wrote 'negative relationship', or just 'negative', rather than 'negative correlation' and so did not score the mark.

Some wrote a correct description, eg 'the closer to the centre the more expensive the rent' but then contradicted this by writing 'positive correlation' and so failed to score any marks.

In part (c), 1 mark was awarded for drawing an appropriate line of best fit but some candidates, having drawn a line of best fit, misread the scales and so lost the accuracy mark.

## Question 3

Questions on questionnaires are usually well answered and this was certainly the case here. Full marks were obtained by two thirds of candidates with very few scoring no marks.

Many candidates did not understand the concept of a biased sample, which resulted in a large range of incorrect responses relating back to the question, rather than the people being asked the question, or even commenting on the sample size.

## Question 4

This question on straight line graphs was very well answered indeed with three quarters of candidates gaining all 4 marks.

Surprisingly, a significant number of candidates, despite constant reminders in previous reports, plotted correct points but did not join them up, scoring 3 marks.

It was a shame to see some candidates realise from part (b) that their points needed to be altered to form a straight line but then not go back to change their solution in part (a).

There were also some candidates who failed to realise that this was the equation of a straight line graph and drew a curved graph instead; many also made mistakes in completing the table by adding 5 to the $x$ value, ignoring the need to multiply by 2.

## Question 5

Questions on finding the $n$th term of an arithmetic sequence regularly appear on our papers so it is surprising to see so many answers of $n + 6$ instead of $6n - 3$.

In part (b), a multitude of solutions fell short of the mark because they were incomplete, eg 'they are all odd', without mentioning that 150 was even or saying that the value of $n$ or $\frac{153}{6}$ is not an integer without stating the equation $6n - 3 = 150$. It was also commonly thought that, because 15 was in the sequence, 150 was as well.

## Question 6

Almost every candidate was able to give the correct answer to part (a) but many struggled with the complexity of part (b). Although a third scored full marks in this part, many scored just 1 mark either for establishing that \$400 needed to be subtracted from £800 or for a correct method to change £800 into dollars. A variety of methods were adopted and some candidates were able to make some progress towards a solution and scored 2 or 3 marks.

There was much confusion between dollars and pounds, often shown by incorrect readings from the graph. Even when using a correct method, many failed to read accurately from the graph. Many candidates would have gained more marks if they had stated their method more explicitly.

## Question 7

It was disappointing that a third of Higher Tier candidates could not gain full marks for collecting like terms in part (a) of this question and that 8% scored no marks at all. The most common errors seen were $+ 3y$ or $6x + - 3y$ or collecting $x + 5x$ as $5x^2$ or $4y - y$ as 4.

The performance in solving an equation in part (b) was a little better with a quarter scoring one mark for expanding the bracket and about a half gaining full marks for the correct solution, although some were not able to complete the division correctly and gave an answer of 1 or $\frac{-7}{7}$. A few gave the answer embedded in the equation and were penalised.

## Question 8

This question on Lowest Common Multiples was well understood with over a half of candidates gaining all 3 marks for a correct answer, usually by listing the two sets of times. Two marks were awarded for listing at least three correct multiples of 9 and 12, with at most one incorrect, and a few gained 1 mark for listing three correct multiples of one of them, with at most one incorrect. A surprisingly large number of candidates listed the times, but did not notice 9:36 was in both lists, so gave an answer of 10:12.

## Question 9

This algebra question on indices gave a large range of marks. Almost all candidates gave the correct response to $a^4 \times a^5$ but, when it was made more complicated in part (b), this percentage dropped to about a third for full marks and 1 mark was awarded to those candidates who could write two of the components in the answer correctly.

It was disappointing to see so many candidates dividing the powers to give $e^6$ or $f^4$. Most worrying was seeing candidates cancelling the 5 from the 45 to give 4, dividing the 5s to give 41, or even subtracting the 5 to give 40.

Using a fractional index was not very well understood as only a quarter of the candidature gained the mark for the square root of 9, with 4.5 being a common wrong answer.

## Question 10

Candidates' performances on this starred question gave a good differentiation of marks. Only a quarter of candidates gained 1 mark for stating either that angle *AED* was $38^\circ$ or that angle *AEF* was $142^\circ$; a further mark was gained for a correct method to find one of the base angles of isosceles triangle *ADE*. A large number of candidates realised the triangle was isosceles but then failed to identify the correct pair of equal angles possibly because they thought 'base angles' are those at the bottom of the diagram.

Problems arose when candidates had to give their reasons. The most successful candidates were those who wrote their reasons next to the working the reason applied to. It was a pity that only a very small percentage of candidates gained both marks for a correct answer with a full set of reasons, but some gained 1 mark for one correct reason. Many candidates knew the correct reasons but failed to write enough, eg 'angles in a triangle' without stating they add up to $180^\circ$.

Candidates are realising that Z angles will not gain them the mark but often confuse corresponding angles with alternate angles, some resorting to talking about parallel lines. Many candidates failed to score as they did not identify the correct angles in the working, by using correct angle notation or by showing them on the diagram.

## Question 11

This question was well understood and about half the candidates gained all 5 marks for a fully correct solution. A small percentage of candidates failed to score any marks at all, with the modal mark of 3 being gained by candidates who correctly carried out percentage calculations and established £60 and £140 as the commission. Interestingly, many candidates then subtracted these from the basic pay or added them to or subtracted them from £1200, £1400 or £2600 (the total cost of the insurances).

## Question 12

This question on simple ratio was often misunderstood. Candidates who understood that a ratio of 1:2 meant that you had to double 16 often went on to give a fully correct solution but those who halved the 16 failed to score any marks.

Many candidates only multiplied by 4, mistaking the number of schools, and a significant number divided the 16 boys by 3, the total of the ratio components. Despite this, about half the candidates did score full marks, with a smaller number gaining 3 marks for understanding what they had to do with the correct number of boys and girls.

## Question 13

Although few candidates gave a fully correct answer to this question, there was much misunderstanding of the relevance of dividing $360^\circ$ by 5. A small number of candidates found $108^\circ$ as the interior angle in a regular pentagon but could make no further progress and those who understood the question but showed inaccurate calculations scored 2 marks.

It was also clear that many candidates did not use the diagram, as they did not appreciate that the interior angle of a regular pentagon was obtuse and could not be $72^\circ$.

## Question 14

Questions on cumulative frequency graphs are regularly represented on our papers and this question was a well-tried example. Surprisingly, about a quarter of candidates scored no marks in part (a) because they could not work out the cumulative frequencies; a smaller percentage scored 1 mark in part (b) because they did not draw a correct cumulative frequency curve from their table, with many plotting the points correctly and drawing a line of best fit.

Most candidates were able to read some information from their cumulative frequency curves but only 15% gave a fully correct solution to this standard question. A significant number gave the median as their answer in part (c) and many of the candidates who correctly read from the curve in part (d) then failed to subtract from 80.

## Question 15

This question on loci was poorly answered with very few candidates scoring full marks. The modal mark awarded was zero; 1 mark was awarded for the quarter circle of radius 5 cm and a line parallel to *CD* and 3 cm away from it. The most common mistake was to misunderstand 'nearer to *AB* than to *AD*' as few bisectors of angle *A* were given with the diagonal *AC* often seen in its place.

## Question 16

This question on standard form gave a good range of marks. In part (a) most candidates were able to change a number written in standard form into an ordinary number but this reduced in part (b) to about a third when a number smaller than 1 had to be written in standard form. The division of two numbers that were written in standard form was poorly understood, with only a few candidates giving the fully correct answer and a few more gained 1 mark, usually for writing $0.5 \times 10^9$ or 500,000,000 or even establishing $2.3 \div 4.6 \times 10^{12-3}$, but the very large majority who gained no marks usually failed to realise, due to this being a non-calculator paper, that $2.3 \div 4.6$ was 0.5 and many thought the answer was 2 or 2.2.

## Question 17

Performance on algebraic fractions does not seem to get very much better over time, although a few candidates did gain 1 mark for writing the left-hand side of this equation over a common denominator or correctly multiplying out by a common multiple of 2 and 5.

A common error was to see all the left-hand side multiplied by 10, but not the right-hand side. The percentage of candidates who could then turn this into a linear equation of the form $ax = b$ was very small and fully correct solutions of $\frac{12}{13}$ were seldom seen. There were many attempts using inappropriate trial and improvement methods, all of which were unsuccessful.

## Question 18

This question was poorly understood, with a large number of candidates failing to recognise which lines to reflect the shapes in. Many candidates frequently used the $y$-axis or $y = -1$ instead of $x = -1$, or the $y$-axis instead of $y = 0$. When you compound this with those candidates who ended up with **Q** in the fourth quadrant rather than the second, it is easy to see why fully correct solutions were given by only just over 10% of candidates.

Those candidates who ended up with only **R** or both **Q** and **R** correctly drawn and placed gained 1 mark and earned a further mark if they could write 'for rotation of $180^\circ$' or 'for an enlargement of scale factor $-1$'. It was disappointing that three quarters of candidates scored no marks on this question.

## Question 19

This question testing circle geometry gave a good distribution of marks, with some candidates being able to recognise that the angle between a radius and a tangent is $90^\circ$, mostly seen on the diagram. A further small percentage were able to establish, by using a correct method, that angle *AOC* or angle *BOC* was $56^\circ$ or that angle *AOB* was $112^\circ$, while only a quarter could gain all 3 marks for a fully correct solution and identify the answer as $68^\circ$.

Some candidates incorrectly assumed *OC* = *BC* and tried to use an isosceles triangle. Most candidates were not good at naming the angles that they were finding and as a consequence some lost marks by not identifying correctly which angle they were trying to calculate.

## Question 20

It was disappointing to see that less than a quarter of candidates could factorise a three-term quadratic expression correctly and then solve the associated quadratic equation. However, some managed to factorise correctly and about the same number were able to give a solution where the 3 and 9 in the factors had the incorrect signs.

A surprising number of candidates did not realise that part (ii) followed on from part (i) and gave a solution involving the quadratic formula. In part (b) only a quarter of candidates were able to correctly factorise a quadratic expression where the terms were the difference of two squares (a popular question to include on a Higher Tier paper).

## Question 21

In this question on algebraic proof there were very few fully correct answers. One mark for establishing $n$ and $n + 1$ or equivalent was awarded to a few candidates and another small number of candidates who were able to write $(n + 1)^2 - n^2$ gained 2 marks. Some candidates were then able to correctly expand the brackets and correctly simplify the expression to $2n + 1$ or equivalent, scoring 3 marks. For the fourth mark candidates had to establish and state that both elements of the original statement were equal.

A significant number of candidates used an arithmetic approach and gained no marks. There were also many nil attempts.

## Question 22

This question on transformation geometry was not very well answered with a small percentage of candidates giving a fully correct answer. More than three quarters of candidates scored no marks but 1 mark was awarded for showing a similar-sized shape in the correct orientation in the third quadrant or for a shape of the correct size in the correct orientation. If they showed both of these, they scored 2 marks.

The negative scale factor of this transformation proved a major stumbling block with many candidates instead using a scale factor of $+\frac{1}{2}$.

## Question 23

Candidates struggled to bring both elements of this question together. One mark was earned by the one third of candidates who wrote an expression for either the area of the circle or the surface area of the hemisphere and 2 marks were gained by candidates who did both of these.

Very few candidates could go one step further and give the answer as $75\pi$, although 235.5 was also accepted as many candidates ignored the instruction to leave answers in terms of $\pi$, and attempted calculations using an interesting variety of decimal approximations.

A significant number of candidates used the formula for the volume of a sphere, once again confusing area and volume.

## Question 24

This probability question without replacement was recognised as such by most of the candidates, although a surprising number did give a denominator of 121, showing that they thought one of the sandwiches was replaced before the second one was taken.

An answer of $\frac{76}{121}$ was awarded 2 marks for the work in dealing correctly with the numerator.

If candidates were able to correctly show a denominator of 10 on a tree diagram or use it as part of a second probability then 1 mark was earned and some candidates earned this 1 mark.

A second mark was earned by candidates who could write the probability of one combination of correct probabilities as a product and a further mark was gained if those, or at least three of them, were shown to be added.

The fourth method mark was awarded if all six combinations were added or if they were working from 1 − probability of both of the same types taken. Fully correct answers were given by only a small number of candidates.

## Question 25

Candidates in GCSE Mathematics usually struggle with transformation of functions and this question was no exception. In part (a), less than a quarter could show that they understood that $-f(x)$ was a reflection of the curve in the $x$ axis and that (0, 4) and (−4, 4) reflected to (0, −4) and (−4, −4) respectively, but half of these could show an inverted parabola with a maximum point shown at (−2, 0). Many candidates lost a mark as their inverted parabola was hastily drawn and did not pass through the required points.

In part (b), very few candidates could write $y = f(x - 6)$ as the required equation of the translation with $y = f(x + 6)$ and $y = f(x) + 6$ being the most common wrong answers, with a few gaining the mark for writing $y = (x - 4)^2$.

## Question 26

The straightforward part (a) of this vector question was correctly answered by only a few of the candidates; when a proof was required in part (b), the percentage of successful candidates dropped even lower.

One mark was awarded to those who could establish that vector *AX* was a third of vector *AB* or that vector *OY* was equal to the sum of vectors *OB* and *BY*.

A further small number gained 3 marks and were able to show that vector *OX* was equal to 2**a** + 2**b** and vector *OY* was equal to 5**a** + 5**b** but were unable to connect the two with a convincing statement of proof as is required in a question testing quality of written communication (QWC).

## Summary

Based on their performance on this paper, candidates should:

- improve their skills in long multiplication using decimals
- improve their skills in the manipulation of algebraic expressions and the solution of equations
- practise questions on enlargement by a negative scale factor
- write the geometric reason next to where it is used in questions requiring an explanation of geometric reasons
- improve the organisation of their working in those questions where a logical proof is required
- take care with their handwriting and the forming of their figures as many candidates could not read their own writing and made transcription errors.

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