Examiners' Report/
Principal Examiner Feedback

Summer 2013

International GCSE Mathematics A
(4MA0) Paper 4H

Level 1/Level 2 Certificate in Mathematics
(KMA0) Paper 4H

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Summer 2013
Publications Code UG036366

International GCSE Mathematics A (4MA0)
Paper 4H June 2013

General comments

Many students made excellent responses to the questions. Their level of algebraic fluency was good; they made good use of standard techniques and calculations and manipulations were accurate. Most had been well prepared to handle the routine tasks and were able to demonstrate proficiency. However, some students found the demands of this paper too high and struggled to show what they had learned and what they could do.

All students should be encouraged to judge whether the answer they have found to a question is reasonable. In this particular paper, this may have lead to more students rejecting an answer of 13.3 (kph) for one of the questions. One further, generic, cause of mark loss was the inability of some students to calculate with negative numbers, in particular when they tried to square them.

Question 1
Students found both parts of this question straightforward. In (a), a few added the three given probabilities and left the answer as 0.9. Answers of 0.1, $\frac{1}{10}, \frac{10}{100}$ and 10% were all seen and given full marks. There were very few errors on part (b).

Question 2
Students had to show a complete method for this 2 mark question. The most common successful approach was to divide 15 by 5 and multiply the resulting 3 by 3. Less common was to start with the 2:3 ratio and build up 4:6, 6:9 which is a reasonable strategy given that the numbers were so low. Those who went wrong often divided 15 by 5 and went no further.

Question 3
Most students were able to use the relationship between speed, distance and time correctly. However, a surprising number thought that the time was 9.45 hours (Overlooking the idea of fractions of an hour) and divided accordingly to get an incorrect, although plausible, answer of 825 kph. Others changed the time to 585 minutes, did the division and got an answer of 13.3, which represents kilometres per minute. Many students that used this method did not score the final accuracy mark as they did not realise the need to convert this back into kilometres per hour.

The most direct and successful approach was to work out 7800 ÷ 9.75 or $7800 \div 9\frac{3}{4}$ which many students did. A few who found 7800 ÷ 585 did remember to convert to kph by multiplying by 60 but often gave an inaccurate answer due to premature rounding.

Question 4
Part (a) was fairly well done, although some students did not give their answer as a **single** transformation and thus scored no marks. Others left out the brackets when giving the coordinates of the origin. Answers to part (b) were mixed with some students confusing the vector components with coordinates. Often, the x component was carried out correctly but the y component was interpreted as a shift down by 2 units.

Question 5

In both parts of this question students were expected to show the process(es) that led to the given answer(s). It was insufficient to use the fraction key on the calculator.

For part (a) most successful students used the approach of $\frac{21}{24}-\frac{20}{24}$ to get to the given answer.

A few used a common denominator of 48 and gained the marks for $\frac{42}{48}-\frac{40}{48}=\frac{2}{48}=\frac{1}{24}$.

Students who attempted to use decimals scored no marks.

In part (b) the most common approach was the standard one of multiplying by the reciprocal of the second fraction. So $\frac{5}{8}\times\frac{12}{7}$ followed by either $\frac{60}{56}$ or by correct cancelling gained the marks. Some students turned both of the original fractions into ones with the same denominator to give typically $\frac{15}{24}\div\frac{14}{24}=\frac{15}{14}$ and gained the marks.

Question 6

This was a question where students had to demonstrate understanding and use of balancing when solving a linear equation. A correct solution found by either trial and error or without any algebraic working scored no marks. One possible solution was to write $7y - 2y = 6 + 8$ followed by $5y = 14$ and then $y = 2.8$. Many students did do this or something very similar. A few students did not understand how to solve an equation and dealt with the left and right side separately, ending up with, for example, $y = 5y + 14$ as their answer.

Question 7

In part (a), students were expected to find the exact coordinates. A number of students could not get at least one of the coordinates correct and seemed to have no idea of finding the mean of the two x coordinates and of the two y coordinates.

Many students found part (b) difficult because they had to picture the right angled triangle and work out the length of two of the sides (2 for the height and 7 for the base). The many that could do this generally got full marks. Allowance was made for those who made a miscalculation for the base or height with 3 and 8 being quite common; they generally were able to score 2 marks. However, marks were not given in cases where the triangle was clearly not right angled. Students who worked out $\sqrt{4.1^2+8.2^2}$ were given no marks.

Question 8

Most students were able to isolate the correct prime factors by using either a factor tree or by repeated division. Only a few thought that 1 was prime, but some thought that 51 was. Some students lost an easy mark by simply listing the prime factors as 2, 2, 3, 17 rather than the product $2\times2\times3\times17$.

Question 9

Part (a) proved to be quite demanding for many students as they did not understand the significance of the double inequality. They often tried to manipulate the -6 ‘to on the other side’ and got $3x<15$ leading to $x < 5$. Part (b) was more successfully answered, although some students gave only a partial solution (with 0 omitted) or included 3 in their list.

Question 10
Most students multiplied the given length of 22 cm by the scale to get 550000 (cm), although very often the units were omitted. Most students knew they had to convert to km, but many divided by 1000 to get 550 km (a very common answer), instead of by 100 (change to m) and then by 1000 to get the correct 5.5 km or more directly by 100000. A few students decided to multiply 22 by 25001.

Question 11
For part (a) students were required to demonstrate that they could substitute into an algebraic expression and evaluate it correctly. Students were expected to show the evaluation of each term to 8 – 24 + 20, rather than simply state that $2^3 - 6 \times 2^2 + 20 = 4$ In part (a)(ii) the evaluation of the expression when x = -1 was often incorrect with 25 being a common response.

Part (b) was generally well done with most students being able to plot their points accurately and draw a smooth curve through their plotted points.

In part (c), students had to differentiate the given equation and use their answer to find the gradient at x = -3. Some were able to do so, but a surprising number were able to differentiate correctly but then fail to evaluate the resulting derivative accurately, with 9 being common. A few students were able to differentiate the terms in x correctly but left the 20 in their answer for the derivative. A few others worked out the second derivative and gave this as their answer or substituted into the original expression for y. Students who drew a tangent to their curve to work out an estimate for the gradient gained no marks.

Question 12
Most students were able to find midpoints, multiply by the corresponding frequencies and sum to find an estimate for the total amount of money. A few used the upper end of each interval and some used 20, the interval width for each interval midpoint. Very many went on to attempt to work out the mean once they had found their estimate. These students were not awarded the final mark.

Question 13
This, like question 12, was another case of many students not reading the question carefully. A large number assumed that the interior angle was 140^o and thus the exterior angle was 40. Many students spotted that the angles were 160^o and 20^o respectively. Others set up 1 or 2 equations to find the values. They then went on to work out 360 ÷ 20 = 18.

Some students used a much more formal algebraic approach with $\frac{180(n-2)}{n} - 140 = \frac{360}{n}$

Most of these students were able to solve the equation correctly to get n = 18

Question 14
Virtually all students were able to identify the ocean with the largest surface area in part (a), although some wrote down the size rather than the name. In part (b), many chose to convert the numbers from standard form before adding. As the answer was required in standard form there was no need to do this and many students slipped up when doing this. For part (c), many students again chose to convert from standard form, although many did get the correct percentage.

Question 15
Most students understood what they had to do and produced probability tree diagrams which gained full marks. A few only extended the tree for the case where Peter had won the first game. Most students who could part (a) also scored full marks on part (b). For those that did not score full marks, the probabilities were often added rather than multiplied.

Question 16

It was essential to get the correct relationship from the start on this question to make a success of it. Any relationships which were not inverse square resulted in 0 marks out of the 6 available. In order to score the 3 marks for part (a), students had to get an answer of $P = \frac{90}{r^2}$. The answer $P = \frac{k}{r^2}$ did not gain full marks unless the correct value of *k* was found somewhere in the question and $P \propto \frac{90}{r^2}$ was not given full marks. Most students who were successful in part (a), were also successful in parts (b) and (c).

Question 17

Students had little problem in dealing with part (a). The answer was either correct or the line left blank. For students who knew about the concept of an inverse function, part (b) proved straightforward. Most successful students adopted the approach of $y = \frac{x-6}{2}$ or $x = \frac{y-6}{2}$ and obtained the correct expression 2*x* + 6 from rearrangement. Some students adopted a flowchart approach which gained full marks if it led to 2*x* + 6 on the answer line.

Part (c) generated some confusion amongst students. Many seemed to realise that square roots of negative numbers were ' not allowed' (sic). However, many found it difficult to translate this into a statement about the values of *x*, many opting *x* < 0. In addition, there was confusion between 'strictly less than 4' (2 marks) and 'less than 4' (1 mark). Some students restricted their answer to whole numbers.

Part (d) caused most problems. Many students juxtaposed the expressions for f and g to give $\frac{x-6}{2} + \sqrt{x-4}$, others gave gf and few could simplify to an acceptable expression, in many cases moving from $\sqrt{\frac{x-6}{2} - 4}$ to $\sqrt{x-14}$. In such a question as this where there are fractions under a square root sign, it is important that students write the expression carefully so that there is no ambiguity.

Question 18

The simplest way to complete the question was to use a standard area - typically 25 for the square from 7 to 8, although many students also counted the number of small squares from 4.5 to 8. As the frequency density was not uniquely specified, students gained full marks for using the total area in the histogram from 4.5 hours to 8 hours and multiplying by an appropriate stated factor. Many students did not understand the concept behind a histogram and added the heights of the 3 bars.

Question 19
Most students were able to state the correct length for *QT*. In order to score the mark for the reason students were expected to quote "tangents to a circle from an external point are equal in length" or something equivalent. The minimum expectation was to see 'tangents' 'point' (i.e. some reference to the tangents meeting) and 'equal'. Many students expressed the correct idea in a much less precise, or occasionally longwinded, form
.
Part (b) proved to be demanding with many students unable to find the correct lengths of the sides of the triangle. In many cases students were under the misapprehension that the triangle was isosceles with sides 13cm, 13cm and 16 cm. Students could still score marks, however, if they used the cosine rule correctly to find the size of angle *PQR*, even with the incorrect sides, providing their working was clear. Sometimes this was not the case as they did not give any indication of which sides they were using.

Question 20
Students found this question demanding. Many misunderstood that the values in the Venn diagram referred to the number of elements and so listed these as set members. Consequently, an answer such as 2, 3, 4, 6 with or without brackets was seen for (i) with similar responses for the other parts. There was also plenty of evidence that students did not understand the use of complement or were careless when reading the diagram. For example, 13 was a common incorrect answer to part (ii) and 4 for the answer to part (iii).

Question 21
Many students were able to write down a correct answer to part (i). Part (ii) proved to be more of a challenge, although many students were able to use the relationship

$\overrightarrow{PX} = \overrightarrow{PU} + \overrightarrow{UT} + \frac{1}{2}\overrightarrow{TQ}$ or equivalent to score the first mark. A common error was to think that the answer to part (b) was half the answer to part (a)

Question 22
This proved to be a challenge for most students, although the most able produced a simple but elegant correct answer. The most direct method involves using Pythagoras in triangle *MAB* to find the length of *MB*, followed by tan to find angle *MBT*. Some students chose a longer route by finding the length of *TB* either by using Pythagoras twice or by direct use of the expression $a^2 + b^2 + c^2$, followed by use of sine. Others chose even more complex, but correct methods. A few students calculated the size of angle *MTB*, believing this to be the required angle. Many students did not recognise which was the angle between the line and the plane *ABCD* but worked out the size of the angle *TBA*.

A common error was to fail to read the introduction carefully and to attribute 7 cm to the length of *TA* rather than *AD*.

Question 23
Many students had been well-prepared for this standard algebraic fraction equation. In order to score any marks students had to collect terms over a correct common denominator or to clear the factions to give an equation with correct, but possibly unsimplified terms. Of the students who could do this, many went on to collect terms and get a correct quadratic equation. Students could then factorise or use the formula to get the correct solutions. It was not sufficient for the final 2 marks to write down the correct values of *x* - either the correct substitution into the quadratic formula had to be shown or the correct factorisation.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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