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Examiners' Report/ Principal Examiner Feedback

June 2011

International GCSE
Mathematics A (4MA0) Paper 4H

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June 2011
Publications Code UG028406

International GCSE Mathematics A
Specification 4MA0
Paper 4H

General Introduction to 4MA0

There was an entry of just under 31,400 candidates, 1,800 more than a year ago. This comprised 19,800 from the UK and 11,600 from overseas. The Foundation tier entry fell by 16% but, in terms of numbers of candidates, this was more than compensated for by an 8% increase in the Higher tier entry.

All papers proved to be accessible, giving appropriately entered candidates the opportunity to demonstrate their knowledge and understanding.

Paper 4H

Introduction

This paper proved accessible to the vast majority of candidates. Whilst some parts of questions acted as good discriminators, there was ample opportunity for average candidates to gain marks by knowing and attempting familiar routine techniques. Traditional topics of algebra, trigonometry and probability all provided a good source of marks. The more challenging topics of functions and vectors contained components that less strong candidates could at least start.

Generally, the standard of written responses was high. Although in many questions a correct answer, standing alone, would imply a correct method and gain full marks, it makes fundamental sense for candidates to show their methods clearly laid out and in a legible form. On some occasions, candidates resorted to short cuts in their working and through careless slips obtained the wrong answer. Method marks obviously cannot be awarded for a method not written down. Weaker candidates still need to pay more attention to the size of their answers on numerical questions and decide if their answers are sensible in a physical sense. All candidates would benefit from a careful check for misreads on completion of their script.

This year the statement “Do NOT write in this space” was trialled at strategic places in the paper to deter candidates writing in spaces without signalling their intentions. This statement was omitted from the three blank pages at the end and by doing so, perversely; it almost served as an invitation to carry on working here in a minority of cases. Candidates should not use these pages to show working but request extra, separate pages to tag to the question paper. Two questions (21a and 24b) in particular provoked many false starts and a need for extra paper.

Report on individual questions

Question 1

The first question on the paper caused no significant problems and a high percentage of candidates scored full marks. Better candidates chose the more economical method of multiplying 640 by 0.85. Others chose to break the question down in stages by finding 15% of 640 (96) and subtracting this from 640. In rare cases adding 15% to 640 was performed. This gained the first method mark if 96 was seen, but 640 x 1.15 scored no marks. In a minority of cases candidates viewed the problem as a reverse percentage and divided by 0.85 or 1.15.

Question 2

Most candidates understood the idea behind estimated probabilities and expectation but a minority did not. As a consequence the 30 tails became 31 tails (out of 121 throws) because John threw the coin once more. This mistake was sometimes carried into part (b). The above scenario was rare on paper 4H but more common on paper 2F. The majority of candidates scored full marks. Any fraction, decimal, or percentage equivalent to 30/120 was acceptable in part (a). A full follow through for both the method and the answer was allowed for part (b). Some candidates lost the final accuracy mark by giving their final answer as 50/200.

Question 3

It was anticipated that most responses would multiply the weight of apples or raspberries by 2.5 (from 15 ÷ 6) to get the correct exact amounts for 15 people. Most candidates did indeed choose this route but a minority opted to divide by 6 first. This was enough to gain the first method mark. If the resulting decimals of 38.33 (from 230 ÷ 6) or 33.33 (from 200 ÷ 6) were truncated this led to final inexact answers of typically around 574.95 and 499.95. The accuracy mark was then forfeited in these cases.

Question 4

This question discriminated well. Stronger candidates recognised the need to divide by $1\frac{1}{3}$ (hours) to get the exact answer of 54 km/hr. Methods which fell short of this included 54 ÷ 1.33 which gained 2 method marks, or 54 ÷ 1.3 or 54 ÷ 1.2 which secured only the first mark. Some candidates opted to divide 72 by 80 as another way to gain the first mark. If they recognised this average speed (0.9) was in kilometres per minute at this stage they could go on to gain full marks by multiplying this value by 60. To leave a final answer as 0.9, bearing in mind the units were given on the answer line, shows a weak idea of *size* of an answer, in this context of speed.

Question 5

Part (a) was accessible to most candidates.

Part (b) required some correct working to gain full marks. The working could be a numerical rather than an algebra approach e.g. $(12 - 5) \div - 2$ or $(5 - 12) \div 2$. A correct answer with no working at all was extremely rare but would have scored no marks. Most candidates jumped straight to $-2y = 7$ and then on to an answer of -3.5 to gain all marks.

Part c) was well answered and accessible to most candidates.

Question 6

Methods of approach were equally divided between using the trapezium formula or splitting the shape into a rectangle and triangle. In the latter case, the intention to add the correct areas was needed to gain the method mark.

In part (b) most candidates recognised the need to use Pythagoras. This method could only gain credit if the values 5 and 2 were utilised. Truncation errors from their calculator display cost a minority of candidates their final accuracy mark.

Question 7

This question was generally well answered. Stronger candidates favoured an algebraic approach and produced an equation $(3 + 2 + 7 + 6 + 2 + \text{'}x\text{'}) \div 6 = 5$ and proceeded from there. Embedded correct answers $(3 + 2 + 7 + 6 + 2 + 10) \div 6 = 5$, with no final answer offered, scored both method marks and lost the accuracy mark. Despite the question stating there were six numbers, some candidates ignored the extra number and divided the sum of the given numbers by 5 to produce an answer of 4.

Question 8

Candidates need to ensure they use sufficiently dark pencil for their work to be visible.

A multitude of triangles, circles etc around the line PQ were offered by a minority of candidates who had no idea how to proceed. Others who produced one pair of intersecting arcs and then used a protractor to draw the bisector scored no marks. A number of candidates drew a pair of touching circles centred on P and Q. Arcs of the same radius, from P and Q, above and below the line PQ, clearly intersecting, were needed to secure the first mark. Pairs of parallel arcs above PQ only and then joined up to extrapolate down to PQ scored no marks. In a minority of cases candidates produced two arcs at an equal distance from P and Q, intersecting the line PQ. The required intersecting arcs were then constructed from these two points and this was accepted as a valid method.

Question 9

Both parts of the question scored well, though part (ii) provided more of a challenge.

Question 10

A correct factor tree, or division ladder, which included the prime factors of 2, 3 and 7 scored both method marks. The inclusion of 1 at this stage was condoned. Candidates clearly had to state a product without any 1s to secure full marks. The dot symbol in place of the multiplication was condoned. All factors, either stated or implied from a factor tree or division ladder, had to multiply to 126 to gain any marks.

Question 11

A 'standard' trigonometry question, such as this, is usually well answered. The fact that an answer from a calculator display could be rounded down in this case meant truncation was not penalised. Some candidates chose to use the sine rule and were often successful as sine $90° \equiv 1$.

Question 12

In the past inequalities have involved 'greater than' cases, rather than 'greater than or equal to' cases. The greater than only symbol (>) was condoned at the method stage but a fully correct answer of $x \geq -3.5$ had to be offered for full marks. Consequential work (eg just –3.5 on answer line) was penalised. It was common to see the inequality reduced to an equation and this gained no credit at the method stage. Fully correct answers with no working (or equation working), gained full marks.

Many candidates in part (ii) either re-worked the inequality in part (i) or included decimals in their answer. The award of 1 mark for the inclusion of zero in an otherwise correct answer was rarely seen.

Question 13

Parts (a) and (b) usually secured full marks.

In part (c) the conversion of both 1.21×10^7 and 4.88×10^6 to ordinary numbers before subtraction was unnecessary, but gained the method mark if done correctly. Some candidates lost the final accuracy mark by failing to put their answer back into standard form, or truncating 7.22 to 7.2.

Question 14

Many candidates neglected to square the linear scale factor to produce 9. Incorrect answers of 21 cm^2 (from 3×7) were extremely common and scored no marks.

Question 15

Part (a) presented a component that caused problems with this question. A common mistake was to multiply out the brackets in the numerator. This often led on to incorrect cancelling. Some candidates cancelled the brackets correctly but failed to spot the equally simple cancellation of the 8 and 4. An answer of $\frac{8(x-3)}{4}$ gained one of the two marks on offer.

In part (b) $(a - 12)^2$ was a common incorrect response but did gain one mark.

Candidates in part (c) who did not start by adding $5r$ to both sides failed to gain any marks. 'Squaring' both sides to produce $p^2 = q - 25r^2$ was a common incorrect starting statement. Although rare, candidates who obtained the correct answer of $(p + 5r)^2$ in the body of the script but then went on to process this further incorrectly (e.g. $p^2 + 25r^2$), were penalised by 1 mark.

Part (d) required an algebraic treatment leading to the correct answer of 4.8 (or equivalent) to gain full marks. An answer of 4.8 with no working scored no marks. The fact that the equation yielded a decimal answer made it less obvious to spot by inspection and most candidates attempted to solve by an algebraic approach.

Question 16

For able candidates it was relatively easy to spot that '1 cm^2' represented 10 people, or to work out the frequency density values. Candidates should appreciate that labelling the frequency density axis correctly can usually pick up a mark, even if mistakes occur elsewhere. For weaker candidates the unequal widths in the blocks was a source of problems. In some cases, misreading the scale led to an answer of 96 instead of 100 for the number of people in the 30 to 50 age group. In cases where one of the frequencies was correct and the other incorrect no marks were gained unless a method mark could be awarded by either of the methods described.

If a correct interpretation of the histogram led to both correct answers in part (a), then full marks in part (b) for 3 correct blocks usually followed. Those gaining partial marks for 1 or 2 correct blocks usually produced the correct block for the interval 0 to 10 years. By a fortunate stroke of luck, candidates who used the wrong scale of 10, 20, 30 etc on the frequency density axis sometimes gained a mark by completing the bar for 75 to 80 years at the correct height as the frequency of 20 suited the logic of their scale.

Question 17

Completion of a tree diagram is usually an easy source of marks for most candidates. Provided that each fraction was less than one, these fractions obtained in (a) were followed through for the method in part (b). In this way, two of the three available marks could be gained. Decimal answers had to fully correct, with no rounding or truncating, to secure the accuracy mark. It was very common to omit Pr(late, late) and use just two of the three probability products (ie late exactly once), resulting in an answer of 14/64, to gain just one mark.

Question 18

This was a well answered question but most starting points other than multiplying the recurring decimal by 1000 and subtracting the original decimal to remove the recurring component were not effective. The method mark was awarded for reaching the stage $999x = 396$. It was then a short step to simply divide both sides by 999 to secure the accuracy mark. Jumping directly to 396/999 gained both marks.

Question 19

Candidates familiar with the sine rule usually selected this and substituted values correctly. Calculators in radian and gradian mode could gain 2 or the 3 marks on offer, provided the correct stages in their working had been shown. In very rare cases perpendiculars were dropped from point C and extra lengths calculated from BA extended. If performed correctly these could gain full marks if the correct answer was reached.

Question 20

Part b) was the source of most mistakes with many candidates calculating $g\left(\frac{2}{3}\right)$(= 2.5). Some gave helpful clues to why this happened by showing the replacement of x with a 3 in f(x) therefore f(a) became $\frac{2}{3}$. Others who started correctly and obtained $\left[\frac{2}{a}+1\right]\div\frac{2}{a}=3$ sometimes went wrong on the second step of trying to remove the denominator. An unorthodox (but valid) method was to obtain $x = 0.5$ from $g(x) = 3$ and then proceed on to $a = 4$ from $f(a) = 0.5$.

For candidates familiar with the method of finding an inverse function part (c) proved accessible. Weaker candidates gained an easy mark by stating $y=\frac{x+1}{x}$ or $x=\frac{y+1}{y}$ as a starting point but could not proceed correctly. Methods involving flowcharts were unsuccessful because of the occurrence of x in two separate places. A significant number left parts (b) and (c) untouched.

Question 21

Part (a) proved to be probably the most challenging question on the paper. Essentially it was required that a candidate took the three items of information in the question (x%, $50x$ and $600 + 5x$) and use these three items to produce the given quadratic. There were a variety of starting points and the marking scheme gave the three most common.

If using the principle $\%\text{profit} = \dfrac{\text{actual profit}}{\text{original amount}} \times 100$ a start point of $x = \dfrac{(600 + 5x - 50x)}{50x} \times 100$ would be acceptable as would be $x = \dfrac{(600 - 45x)}{50x} \times 100$ (just). However $x = (600 + 5x - 50x) \times \dfrac{2}{x}$ would not qualify as a start point as it begins too close to the final quadratic given. A fair number of candidates read the profit as x rather than x%. Although many candidates coped with this question comfortably, others made many false starts and this generated a sizeable amount of candidates requiring extra paper.

Part (b) should have been a better source of full marks but many scored only 1 out of 3. Substituting correct values into the quadratic formula (condoning 1 sign error) secures the first mark. The values in the formula have to then be developed by one line to secure a second method mark. In this case we need to see either 8100 + 4800 or 8100 – – 4800 for the discriminant. The accuracy mark is dependent on 2 method marks awarded (condoning the inclusion of the negative root in the final answer). The International GCSE policy in awarding marks for quadratics has been well-established and publicised frequently in previous Examiner's Reports. It is in place to remove the advantage sophisticated equation-solving facilities on some calculators give to those candidates who own them. To justify this policy numerous examples were found where candidates stated a quadratic formula with the wrong values substituted in but still managed to produce the correct answer.

Question 22

Three-dimensional trigonometry and Pythagoras is not a commonly tested topic and it was pleasing to note the level of success obtained here. Most chose to break down the Pythagoras element in part a) into 2 stages. $5^2 + 7^2$ was the most common starting point but $3^2 + 7^2$ or $3^2 + 5^2$ would have also gained the first method mark. Common errors included applying the first stage but not the second stage of Pythagoras, or using 5 +7 (=12). Very few were familiar with the use of Pythagoras in three dimensions and could jump straight to $\sqrt{(3^2 + 5^2 + 7^2)}$ to gain 2 marks.

By part (b) all three sides of triangle ACG were calculated and were ready to use with either sine, cosine or tangent. It was a better choice to use sine or tangent as these needed the height CG = 3 (given) and involved less follow through. Some candidates used the cosine rule, with varying degrees of success to obtain an answer. The inclusion of the dotted line helped many to visualise the angle required but some thought the answer was the sum of the angles GAC and CAB.

Question 23

Scientific Casio calculators gave an answer for $\sqrt{48} + \sqrt{108}$ as $10\sqrt{3}$. It was intended that some manual manipulation then should take place to convert this to $5\sqrt{2}$ or $10/\sqrt{2}$ or $\sqrt{50}$. A common error was to go from $10\sqrt{3}$ to $5\sqrt{6}$ which showed little understanding. The more astute candidates simply took $10\sqrt{3}$ and divided by $\sqrt{6}$ to get an answer in the form required. Three other common start points were to bring in the surd $\sqrt{6}$ early eg $\sqrt{48} = \sqrt{8} \times \sqrt{6}$, introduce $\sqrt{3}$ early eg$\sqrt{48} = 4\sqrt{3}$ or $\sqrt{12}$ early eg$\sqrt{48} = 2\sqrt{12}$.

Question 24

All components to part (a) proved accessible. No simplification was required for any of these components. Part (b) was a challenging question and it was essential that the correct answer of $k = 4$ was not plucked from thin air and given full credit. Candidates had to gain both marks in (a)(ii) and (a)(iii) and at least 1 method mark in part (b). In this way, a correct route from T to S or Q to T was needed and a vector method started.

Some candidates misunderstood that dividing a line into a ratio of 1 : 4 produces fractions involving fifths and not quarters.

In very rare cases, some candidates delivered a very economical and perfectly sound mathematical argument based on the similar triangles QTR and PTS and this gained full credit.

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