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June 2011

International GCSE
Mathematics A (4MA0) Paper 3H

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International GCSE Mathematics A
Specification 4MA0
Paper 3H

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 3H

Introduction

The standard of this paper proved to be appropriate and gave candidates the opportunity to show what they knew. Many of the 30,000 candidates gained high marks and the majority showed their working clearly.

Q20 (Standard form) and Q23 (Area and volume) challenged even the ablest candidates. So too did Q21(a) (Deriving a quadratic formula), albeit to a lesser extent. Otherwise, all questions had a high success rate.

Report on individual questions

Question 1

Errors were rare on both parts, although -6.2^2 was sometimes omitted. Very occasionally, the correct value in part (a) was either truncated (1.72) or given to 3 decimal places (1.727) in part (b). The small minority of candidates whose value in part (a) was wrong often gained the mark in part (b) by rounding their value correctly. For example, an answer of −43.3709…, the result of $\frac{24.1}{8.4} - 7.8 - 6.2^2$, was usually rounded correctly.

Question 2

This was well answered. The majority either quoted 540° as the sum of the angles of a pentagon or found it using 180 × (5 − 2). A few used incorrect angle sums, such as 450°, 520° and 560°, consequently scoring no marks on the question. A minority used exterior angles, often successfully.

Question 3

Most candidates found the basic algebra straightforward in all three parts of this question. In the third part, the constant term was sometimes given as +21 or −4 and answers such as $y^2 - 21$, $y^2 - 10$ and $y^2 - 4$ were seen. Even the correct four terms in the expansion was no guarantee of correct simplification, the coefficient of y occasionally being given as −10. In the other two parts, though, no errors appeared with any regularity.

Question 4

There were very few errors in part (a) and part (b) also had a high success rate, although a significant minority of candidates used 30 × 0.1 to obtain 3, answering the question for mango juice instead of for orange juice. This received no credit.

Question 5

Most candidates showed a clear method. The most popular and concise approach was to convert $\frac{5}{6}$ and $\frac{3}{4}$ to $\frac{10}{12}$ and $\frac{9}{12}$, from which the result followed directly. Less popular but equally acceptable was conversion to $\frac{20}{24}$ and $\frac{18}{24}$, which have a difference of $\frac{2}{24}$. A few candidates converted the fractions to decimals but this approach received no credit. Spurious working such as $\frac{5-3}{6\times4}$ and $\frac{6-5}{4\times3}$ showed ingenuity but went unrewarded.

Question 6

In the first part, many candidates gave completely correct descriptions of the transformation. If an error occurred, it was most likely to be with the angle, often the omission of 'clockwise' or, less often, 'anticlockwise' appearing. Sometimes 90° itself was omitted. Combinations of transformations, which receive no credit, were seen occasionally, especially combinations of rotations and translations, but they seemed less common than usual.

There were many correct reflections in the second part but there was also one popular incorrect reflection obtained by reflecting either triangle **Q** in the y-axis or triangle **P** in the line $y = -x$.

Question 7

This question on ratio was very well answered and there were no errors which appeared often enough to be noticed.

Question 8

Candidates were generally more successful on the first part (intersection), where errors were rare, than on the second part (union), where the most common wrong answer was {3, 5, 7, 9,11} and both {3, 5, 7, 11} and {2, 3, 5, 7, 11} appeared regularly.

Question 9

Many candidates gained full marks, often using 1.05 as a multiplier. Candidates who stated the correct answer, \$9261, subtracted \$8000 from it and then gave the interest, \$1261, as their answer were not penalised. Simple interest was sometimes used, instead of compound interest; candidates who made this error generally scored 1 mark out of 3, usually for the interest earned at the end of the first year.

Question 10

Many candidates scored full marks for the formula $C = \frac{3d+7}{2}$ or for an equivalent formula, even a less simple one, such as $C = \frac{d \times 3 + 7}{2}$, or for one with unnecessary brackets. Formulae such as $C = 3d + 7 \div 2$, which included all three operations but lacked necessary brackets, received 2 marks out of 3. In general, there was a 1 mark penalty for the omission of '$C =$'. Formulae with d^3 instead of $3d$ received no credit.

Question 11

In part (a), the majority of candidates scored full marks, usually by successfully finding and giving as their answer an estimate for the total weight of the parcels, as the question required. A sizeable minority found the total weight and then went on to find the mean weight but, as long as the total weight, 444 kg, was explicitly stated in the working, full marks were still awarded. Errors were rare but the most common one was the use of upper limits instead of halfway values.

Full marks were also common on the cumulative frequency in parts (b), (c) and (d). A few candidates drew bar charts or lines of best fit but, as usual, the most common error with the graph was plotting points in the middle of intervals. If candidates who made this error went on to use their graph correctly and showed their method, the overall penalty incurred was only 1 mark. Some fell at the last hurdle; having found the correct answer from their graph, they subtracted it from 80 and lost the final mark.

Question 12

Many candidates produced completely correct solutions to both parts of this question on proportionality, although others either made no attempt or tried to use Pythagoras' Theorem. In the first part, scale factors were the most popular approach, usually $BC = 1.5 \times 5.2$ but sometimes $BC = 5.2 \div \frac{2}{3}$. In the second part, scale factors were still widely used but proportionality statements such as $\frac{CE}{7.2} = \frac{6}{9}$ also appeared regularly. It was quite common to see candidates comparing 5.2 and 7.2, which are not corresponding sides. Scale factors were sometimes used incorrectly, multiplying instead of dividing, for example, or used with 7.2 to find BC.

Question 13

Most candidates possessed the algebraic skills to solve this equation and there were many completely correct solutions with working shown neatly and accurately. The majority started by expressing the left-hand side as a single fraction with a denominator of 20 $\frac{5(2x-1)+4(x-1)}{20}=2$ or as the sum of two fractions with denominators of 20 $\frac{5(2x-1)}{20}+\frac{4(x-1)}{20}=2$. The minority who initially multiplied both sides by 20 started with either $5(2x-1)+4(x-1)=40$ or went directly to $10x - 5 + 4x - 4 = 40$, which led to a particularly concise solution.

Question 14

Many candidates appreciated what was required, wrote down $4 \times 1.75 + 1 = 8$ and scored 2 marks. Those whose knowledge of bounds was more fragile often started with $4 \times 1.8 + 1 = 8.2$ which frequently led to an answer of 8.15. Even if 8.2 were rounded down to 8, the correct answer, no marks were awarded. The 4 was sometimes rounded down to give $3.5 \times 7.5 + 1$ and, on rare occasions, the correct final answer was rounded down to 7.5.

Question 15

Although there was a high success rate in part (a), there were three regular errors. Two of them occurred in finding the area of the rectangle; its width was sometimes taken to be 2.7 cm or 7.1 cm, instead of 5.4 cm, the diameter of the semicircle. The other error occurred with the area of the semicircle, some candidates failing to halve $\pi \times 2.7^2$.

Many candidates succeeded in making r the subject of the formula $P = \pi r + 2L + 2r$ but a substantial number were unable to make a meaningful attempt, showing steps such as $\frac{P}{\pi}=r+2L+2r$. Between these two extremes, candidates usually obtained $P - 2L = \pi r + 2r$ with both r terms on one side but gained no further credit, if their next step was, for example, $\frac{P-2L}{\pi}=3r$. It was not unusual to see an expression on the answer line which included r, suggesting that a minority did not fully appreciate the meaning of subject of a formula.

Question 16

In the first part, the angle was usually correct. A reason such as 'Angle at the centre is twice the angle at the circumference' was expected and many candidates gave one. Other reasons were marked with some tolerance, if they showed that the candidate understood the principle involved and were phrased in general terms. So, for example, 'Angle in the middle is twice the angle at the perimeter' was accepted but 'Angle $AOB = 2 \times$ angle ADB' was not.

The angle was often correct in the second part but several incorrect answers appeared regularly, especially 57°, 106°, 66° ($180 - 2 \times 57$) and 61.5° $\left(\frac{180-57}{2}\right)$.

Question 17

Both parts of this probability question were well answered. Part (i) was expected to be more accessible than part (ii) but this did not seem to be the case. In questions like part (ii), candidates sometimes omit a relevant combination and this did occur, the usual omission being P(1, 2). More prevalent on this occasion, however, was the inclusion of an extra term, generally a second $\frac{2}{7}\times\frac{3}{6}$. The incorrect product $\frac{3}{7}\times\frac{4}{6}$, presumably P(1 or 4) × P(2 or 4) was sometimes used. This took into account the difference of 1 but failed to treat the two possible pairs separately. Predictably, a minority answered the question as if it were with replacement. Those who did this could score a maximum of 2 of the 5 marks available.

Question 18

There were many successful methods which gained full marks. The majority of these comprised finding the length of BC (47 sin 32°) and then using $\tan 51° = \frac{BC}{BD}$. For those who used this approach but lost marks, an error in rearranging $\tan 51° = \frac{BC}{BD}$ was often the problem. Use of tan 39°, which was seen occasionally, avoided this hazard.

Those who found BC with a two-step method using AB = 47 cos 32° and $BC = \sqrt{AC^2 - AB^2}$ ran the risk, inherent in all circuitous methods, of loss of accuracy in the answer due to premature approximation at some stage. Another popular method consisted of finding the length of CD using the Sine Rule and then using cos 51° to find the length of BD. There were many variants on these two basic strategies. It was not unusual to see the Sine Rule used, unnecessarily but usually accurately, in right-angled triangles. Working was often easy to follow but some attempts provided a challenge to markers, especially when they covered all the available space. Their task was made more difficult by the ambiguous labelling of sides. At the other extreme, it would be hard to improve on the conciseness of the candidate who wrote just two lines:
'BC = 47 sin 32° = 24.9' and
'BD = 24.9 tan 39° = 20.2'.

Question 19

Many candidates scored full marks. Of the rest, some lost a mark through evaluating the constant of proportionality inaccurately, usually as $k = 2.5$, but a substantial number of candidates lost all the marks, as, for no apparent reason, they used the wrong sort of proportionality, often taking P to be directly proportional to Q.

Question 20

This proved to be a very demanding question, many candidates failing to score a mark, even though one was available just for expanding $(a \times 10^n)^2$ as $a^2 \times 10^{2n}$. A wide range of incorrect results for this was seen, especially $a^2 \times 10^{n^2}$ and $a^2 \times 10^{n+2}$. A surprisingly large number tried to expand $(a + 10^n)^2$. To progress further, a close understanding of standard form was needed and only a minority gained full marks. A few candidates allocated specific values to a and n, found x^2 for these values and then generalised from their result. Full marks were awarded if their answer was correct but no marks otherwise. Centres might note that this question was similar to one of the examples in a recent Notice to Centres.

Question 21

Part (a) produced a wide range of responses from candidates. Many derived the formula clearly and concisely but a substantial number were unable to make a start. In between, some scored 1 mark for an expression for the area of a triangle, even if the brackets were omitted, while others embarked on ill-fated attempts using Pythagoras' Theorem or the quadratic formula. Another incorrect starting point was expanding $(10 - x)(8 - x)$, although sometimes this led mysteriously to the correct formula.

In part (b), most of the candidates with any knowledge of calculus differentiated correctly; the majority of these then equated their derivative to 0 and evaluated x as 4.5, although some found the second derivative. A rigorous explanation of why the value of A is a minimum was not expected. Answers such as 'the coefficient of x^2 is positive', 'it's a positive quadratic', 'it's a U shape' and $\frac{\mathrm{d}^2A}{\mathrm{d}x^2} > 0$ were all accepted. Common explanations which were unacceptable for various reasons included $\frac{\mathrm{d}A}{\mathrm{d}x} = 0$ 'The area cannot be negative', 'It's a parabola', 'It's an x^2 graph' and 'The coefficient of x is positive.'

Question 22

There were many complete, correct solutions to this equation, although a substantial minority of candidates achieved no success on this question. Most of those with the correct first step $x^2 + (2x - 3)^2 = 2$ then expanded the brackets correctly, although $4x^2 - 9$ appeared occasionally. Those who had scored the first 2 marks usually scored the third for the correct quadratic equation $5x^2 - 12x + 7 = 0$. Factorisation was the most direct method of solving this but the use of the quadratic formula was, of course, acceptable; candidates were, however, expected to evaluate the discriminant. If the correct values of x were found, it was unusual to see the corresponding values of y either omitted or inaccurately evaluated.

Question 23

This was a challenging question and only the ablest candidates achieved full marks, often with elegant solutions. The first mark was awarded for using the relevant mensuration formulae, available on the formulae sheet, in the area relationship given in the question to obtain $\frac{2\pi r^2 + 2\pi rh}{4\pi r^2} = 2$, although many were unable to take even this first step. $2\pi r$ sometimes appeared instead of $2\pi r^2$, presumably the result, in some cases, of confusion between the area and the circumference of a circle. The first mark was also awarded for $\frac{\pi r^2 + 2\pi rh}{4\pi r^2} = 2$ where candidates had included the area of only one circular end. As this did not reduce the demands of the question, candidates who made this error could still score 4 marks out of 5, if their subsequent working was correct. There was, however, no credit for candidates who started with $\frac{2\pi rh}{4\pi r^2} = 2$, as this did reduce the demands. Numerous candidates gained the first mark but did not complete the question successfully. The reasons for this were many and varied. Some candidates made mistakes with cancelling at an early stage while others progressed well until they made an algebraic error. In the minds of some candidates, area and volume triggered thoughts of area factors and volume factors. Inappropriate use of these often gave a value of $\left(\sqrt{2}\right)^3$ or $2\sqrt{2}$.

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