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International GCSE Mathematics A (4MA0) Paper 3H

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International GCSE Mathematics A
Specification 4MA0
Paper 3H

General Introduction to 4MA0

January 2012 hosted for the first time, the winter session of the International GCSE Mathematics A. All previous sessions had taken place in November. The total number of candidates rose to slightly over 2550, the highest entry for a winter session. Foundation entries, which had been decreasing, recovered to nearly 450 (from 300 in November 2010). Candidate entries for the higher tier were just over 2100.

Most of the 480 Foundation tier and 2200 Higher tier candidates took the opportunity the papers gave them to show what they knew.

Paper 3H

Introduction

Generally the work produced on this paper was of a good quality and methods were well presented and easy to follow. In a minority of cases candidates crossed out a response in such a way as to make it unreadable. This was more likely to happen on the more searching questions towards the end of the paper. It is worthwhile emphasising that work should not be crossed out until it is replaced by something better, but candidates should not leave the marker with a choice of methods to mark.

A feature of this paper was the number of questions where the candidate was invited to establish a given result. In these “show that” questions the onus is on the candidate to establish the given result in clear, logical, sequential steps. Taking sizeable jumps in reasoning, and hence not writing down steps, leads to the risk of having marks withheld through a lack of explanation.

Report on individual questions

Question 1

Part (a) was well answered by the majority and gave most the opportunity to start the paper with confidence. It was anticipated that for both parts of this question students would work in millions and avoid the tendency to produce lots of trailing zeros. The word ‘million’ on the answer line in part (b) was there to encourage candidates to do just that. Happily in most cases this was the case. Some candidates did not know the number of zeroes in 7 or 33 million and hence those who used (say) 32000 or 320000 lost all their marks. In part (b) more astute candidates were able to perform a single calculation of 1.04 x 32 to increase 32 by 4%. Answers with the correct number of zeros rounding to 33 million were accepted. Incorrect rounding was not penalised as long as accurate answers were seen in the body of the script. In a small minority of cases some candidates thought that the increase in part (b) was 4% per year and treated the question as a compound interest problem over two years.

Question 2

For a question placed so early in the paper this was surprisingly poorly done. Candidates failed to examine the spinner carefully enough to spot there were two red sections, not one. As a result answers of 6 (from 1/5 x 30) were almost as common as the required answer of 12.

Question 3

Requesting answers to 3 significant figures was given as guidance, rather than an instruction, and incorrect rounding from answers seen in the body of the script was not penalised. Therefore those candidates that wrote 459 as their final answer gained full marks as long as a more accurate full answer was seen in the body of the script. Answers in the range 4592 to 4597 took into account lower and upper limits of π as 3.14 to 3 1/7 Most candidates gained full marks and it was rare to see the diameter used rather than the radius.

Question 4

This was a challenging question to gain all four marks. Construction questions need correct construction lines (i.e. arcs) clearly seen. Many candidates gained the first two method marks by drawing correct arcs of length 6 cm from A and B and then a further correct arc of length 10 cm from either A or B. A further arc of length 6 cm from either of the two correct top vertices was required to complete the method process. The first two method marks were independent but the final method mark was dependent on the first two awarded. Many candidates gained 1 mark by drawing arcs of 10 cm from A and B and producing a "stretched" parallelogram as a result. Tolerance of ± 2mm was allowed on all arcs. A special case of 1 mark was awarded for a correct rhombus without any construction lines.

Question 5

Most components of this question proved accessible. The most challenging part was (b)(ii) in expanding the brackets. In cases where students lost marks it was either through multiplying out the brackets incorrectly (e.g. $3y^2$ instead of y^3 and/or $10y$ instead of $10y^2$) or subsequent incorrect simplification taking place on what was an originally correct answer. Therefore $y^3 + 10y^2$ became $10y^5$ or $10y^6$. In this latter case one mark was deducted from the two that would have been awarded.

Question 6

Candidates generally coped well with the idea that the set theory symbol in part (a)(i) represented the empty set and hence there were no students who studied both German and Maths. Marks were withheld if they went on to add erroneous information such as "*they didn't study Maths but did study French*". This rule also applied in part (a)(ii)... "*Preety doesn't study French but she does study Maths/German*". A sizeable number of responses mentioned that Preety did in fact study French, possibly because they did not examine the negation symbol closely enough.

Some students in part (b) used Venn diagrams as a visual device to reach the correct result though this did lead to some incorrect answers of {1, 3} by the selection of the elements in B not A.

Question 7

Both components of this question were generally well answered. The two initial entries in the table pointed the candidates in the right direction concerning mid-interval values. Final answers of 8 texts (rather than 8.2), for those candidates who were troubled by the decimal value as a final answer, were not penalised provided full working was shown. The table gave a clear structure on how to proceed and most candidates followed this lead. One arithmetic error was condoned for those candidates unable to choose and use the correct mid-interval values.

In part (b)(ii) it was pleasing to note that most candidates appreciated that grouping the data and using mid-interval values would lead to an estimate for the mean number of tests. Responses which did not gain credit were references to 8.2 being a decimal and thereby the impossibility of sending part of a text, or the fact that this one day might not be typical and a subsequent day might lead to a different result.

Question 8

Part (b) was the first question on the paper of a "show that" structure where the onus was on the candidate to establish in clear, legible steps a stated result, (i.e. a linear equation in this case). It should be noted here, and elsewhere, there is a danger that marks are withheld if the candidate skips stages and does not explain his/her working in a systematic way. Some candidates thought that $2 \times \frac{x}{60} = \frac{2x}{120}$ Candidates who failed to score well in part (b) usually started afresh in part (c) and gained the 2 marks available.

Question 9

The orientation of the triangle caused difficulties for some, who then opted to use tangent instead of sine, mistaking *PR* for the adjacent rather than the hypotenuse.

In part (b) 5.84 was sometimes mistakenly selected rather than 5.85 as the upper bound whilst 5.75 had more success as the lower bound.

Question 10

A sizeable number of students lost the final mark by failing to appreciate the question required the total interest to be calculated after 3 years, rather than the capital. Answers of £8932.62p (from 1.06^3 x 7500 or equivalent) were therefore given 2 of the 3 marks available. Some candidates failed to distinguish between compound and simple interest and calculated 3 x 450 = £1350. This gained 1 mark, as did £8850 (from 3 x 450 + 7500)

Question 11

This was generally well answered, especially by the more able candidates. The relatively simple task of multiplying out the brackets was needed to proceed onto gaining full marks. Weaker candidates often did not have sufficient precision in their working to correctly gather up the x and y terms. A three term statement equivalent to $5x - 3 = 2y$ was needed to gain the second method mark. Sign errors were common – such as $-2y = 5x + 3 \Rightarrow y = \dfrac{-5x+3}{2}$

Frustratingly, unsimplified expressions such as $y = \dfrac{(6-1)x-3}{5-3}$ failed to pick up full marks.

Question 12

Most candidates spotted and used correctly the scale factor of 3/2 or 2/3 between the larger and smaller quadrilaterals. Weaker candidates noticed a difference of 3 cm between *PQ* and *BC* and offered an answer of 9 (from 12 – 3) for part (a) and, 8 (from 5 + 3) for part (b).

Part (c) was generally poorly done. Despite area scale factors being a regular feature on past papers most candidates still assume the areas will increase/decrease by the same linear scale factor. Of those that used the correct area scale factor of 2.25, many forgot to subtract the original area and got a final answer of 72 cm^2 instead of 40 cm^2.

Question 13

The numerical answers for the angles *PQS* and *PTS* gained more marks for the students than the reasons given. Geometry questions asking for 'reasons' to back up any answers require an appropriate geometrical fact and not just a description of the calculation used.

In part (b)(ii) the preferred reason was the angle at the centre (say *PTS*) was not twice the angle at the circumference. Many candidates spotted that triangles *PQT* and/or *SRT* were not isosceles and hence $PT \neq QT$ and/or $ST \neq RT$ and hence not radii. This was accepted as a necessary (but not sufficient) condition for *T* <u>not</u> to be the centre of the circle, provided some justification was given why these triangles were not isosceles, (e.g. angles at the base were not the same).

Question 14

It was pleasing to note how the majority of candidates explained their algebraic steps clearly in order to derive the expression for the area in part (a) and gained all of the 3 marks on offer. Markers had to be convinced that candidates were working from the premise that the perimeter was 72cm, using the sides of x and y cms, and not working backwards from the given answer. Central to this was establishing $y = x - 6$ and going on to state $A = x(36 - x)$

Most of the remainder of this question proved accessible to those candidates familiar with calculus and an algebraic treatment was not required to gain full marks in part (c), however, many left the answer as 18 cm^2 rather than 324 cm^2.

Question 15

Implicit in the requirement to express *F* in terms of *d* is to go beyond the proportion sign and obtain a formula for *F* in terms of *d* containing an equals sign, to start gaining marks. If candidates failed to read the second line of the question carefully, an *inverse square* relationship was not attempted, and it was difficult for the candidates to recover in parts (b) and (c) and gain any marks.

Question 16

Parts (a) and (b) were generally well answered and part (c) less so. Most candidates were able to see easily from the 4^{th} interval ($50 \leq t < 60$) that 1 cm^2 = 2 runners, or obtained the correct frequency densities from this same interval.

In part (c) a follow through method mark was allowed for those candidates that failed to achieve the correct answer to part (a), however a detailed partition of two intervals was the preferred method to achieve the correct answer and many failed in this task.

Question 17

A variety of starts were acceptable, the most common being x = 0.17 recurring then $10x$ = 1.7 recurring before subtracting to reach $9x$ = 1.6 to gain the first method mark. A fraction equivalent (but not equal) to 8/45 then had to be reached. Typically this was 16/90. In a minority of cases candidates split 0.17 recurring into 1/10 + 0.07 recurring. Marks were not awarded unless 0.07 recurring was shown (by working) to equal 7/90. The final accuracy mark was then awarded for 9/90 + 7/90.

Question 18

The key to gaining the correct answer was recognising angle *AOC*=70° (from 2 × angle *ADC*). Sometimes candidates went to elaborate lengths using trigonometry on triangle *ACD* to find length *AC*, then bisecting this and using trigonometry again to establish this simple result. Three of the six marks available could be achieved if the angle of 70° was not used, by using correct methods to calculate areas of the triangle *AOC* and the sector *AOC* before subtracting these.

A common mistake was to drop a perpendicular from *C* to *AO* and incorrectly assume this bisected side *AO*. This incorrect perpendicular height was then used to calculate the area of triangle *AOC*. Unless it could be shown that the candidate assumed triangle *AOC* was isosceles with *AO* as its base, or was equilateral, this method for calculating (incorrectly) the area of triangle *AOC* was not accepted. Some candidates thought that they could regard ACD as a sector of a circle with radius 18 cm and used the angle of 35°.

Question 19

Markers are mindful that certain brands of calculators, (typically Casio), could reach $2\sqrt{6}$ by entering the whole surd expression directly or $4\sqrt{3}$ for entering the numerator. Justification for each stage was therefore carefully scrutinised and method marks were awarded for certain stages reached. The two main approaches were to express root 27 as $3\sqrt{3}$, or to “realise” the denominator as the first step, by multiplying numerator and denominator by $\sqrt{2}$. A number of candidates threw away their last mark, having reached $2\sqrt{6}$ successfully, by stating the value for k was equal to 6.

Question 20

This was answered well by able candidates. Some gained no marks by losing the denominator at the start. Others lost their final accuracy mark by cancelling (typically x’s) incorrectly having reached $(8-x)/(2x - x^2)$ in the body of the script.

Question 21

In part (a), as with previous questions, having been asked to establish a result, the candidate was required to demonstrate a clear path from the area of the trapezium given as 42cm^2, to the given quadratic expression, without taking multiple steps. To gain any marks the first stage was to establish an equation based on the given area of 42cm^2. This could be derived from using the trapezium formula, or partitioning the shape into a rectangle and triangle. Jumping directly at the beginning to $x(x + 5 + x + 8) = 84$ was penalised as it was felt to be too close to the final answer.

In part (b) most candidates recognised that the quadratic equation in part (a) had to be solved, though some did not and hence forfeited the final 5 marks on the paper. It was disappointing to see a number of candidates deciding in the last stages of the paper that $CD = \sqrt{(3^2 + x^2)} = 3 + x$ and so lost the final accuracy mark when substituting $x = 4$ into their perimeter expression.

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