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Examiners' Report/
Principal Examiner Feedback

Summer 2015

Pearson Edexcel International GCSE
Mathematics A (4MA0)
Paper 3H

Pearson Edexcel Certificate
Mathematics A (KMA0)
Paper 3H

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Grade Boundaries

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The questions on the paper reflect its international status. In this paper questions are sourced from Italy, India, North America and France.
The paper also had some questions which were intended to allow students to demonstrate that they had more than a superficial knowledge of the techniques that they should know. This was evident in, for example, questions 3(b), 4(b), 6(b), 11, 15, 16(c) and 18.
There were many cases where students misread the information in the question. This was particularly the case in questions 2, 6(b), 7(b), 10 (b), 11, 15 and 18 – a potential loss of over 10 marks.

Question 1
Most students had a clear idea of how to use the scale and then to change from m to cm (and generally in that order). Although a number did not know how many cm there are in a metre. Errors generally fell into two classes – firstly those that used the scale wrongly by multiplying by 200 instead of dividing and secondly those who misunderstood what the ratio scale was and divided by 201. When performing calculations which involve ‘real’ objects, students should always ask themselves about the reasonableness of their answer. Answers such as 1.725 cm, 69000 cm and 6900000 cm for the size of the model should have immediately raised alarm bells.

Question 2
Successful students generally adopted two approaches. The best approach was to calculate the angle of the materials sector, then treat the rest of the task as proportionality and work out $\frac{225.5}{82} \times 86$. A good approach was to convert angles to percentages, then carry out an equivalent calculation such as $\frac{225.5}{22.\dot{7}} \times 23.8...$, but this often led to an inaccurate answer due to premature rounding.
A more roundabout method was to calculate the total of the costs (990 million euros) and then find the appropriate fraction of this sum.
A common error was to treat the 225.5 million as the total of the company and to find $\frac{86}{360} \times 225.5$. This earned just the one mark. Some students tried to change the 225.5 million into 225500000 and often made an error. It was clear from the answer line that working could be carried throughout using ‘millions’.

Question 3
The first part was standard with the correct simplified expression 4*n* + 1 often seen, although any correct form was acceptable. There were still many students who thought the answer was *n* + 4, however. Part (b) proved to be unknown territory for many of the students who had got both marks in part (a). It was expected that students would take one of two approaches. The first was to replace *n* by (*n* + 1) to give the expression 4(*n* + 1) + 1. This was acceptable although many students went on to 4*n* + 5 by expanding the bracket. An alternative approach was to recognise that the difference between successive terms was 4 so the *n* + 1 th term was the *n*th term + 4. However, many made the error of simply adding one onto their answer from (a).

Question 4
Students were generally successful in finding *z* = 19 in part (a).
Getting full marks in part (b) was more of a challenge. Many students were able to use the information about the range and the value of z (19) to find the value of w (9). They found it much harder to get the fourth mark. Successful students were able to see that *x* + *y* had the value 24 from the use of the introduction to part (a) as 33 – 9. Some then assumed that *x* was 11 and *y* was 13 giving a median of 12. However the individual values of *x* and *y* are irrelevant just as long as the sum is 24. A very common approach was to assume that the median lay half way between *w* and *z* and so students gave the value 14 from 9 + half of 10.

Question 5
Part (a) was a conventional proportionality question and as such was very well answered. Most students started by finding the cost in rupees (2800) of 1 gram of gold and followed by multiplying by 4.6.
Part (b) was also well answered with many students finding 92.5 % of 15960. A few students found 92.5% of their answer to part a; they could score a maximum of 2 marks. Others reduced the 5.7 grams by 7.5%. first and then used the unit cost to work out the answer. This gives the same value as the correct approach and was awarded full marks if the correct answer was seen. A minority of students used 75% in place of 7.5%. This scored no marks. There was also a significant portion of students who treated it as a 'reverse percentage' question and divided by 107.5% to gain an incorrect answer. Some increases, rather than decreased, by 7.5%.

Question 6
Both parts were generally well done. Part (a) was found from π × 1.5 or more rarely through 2 × π × (1.5÷2). Nearly all students scored at least 1 mark on part (b) from 1000 ÷ answer to part (a). Many students did not appreciate the implication of 'complete' and gave an answer which was unrounded (frequently 212.2). Some students gave an answer of 213 as the number of complete turns needed to cover the given distance. A minority of students misread the given dimension as the radius.

Question 7
Currency questions are often set on this paper in accordance with its international nature. Virtually all students scored at least 1 mark on part (a). There were a number who, however, did not read carefully enough and used 1.6 instead of the correct 1.16.
Part (b) was also well done, with most students converting the 850 euros to pounds first, followed by the addition of the £3.50. Answers in the range 736 to 736.3 were accepted, as detailed knowledge of any currency is not a requirement for the paper.

Question 8

A standard Pythagoras question in which most students found the correct answer of 1.6. A few tried to use trigonometry – generally unsuccessfully. The most common error seen came from students adding instead of subtracting the squared quantities, which scores no marks, and from incomplete solutions (not square rooting the area to obtain the side length).

Question 9

Part (a) was well answered – the most common errors being $9y^3$ (from adding the coefficients as well as the powers) and $20y^2$ (from treating the power in $5y$ as 0 rather than 1)

Part (b) was also well done with many students either giving $\frac{3e}{5f^2}$ or $0.6\frac{e}{f^2}$ or $\frac{3ef^{-2}}{5}$.

A few students wrote $-10\frac{e}{f^2}$ presumably from subtracting the coefficients as well as the powers. Common was $\frac{3e}{5f^{-2}}$.

Part (c) proved to be much more of a problem with many students apparently failing to realise that two pairs of brackets were required. There was in many cases, however, an awareness that the answer must be of the form $(ap + bq)(cp + dq)$. A significant number did manage to get this form with at least $ac = 6$ and $bd = -6$. The grouping method $6p^2 + 4pq - 9pq - 6q^2 = 2p(3p + 2q) - 3q(3p + 2q)$ was rarely seen.

Part (d) was well done with most students dealing correctly with the negative powers.

Question 10

This question was intended to test the use of a calculator with standard form, so it is disappointing to see students laboriously writing out the values in full before going on to find their sum. Those who did attempt to use a calculator shoed a lack of understanding of how to use their calculator to undertake addition of numbers in standard form. Often the numbers were set in columns that were so untidy then when the resulting addition was carried out the answer indicated that the correct columns had not been totalled. Some students did spot that all the powers of 10 were the same so just wrote down the mantissae and added them – a significant reduction in the amount of digits to process and an answer that was invariably correct.

In part (b) some students were confused by the role that k was to play and wrote down the incorrect $k \times 1.22 \times 10^{13} = 7.45 \times 10^9$ or the correct $1.22 \times 10^{13} = k \times 7.45 \times 10^9$ followed by $(k =)\frac{7.45 \times 10^9}{1.22 \times 10^{13}}$. A significant number of students did not take enough care in reading from the table and used 8.21×10^{10} as the volume of water in Lake Superior. This resulted in no marks.

Question 11
Students usually adopted one of two approaches to find the volume of the prism. One was to calculate the total cross-sectional area from 144 + 136 = 280 cm^2 and then multiply this by the depth (80 cm). The alternative was to treat the solid as a cuboid and a prism with a trapezoidal cross-section, find the volume of each and then add.
The formula for the area of a trapezium is on the formula sheet so it was disappointing to see some students assuming the trapezium *EFCD* was isosceles and then splitting the quadrilateral into a rectangle and two triangles. This often resulted in an incorrect answer.
Some did not read the given information carefully enough, or not at all. They made the assumption that the side of the square and the height of the trapezium were both 10 cm.
This could score a maximum of 3 marks. A very small number of students calculated the surface area rather than the volume.

Question 12
It was pleasing to see so many students who could find the mean with such ease. Providing full working was shown students could give their answer as 149.88 cm and even 150 cm. There was still a large number who thought the answer was 149.5 from the mean of 151 and 148.

Question 13
Part (a) was a standard piece of algebra and as such much of the entry were able to show their proficiency in finding the correct values using a full algebraic approach. A few students lost two easy marks by moving from $6y = -3$ to $y = -2$. Many lost a mark to arithmetic errors when multiplying the equations. Solution by substitution was also seen.
Part (b) was not so well done, although many students saw the need to find the gradient by writing $y = -2x + 6.5$ for example. Many then were unable to complete as although they knew that the required line should be of the form $y = -2x + c$ they could not see how to find the value of *c*, in many cases going for the value −1.
Some students know that any line parallel to the line with equation $4x + 2y = 13$ must have an equation of the form $4x + 2y = k$. They were able to complete the task efficiently by substituting $x = 3$ and $y = -1$ into the left hand side to find *k*.
A few students used the direct and acceptable $y - y_1 = m(x - x_1)$.

Question 14
Part (a) is a routine difference of two squares factorisation. There were two possible approaches to part (b). The first used part (a) to write $N = (2^{11} - 1)(2^{11} + 1)$ followed by use of the calculator to find the required numbers 2047 and 2049. The second relied on writing N as a product of its prime factors and then combining those factors in a sensible way. The type of scientific calculator that students should be using for this examination will write $2^{22} - 1$ as a product of its prime factors as *N* was chosen not to be so large that this was possible.
$N = 3 \times 23 \times 89 \times 683$, so the required factors come from 3 × 683 and 23 × 89. Some students either did not know what an integer was or overlooked that the answers should be as such and gave decimals. Some students decided to evaluate the expression (4194303) and square root. Unfortunately this approach was poorly interpreted and a significant number of students rounded to 2048

Question 15

This was a slightly complex trigonometry problem in the sense that there was no right angled triangle drawn for the candidate. Consequently students had to decide which triangle they were going to use. The simplest and most successful approach was to draw a line from *D* parallel to the side *CB* meeting the side *AB* at the point *M* (say). Then it was a simple matter to use tangent in triangle *MDA*, find angle MDA and add 90^{o} for angle *CDA*. Other students drew a line from *C* to *A* and used the cosine rule in triangle *CDA*. They had a lot more work to do – Pythagoras twice for *AC* and *AD* followed by the rearranged form of the cosine rule to find the angle *CDA*. Other efforts included a combination of tangent in triangle *ACB* with Pythagoras and sine rule for triangle *CDA* or a combination of tangent in triangle *BCD* (to find angle *BDC*) together with cosine rule in triangle *BDA* after finding *BD* and *AD*.

Many students lost marks on this question by not reading the given information. The length of *AB* was clearly given as 25 cm, so students forming triangle *MDA* should **not** have been finding $\tan^{-1}\left(\frac{25}{24}\right)$ for angle *MDA*. Many students did just this and so lost at least 3 of the available 4 marks. Almost as wasteful were those who found angle *ADM* correctly but did not add on the 90^{o} to give angle *CDA*. Lots of early rounding when using a more complex method meant many students risked losing the accuracy mark.

Question 16

The table was almost always completed correctly and most students drew a smooth curve through their correctly plotted points although occasionally (3, 3.125) was plotted inaccurately. For part (c), far less were able to link the given equation to solve with that of the curve. For those that did , they often lost an easy mark by using the line $y = 3.5$ drawn only to its first point of intersection with the curve; a lot drew y = 7 as their line. Students who gave no evidence of using a curve but who got $x = 1.7$ say were not awarded any marks unless they had demonstrated that they had indeed used the curve and not obtained their solution by trial and error.

Question 17

Students were well prepared for parts (a) and (b) with very many getting both marks. For part (c) most students were able to start an answer and many went on correctly to collect terms over a common denominator. However, many then went astray as they moved from $\frac{3(x-2)+x+1}{(x+1)(x-2)} = 0$ to $3(x-2)+x+1=(x+1)(x-2)$ and were awarded no further marks.

The demand in part (c) did specify the use of an algebraic method, so an answer of $x = 1.25$ without supporting algebra was awarded no marks. The most frequent error from those using algebra was the incorrect multiplication of the denominator by 0 when attempting to solve their equation.

Question 18

The correct reasoning processes needed to answer this question were $\frac{\text{LB(numerator)}}{\text{UB(denominator)}}$ and UB (denominator) = UB (b) – LB (c) . Responses tended to fall into three groups – students who followed the processes shown above (generally gained full marks), students who knew something about lower bounds and upper bounds but could not apply the reasoning correctly (1 mark) and students who had little or no idea of bounds (those who worked out an answer using exact values and then took off 0.5 from their answer to get 8.35.) Sadly, a few students were careless and omitted the ‘2’ in the formula in their evaluation

Question 19

This was a standard question and as such was well answered by many students. Some did lose a mark through extending the last bar to 350 instead of the correct 300 and a few decided to, for example, give bar heights that were half the ones given in the mark scheme. Unless they relabelled the frequency density axis or provided a key, these students were limited to 2 marks. Some students decided to divide each frequency by the corresponding midpoint value in the class interval, or by the upper limit. A minority mis-drew the first bar with a width equal to that of the second bar losing a mark in the process. Another common error was to divide by the midpoint or end points of the table to find their 'frequency density'.

Question 20

This was a standard probability question. Few students had any problem with part (a) although it was disappointing to see some students adding the probabilities. Part (b) was also well answered although some students failed to take account of the fact that there are three ways of getting the required number 5 exactly once, so many gave the answer $\frac{25}{216}$ and scored just the one mark.

Question 21

Students did not do well on this question. The challenge was to find a suitable way to link the angle at *D* with the angle at *A*. This could only be done by drawing on knowledge of the geometry of the circle. One possible route was to join *B* to *C* and use a combination of angle in a semicircle, the alternate segment theorem and the sum of the angles in a triangle. An alternative was to join *B* to the centre of the circle (say *O*), and use the isosceles triangle, the angle between tangent and radius and the angle sum of a triangle. It was particularly disappointing to see so many students who thought angle *DBA* was 90^{o}. They scored no marks. A common error was seeing the triangle *ABD* as isosceles which led to an answer of 29.

Question 22

This question was unusual and as such caused difficulty for students. The most successful students were those who recognised the transferability of direct proportion – that is if $A \alpha B$, and $B \alpha C$ then $A \alpha C$. Such students generally went on to complete the question successfully. Other students used $A = kT^2$ and $A = Kr^3$ and were able to find the value of $\frac{k}{K}$ then go on and use this to find *r*. A few others used a ratio approach with r^3 and T^2.

Many students unfortunately went astray early in their attempt as they wrote $A = kT^2$ and $A = kr^3$ but then could not reconcile the two formulae when they substituted in values for *T* and *r* and equated their two expressions for *A*.

A number of students who did find the value of the combined constant then failed to score full marks, some failing to cube root, others failing to square 365 A significant number of students, once quoting the proportionality equations, proceeded to equate the two equations $kT^2 = kr^3$, and incorrectly 'cancel' *k*. Others simply ignored the powers, thus scoring no marks.

Question 23
This was standard three – dimensional geometry/ trigonometry question which many students did successfully. The most common approach was to use Pythagoras to find the length of the diagonal *AC*, then find the length of *AO* where *O* is the centre of the square. This was followed by using Pythagoras in triangle *AVO* to find the height *VO*.
Equally good, but far less common were those who used Pythagoras in triangle *AMB* where M is the midpoint of *AB*. They followed by using Pythagoras in triangle *VMO* to find the height *VO*.
There were many students who appeared to misunderstand the diagram or did not understand the height of the pyramid. They either assumed that *AO* was 5 cm or that *VM* was the height of the pyramid. They were awarded no marks.
Some students were not careful enough in the use of their calculators and so lost at least one accuracy mark. Typically this came about from finding that *AO* was $5\sqrt{2}$ then writing $12^2 - 5\sqrt{2}^2$ and getting the incorrect 134. A significant number of students incorrectly saw 12, 10 in a right-angled triangle, with the missing side as the height, scoring no marks.

Question 24
This was a structured vector algebra question with part(a) asking for the simplest expression in terms of **a** and **b** for the vector $\overrightarrow{OX}$. Most students used a method involving, for example, $\overrightarrow{OP}+\frac{1}{2}\overrightarrow{PQ}$. A few had learned the appropriate formula for the midpoint and wrote down $\frac{1}{2}(6\mathbf{a}+6\mathbf{b})$ following up with the correct simplified answer. Many found *PX* only, and did not use this answer to find *OX*. Part (b) required understanding a simple ratio/fraction conversion followed by vector addition. It was pleasing to see many students being able to do this and get full marks for this vector question. Some found $\frac{2}{3}$ or $\frac{1}{3}$ of OX (depending upon which route they take), and did no more, or they used the ratio incorrectly eg instead of $\frac{2}{3}$ they used $\frac{1}{2}$.
Students who got part (a) wrong were able to pick up the 2 marks for part (b) if they showed working in (b) and their answer followed on from their answer in part (a). A significant number of students used OQ rather than QO (or some equivalent) and lost simple marks despite showing a correct method. Students should be encouraged to write full vector equations as well as considering the direction of vectors.

Summary

Based on their performance on this paper, students should:

- ensure that they read questions carefully and take care when copying numbers given in the question

- remember that the formula for the area of a trapezium is given on the formula sheet and use this formula when appropriate

- show clear algebraic working when this requirement is included in the demand for a question

- use brackets when squaring values such as $5\sqrt{2}$

- read information given below diagrams carefully and transfer all such information on to diagrams before attempting any calculations

- be prepared to add additional lines to diagrams to help find the required length or angle.

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