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Principal Examiner Feedback

Summer 2015

Pearson Edexcel GCSE
In Mathematics A (1MA0)
Higher (Calculator) Paper 2H

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GCSE Mathematics 1MA0
Principal Examiner Feedback – Higher Paper 2

Introduction

Students appear to have been able to complete the paper in the time allowed. Most students seemed to have access to the equipment needed for the exam. The paper gave the opportunity for students of all abilities to demonstrate positive achievement while at the same time discriminating well between students of differing abilities. In particular, questions 1 − 4, 6, 7 and 8 were answered well by the great majority of all students and most questions in the first half of the paper attracted many good responses. Exceptions to this were question 12 on coordinates on a straight line and question 13 on bearings. At the top end of the ability range, only the best students could produce fully correct solutions to questions 21, 24, 26, 27 and 28.

Many students presented their working in a clear, logical manner and questions involving an assessment of the quality of written communication were tackled well with conclusions drawn and clear comments made where appropriate. There were, however, also many cases of disorganised working with calculations scattered apparently randomly throughout the working space. In a small minority of cases correct answers were not supported by any working and so could not be awarded the marks available, for example in question 19 which involved trigonometry.

There were some instances where students rounded their answers prematurely. For example in question 15(b) students who wrote "4.3 × 107" without first writing "4.2875 × 107" could not be awarded full marks and in question 19 students who rounded intermediate calculations risked not being able to give an answer within the range condoned.

Report on individual questions

Question 1

This question was well answered by most students. Students usually answered parts (a) and (b) by giving the probabilities as a fraction and the responses seen were generally accurate. $\frac{10}{30}$ and $\frac{1}{3}$ were common incorrect answers to part (a). Simplification of the answer to part (b) was not expected and so not penalised if incorrect provided students had also written the unsimplified version correctly. Only a very small number of students gave probabilities greater than one. Where their final answer to part (b) was incorrect, some students scored a method mark for finding the number of white chocolates.

Part (c) was also done well though some students made errors in adding 0.35 and 0.17 or in subtracting 0.52 from 1. Some students wrote their answer in the table provided rather than on the answer line and then wrote something different on the answer line. These students could not be awarded both of the available marks. A minority of students gave their answer in correct fractional form, usually as $\frac{12}{25}$. The most common incorrect answer seen by examiners was 0.52.

Question 2

The great majority of students gained some credit for their response to this question, usually at least 3 of the 4 marks available. Many students successfully evaluated the expression for a value correct to one decimal place but did not use a value between 3.45 and 3.50. Less successful students restricted correct evaluations of the expression x3 – x2 to whole numbers and some students could not interpret the significance of their evaluations when x = 3.4 and x = 3.5 and so tried evaluating the expression for values of x greater than 3.5 as their next step. Some students did not round their final answer to one decimal place. A few students did not record any evaluations but merely restricted their responses to phrases such as "too big" or "too small". Examiners could not give any credit in such cases.

Question 3

This question was not as well done as we might wish and it appears a significant proportion of students are not sufficiently familiar with using a calculator to work out the value of complex expressions such as the one given in part (a).

In part (b) a good proportion of students seemed to confuse 4 decimal places with 4 significant figures. Some students who had an incorrect answer to part (a) were able to round their answer correctly and so recover a mark here.

Question 4

The vast majority of students were able to show they could enlarge the given triangle by a scale factor of 2 to gain at least 1 mark but far fewer were able to centre their enlargement on point A. A small proportion of students scored 1 mark for 2 correct points or for an enlargement, scale factor 3, centre A.

Question 5

Students used a variety of approaches to this question. Most students began by working out the total number of students at all 3 schools and then used this to break down the problem into finding the number of students from each school, some by forming an equation and others by a trial and improvement method. Of those students who used an algebraic approach, a large proportion who denoted the number of students sent by Redlands School with x incorrectly went on to give the expression $2x - 7$ for the number of students sent by the Francis Long School. A significant number of students formed an equation by equating their expression for the total number of students to 1155, the total amount of money spent instead of 77, the total number of students. Despite these common errors there were many fully correct answers using an algebraic approach.

Students who used a trial and improvement method generally found the process straightforward and usually scored full marks.

Weak students were often able to find the number of students by dividing 1155 by 15 but could not progress any further.

Question 6

This "best buy" question was well answered with the majority of students finding the cost of one sachet of coffee from each box before correctly deducing which size of box gave the best value for money. A small minority of students found out how many sachets from each size of box could be bought for £1 but some students using this approach could not correctly interpret their results. Poor use of money notation was evident from many students with amounts of money such as 46p being expressed as 0.46p. A small proportion of students attempted to use common multiples to compare the costs. However, they often failed to find a common multiple of all three quantities. Other students only compared the costs for two boxes using a different method. Nearly all students explained clearly in words which box was the best value for money and it was usually possible for examiners to award the mark for quality of written communication.

Question 7

Students answered this question well. Nearly all students correctly expanded the brackets in part (a) and the vast majority also obtained the mark available in part (b). Commonly seen incorrect responses to part (b) included $12y - 9y$, $12y - 9$ and $12y^2 - 9$. More careful checking by students would have eradicated many of the errors made here. The double bracket expansion in part (c) was also well done though the weakest students sometimes made arithmetic errors or tried to "simplify" the final correct answer $t2 + 6t + 8$. Other errors seen included "$t \times t = 2t$", "$2t + 4t = 8t$" and "$2 \times 4 = 6$".

Question 8

The vast majority of students scored at least 2 marks for their responses to this question thereby demonstrating they used a correct method even though there were errors in the arithmetic. The most common error in method seen by examiners was for students to divide 153 by 4 and then 2 and then 3.

Question 9

Though there were many fully correct answers to part (a) of this question, there were as many responses which were worthy of only 1 mark either because students had plotted points at the upper boundary of each interval or because they had joined the first and last points to make a closed polygon. A significant number of responses were worthy of no marks because students misinterpreted the scale on the frequency axis. Some students drew histograms. Many students gave a succinct and clear answer to part (b) but students often lost marks through not giving sufficient detail. The phrase "at least" caused problems for some students.

Question 10

About two thirds of all students entered for this paper were able to score some credit for their responses to this question. About a third of students provided a fully correct response and a further third of students scored part marks for at least one correct boundary. A common error was to replace what should have been an arc with a vertical line.

Question 11

This question was well done with the great majority of students finding the circumference of the cake in cm and reaching a correct conclusion, ie that the length of ribbon was not long enough. A relatively small minority of students used an alternative, yet correct approach, for example by working in inches and converting the 50 cm to inches. Almost all students worked accurately, using the value of π from their calculator and clearly communicated their decision at the end of their working. A small proportion of students used the formula for the area of a circle or restricted their working to changing 7 inches to cm or 50 cm to inches and so gained no credit for their responses.

Question 12

In comparison to question 11, few students were able to answer this question successfully. Less than 10% of students scored full marks. A relatively small proportion of other students gained some credit for working out the difference between the x coordinate of A and the x coordinate of B or for the difference of the y coordinate of A and the y coordinate of C. Many students had no real idea how to approach this non-standard question on coordinate geometry. A good diagram might have helped students but few diagrams were seen.

Question 13

On the whole this question was not well answered. Examiners were able to give some credit to those students who clearly conveyed that they understood which angle was required in this question – this was often through using a clear sketch diagram with the appropriate angle marked. Surprisingly, many of the students who correctly identified the angle made an arithmetic mistake in its calculation. A common incorrect approach was to subtract 65° from 360°.

Question 14

Well done by many students but not by the majority of students, this standard routine also attracted frequent errors. For example many students had one incorrect midpoint, used values at the end of each interval instead of the midpoint or made one error somewhere else. There were also many students who added up the midpoints and divided by 5 and a surprising number of students who found the sum of the products of class interval multiplied by frequency.

Question 15

Part (a) was often answered correctly with answers in one of the forms 0.000064, $\frac{1}{15625}$ or 6.4×10-5 seen most often. The most common incorrect responses included $\frac{1}{25}$, 0.04, 15625,
−15625 and 0.025.
Part (b) was answered less successfully. Many students were able to calculate 3503 as 42875000 but far fewer students were able to write their answer in standard form. A significant number of students rounded their answers, sometimes without giving the full answer before attempting to do this and so lost one of the marks available to them. Students are advised always to write down full versions of calculations before rounding.

Question 16

302.8 (0.7 × 140 + 1.6 × 128) was the most common answer seen, revealing that most students did not have a good understanding of the relationship between, mass, volume and density. Many students were able to pick up some credit for working out the total mass of liquid C, but could not pick up any marks for further progress in this question. A small number of students produced pleasingly elegant and concise fully correct solutions.

Question 17

This question was not answered well. Only the most able students produced fully correct answers. However, a much greater number of students gained one or two marks for finding the gradient of line N or for using the relationship connecting the gradients of perpendicular lines. Many students would have benefitted from making a common sense check on the gradient of their perpendicular line – from the diagram it should clearly be negative but "$\frac{1}{3}$" was quite often used. Some stronger students missed out the
"y =" in their final equation For weaker students, confusion between the terms "parallel" and "perpendicular" was quite common.

Question 18

Most students could name the type of diagram which could be drawn to represent the given information. "Box plot" and "box and whisker diagram" were both acceptable answers as was "cumulative frequency diagram" though this response was not often seen.
It was rare to see a fully detailed comparison of the two distributions in part (b) of the question. In order to gain full marks, students were expected to compare the medians together with a measure of spread, either the range or interquartile range. Students are advised to show any calculations they do and to put their comparisons in context. It was quite rare to see a well expressed statement which showed that the student understood the significance of the median as a measure of location and the range or interquartile range as a measure of spread.

Question 19

This question was a good discriminator. There were a number of possible routes to finding the length of CE and various approaches were seen by examiners. The most able students produced a concise and accurate solution sometimes involving surds rather than giving interim values as decimals. A large proportion of students were able to find either the width of the rectangle ADCB or the length of its diagonal. Both of these lengths are helpful in providing a fully correct method so were given due credit. Many students also realised that they needed to find the size of a further angle in order to make further progress and this was also given credit. Far fewer students were able to give a fully correct solution. A small proportion of students wrote down 16 cm as their answer without any interim working. They were not awarded the marks. Students are advised that they should always show their working. This question included "You must show all your working" in the demand and students who showed no working were not awarded any marks as it was felt that "16" might have been the result of a guess rather than a correct method. Any working seen in response to this question often lacked clarity or a logical order and this is something which centres may like to make students aware of.

Question 20

There were relatively few good answers to this question. The most frequently seen incorrect approach was to substitute values for n and show that the result was an even number. The phrase "for all positive integer values of n" indicated the need for a more generalised method, which could use the expansion and simplification of the given expression and an explanation that any number of the form "12n" must be even. This was the most obvious and most straightforward approach. Many students used this approach but their attempts were all too often spoiled by either the inability to expand (n – 3)2 correctly or more frequently the omission of a bracket between their expansion of (n + 3)2 and their expansion of (n – 3)2 with subsequent incorrect algebra. It was possible to put together a logical written argument involving the consideration of building up the expression in the case when n is even, then separately when n is odd and a few students did this successfully.

Question 21

This question was not well done. The great majority of students attempted the question but responses were usually restricted to “180 × 3 = 540” though a significant number of students used a volume scale factor of 33 (= 27) and gave their answer as 4860, failing to take into account that the depth of soil in each flower bed was the same. Some of the best solutions used an algebraic approach where expressions such as 3x × 3y × z lead students to identify the correct scale factor of 9.

Question 22

A good proportion of students showed an understanding of “reverse percentages” and were able to use 88% or 0.88 to answer the question successfully. Some students identified the need to use 88% or 0.88 but not how to use it correctly. They usually gained some credit for this. There were, as expected, a large number of students who merely increased 1.1 kg by 12% so 1.232 kg was a commonly seen incorrect answer.

Question 23

The two approaches of using “area of a triangle = $\frac{1}{2}$absinC” to find the area of half the parallelogram and finding the “vertical height” of the parallelogram were both commonly seen. Students who used the former were often successful, other students less so. Some students attempted to split the shape into a rectangle and two triangles but this approach was not often completed successfully. A small proportion of students split the parallelogram by joining B to D then tried to use the 20° angle formed in the formula $\frac{1}{2}$absinC but again this was not successful. Weak students either did not attempt the question or simply calculated
“7 × 5”.

Question 24

Questions involving bounds continue to prove very challenging for all but the most able students. There were a good number of succinct and correct answers but most students did not start well as they could not identify correct bounds for either the distance or the time. Often 235 and 200 were used to find the speed. This was given no credit. Students who used 230 miles and 205 minutes were given some credit for recognising that bounds were needed and that “lower bound of distance” ÷ “upper bound of time” was the correct calculation to be used. Many students simply divided a lower bound by a lower bound. Some students identified the correct calculation for speed but failed to convert units of time from minutes to hours. They scored 2 out of the 4 marks available. This was a question where clear and correct working was needed in order for examiners to award marks where they were deserved.

Question 25

Over a quarter of all students gained full marks for their answers to this question. Where the answers were not correct, common errors included using an incorrect formula

(for example $x = -b \pm \frac{\sqrt{b^2-4ac}}{2a}$) or making the substitution incorrectly (for example substituting b = 3 instead of b = 4 or c = 12 instead of c = −12). When a correct substitution was made, some students did not evaluate the discriminant correctly even though calculators were allowed. Most students heeded the advice to give solutions correct to 2 decimal places. A small minority of students missed the clue given by this advice and attempted to factorise the quadratic expression. Other students tried a trial and improvement approach which was almost always unsuccessful.

Question 26

Many students were awarded at least one mark for getting at least one frequency correct in part (a) of this question. Considerably fewer students got all of the frequencies correct. A commonly seen set of frequencies was "9, 16, 10, 8". For their answers to part (b) of the question, many students correctly calculated the number of people in the sample who had a salary greater than £40000 but not all of them expressed this as a fraction or percentage of the total number of people in the sample. For part (c), when trying to estimate the median salary, there was evidence that many students just calculated $\frac{0+50000}{2}$. Other students got as far as identifying that the median would be the $\frac{n+1}{2}$th salary but could not make any further progress in estimating this salary.

Question 27

This question relied not only on students understanding of vectors but also on an ability to work accurately with vector algebra. Many students did not attempt the question. Of those students that did attempt the question, a large proportion wrote "$\overrightarrow{AB} = -2\mathbf{a} + \mathbf{b} + 3\boldsymbol{a} + 2\boldsymbol{b}$" as their first stage missing out the necessary bracket round "$2\mathbf{a} + \mathbf{b}$". Examiners were able to award some marks if students made no further errors, but often the working presented did not make it easy for examiners to follow what the student intended. To reach a correct expression for $\overrightarrow{OC}$, students also needed to express $\overrightarrow{AC}$ as $\frac{7}{2}\overrightarrow{AB}$ or $\overrightarrow{BC}$ as $\frac{5}{2}\overrightarrow{AB}$. This was not well understood with students often using the ratio 2:5 incorrectly and so they gained a first mark for a correct expression for $\overrightarrow{AB}$ but often failed to score any further marks. There were however some well presented, concise, clear and correct solutions from the best students.

Question 28

There were some excellent solutions to this question showing an accurately constructed circle followed by the plotting of a suitable line and accurate reading off of the solutions of the simultaneous equations. Students who did not see the connection between parts (a) an (b) often began a solution using substitution but they rarely completed the question successfully. They struggled to manipulate the equations correctly. A small but significant group of students found the values of x but lost a mark because they did not find the corresponding values of y.

Summary

Based on their performance on this paper, students are offered the following advice:

- Maintain full accuracy until the final answer; do not round intermediate calculations.
- in questions comparing distributions, always try to put your answers in context and support any comments with numerical measures.
- use your calculator to check basic arithmetic - do the calculation twice to check its accuracy and so prevent losing marks unnecessarily.
- make sure you learn formulae thoroughly and know which one to use in a given situation

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