Principal Examiner Feedback

Summer 2013

GCSE Mathematics (2MB01)
Paper 5MB3H_01 (Calculator)

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GCSE Mathematics 2MB01
Principal Examiner Feedback – Higher Paper Unit 3

Introduction

This was a paper which allowed good candidates the opportunity to demonstrate their skills and it also allowed weaker candidates to achieve a reasonable level of success. Overall, the paper was done very well by the majority of candidates.

It was pleasing that many candidates showed sufficient working out to gain method marks when the final answer was incorrect. Working was often well set out.

Although this was a calculator paper, arithmetic errors sometimes spoilt otherwise correct work. When candidates carry out the more straightforward calculations mentally they should use a calculator to check their work.

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

Use a calculator to check calculations that are carried out manually.

Join points freehand with a smooth curve when drawing the graph of a cubic function, not with straight line segments.

Practise carrying out standard form calculations using a calculator.

Do not make assumptions about the size of an angle when a diagram is not accuralely drawn.

Write a vector equation, e.g. *ON* = *OA* + *AN*, as a first step when trying to find a vector.

Report on individual questions

Question 1

This appeared to be a very good first question as nearly all candidates achieved the correct answer and it was pleasing to see that most displayed a good method. The majority divided 7.80 by 6 to find the cost of one cup and multiplied the result by 10. There was also some successful use of partitioning – e.g. dividing by 3 to get the price of 2 cups and then adding twice this value to £7.80. Some candidates failed to calculate $7.\frac{8}{6}$ correctly, choosing to do this without a calculator, and some worked out 1.30 × 10 as 10.30. Incorrect answers were often the result of candidates working out the cost of a wrong number of cups.

Question 2
Many fully correct enlargements were seen and those candidates who didn't get full marks often gained two marks for an enlargement with scale factor 3 but in the wrong position. A substantial number of candidates did not seem to understand the significance of the centre of enlargement. A common wrong answer was to use the centre of enlargement as one of the vertices in the enlarged shape. Candidates using the ray method rather than 'counting squares' sometimes misplaced the vertices through inaccurate line drawing. It was disappointing to see some candidates lose marks through carelessness and be up to half a square out with some of their vertices.

Question 3
Many candidates gained full marks for this question, often with no intermediate working. Those who didn't give the correct answer usually scored one mark for evaluating the numerator as 6.4 or the denominator as 4.62. Candidates who failed to show any working and rounded or truncated their answer did not gain any marks. The standard mistake of entering the numbers into the calculator without using brackets, in this case for the denominator, was seen less frequently than in the past.

Question 4
For this QWC question a full method and justification was required. Apart from some who used the area formula, most candidates knew what to do and marks were often lost due to a lack of communication rather than a lack of understanding. The main issues were not showing full working for finding the circumference of the circle and not fully justifying why 4 rolls of plastic strip were required. It was quite common for candidates to jump from a circumference of 7.5 to an answer of 4 rolls.

Question 5
In part (a), most candidates gave the correct answer and those who didn't usually gained one mark for substituting –2 into $3e + 5$. The most common errors were to get as far as $-6 + 5$ but then give the answer as 1, to work out $3 - 2$ instead of $3 \times (-2)$, and to get 6 instead of –6. These were all infrequent.

In part (b) was another well answered question. Most candidates were able to gain the first mark by subtracting $2y$ or 3 from both sides and the majority went on to solve the equation correctly. Some had the correct idea of subtracting either $2y$ or 3 from both sides but then failed to carry out the operations correctly. Both $2y = 17$ and $6y = 11$ were quite common. Some candidates added the $2y$ and 3 instead of taking them away to get $6y = 17$. A few candidates, having correctly reached $2y = 11$, then divided 2 by 11 instead of dividing 11 by 2.

The majority of candidates in part (c) answered this question correctly and those that didn't usually gained the first method mark by expanding the brackets to get $3x - 15$. Most candidates expanded the brackets as a first step with hardly any choosing to divide by 3 first. Two common errors were subtracting 15 from 21 rather than adding it to 21 and failing to multiply 5 by 3 when expanding the brackets.

In part (d), it was pleasing to see that nearly all candidates understood what is meant by an integer with the majority scoring full marks. Of those that did not, more were seen to include either –3 or 4 rather than to include both these values which appeared somewhat illogical. Others neglected to include zero.

Question 6
Many candidates successfully drew both bearings and correctly identified the position of T as the point of intersection. When only one of the bearings was drawn correctly this was more often the bearing of 060^{o} rather than the bearing of 285^{o}. The main problems were incorrect use of a protractor and failing to realise that T would lie where the two lines crossed. Some candidates drew both bearings correctly but did not extend the lines far enough to give an intersection.

Question 7
Most candidates made very good attempts at this question with many achieving full marks. The first two method marks were often gained by calculating 20% of 3500 and adding this to 3500 or by multiplying 3500 by 1.2. Some candidates did not use their calculator which often resulted in inefficient methods and errors in calculations. A large number didn't show any working when finding 20% of 3500. Some stated that 20% of £3500 was £70. Not all candidates realised that they had to find 20% and add on the VAT. Some seemed to think that the VAT was already included. A few, having found 20% of 3500, subtracted the VAT from the cost of the holiday. The vast majority of candidates, however, subtracted 900 and divided by 6 for the final two method marks. Mistakes were sometimes made in basic calculations. When a calculator is available it is surprising to see answers that involve steps such as 3500 – 900 = 3600.

Question 8
The majority of candidates scored full marks. Some formed an algebraic equation but others just subtracted 15 from the total of 63 and then divided by 3. The most common error was to divide by 2 instead of by 3. Some candidates showed fully correct working but then identified Ellie's total, 32, as the answer, so losing the final mark. Some candidates experimented with combinations of numbers which often gave the correct result.

Question 9
Candidates attempted this question in a variety of ways although most found the cost per gram or the number of grams per 1p (or £1). A significant number of candidates misinterpreted their own calculations, giving 'medium' or 'large' as the best value when the evidence clearly indicated 'small'. Those who calculated the number of grams per 1p, for example, often concluded incorrectly that the medium bottle was best because they thought that the smallest number represented the best value. The other common error was for candidates to use 88, 1.95 and 3.99 as the monetary units in their calculations (i.e. one in pence and two in pounds) which meant that they only had comparative figures for two bottles. Numerous other approaches were seen. Often candidates spotted they could use 1710g as a comparable amount for the small and medium bottles, but

then did not know how to make a comparison with the large bottle containing 1500g. However, many were successful in their alternative approaches – fully correct solutions were seen for comparing 1500g, 570g, 342g, 1710g, 3000g and 200g.

Question 10

The standard Pythagoras question in part (a) was well answered by most candidates. Errors were sometimes made in the calculations and some candidates who tried to apply Pythagoras could not do so correctly.

Part (b) was answered less well. Most of the candidates who correctly identified cos $x = \frac{7}{18}$ went on to give the correct answer but some lost the final accuracy mark by rounding prematurely. Some candidates worked out the correct answer by finding the length of *LM* using Pythagoras and then using either the sine rule or cosine rule to find the angle marked *x*, but many who started this method were unsuccessful. A small number used sine instead of cosine to obtain an incorrect answer of 22.9 degrees.

Question 11

As usual this was a very popular question. It was generally answered very well with most candidates gaining 3 or 4 marks. Working was nearly always well set out and there was often a thorough list of trials with results given to several decimal places. For those that scored 3 marks the most common error was the omission of an appropriate 2 dp trial, though, having carried out trials at 4.8 and 4.9, more candidates than in the past carried out a trial at the midpoint, 4.85, for the third mark. However, some who did do this trial then either gave the solution to 2 decimal places instead of the 1 decimal place requested or chose 4.9 as the answer instead of 4.8. A significant minority, however, carried out trials at 4.8 and 4.9 and then chose the answer by comparing each result to 84. A small number of candidates appeared to be taking a correct approach but failed to write down the results of any of their trials and gained no marks.

Question 12

The majority of candidates gained full marks for this question, finding the missing values and drawing a correct graph. Very few candidates failed to calculate at least one correct value. The points were usually accurately plotted although the point (2, 11) was sometimes plotted at (2, 13). Some candidates only gained one mark in part (b) as they joined the points with straight lines rather than drawing the curve freehand. Some did not join the points at all and some drew a line of best fit for the points. Curves were sometimes inaccurate, not passing through the points exactly or drawn with too thick a line or with several lines. Some candidates seemed to have pre-conceived ideas as to what the graph should look like and drew a parabola that contradicted their calculations.

Question 13

Many candidates appeared familiar with simultaneous equations and were able to achieve a pair of equations which they could add or subtract to eliminate one of the variables. Some used an incorrect operation to eliminate one variable or made errors in adding or subtracting negative numbers, the most common error being $10y - -12y = -2y$. Having got to $22y = -11$ or $-22y = 11$ some candidates then worked out y as –2. Candidates usually went on to substitute their value for y into an equation to find x. Those who tried to eliminate y instead of x were usually more successful as they had to add the equations rather than subtract and so were those who substituted $x = 6 + 4y$ into the first equation.

Question 14

Most candidates attempted to draw triangles B and C with a majority placing them correctly on the grid. Errors in the correct positioning of triangle B or triangle C were sometimes due to candidates not being able to identify the line $x = 1$ and some confused the x and y axes. In some cases it was difficult to determine how the candidate had come up with their images. The majority of the candidates who drew triangles B and C in the correct positions were able to give a correct description of the transformation although a common mistake was to give the centre of rotation as (0, 1) instead of (1, 0). A small number of candidates lost a mark because their description of the rotation did not include an angle or because they wrote the centre of rotation as a vector. Fewer candidates than in the past gave more than one transformation.

Question 15

Many candidates showed a good understanding of compound interest and gained full marks for this question. Some used a multiplier and some worked out the interest and added it on for each year. The use of multipliers usually led to concise and well presented answers. A few candidates used incorrect multipliers such as 1.32, 1.38 and 1.5. When candidates worked out the compound interest correctly for only one bank it tended to be Northway Bank. A common error for Portland Bank was to work out 5% of 6000 and 3.2% of 6000 and add the two together, instead of finding 3.2% of 6300 for the second year. Some candidates did not know the difference between simple interest and compound interest and therefore only gained one mark for finding 3.8% of 6000 or 5% of 6000. Errors were sometimes the result of using incorrect (or inefficient) methods for calculating 3.8% and 3.2%. It was pleasing that almost all candidates remembered to make a decision about the best bank, even if they had used an incorrect method.

Question 16

Many correct answers were seen, usually without any intermediate working. Those who didn't get the correct answer often gained one mark for showing the digits 252 (2.52×10^3 was a common wrong answer) or for working out the numerator as 4 032 000 000. Many candidates, though, made hard work of this question which could have been done easily with the correct use of a calculator. Many converted the values to ordinary numbers to do the calculation, often resulting in an answer not given in standard form or causing them to lose their way. Errors were frequently made in the evaluation of the numerator with many candidates failing to understand the place value implications of the different powers of 10.

Question 17

This inverse proportion question differentiated between candidates. Some candidates followed the complete method expected for full marks but it was not done well by the majority of candidates with some not even attempting it. Of those who established the usual routine with a proportion sign and then the use of the constant *k*, many used direct proportion or inverse (rather than inverse square) proportion and gained no marks. When candidates did write down a correct algebraic statement the rearrangement of the equation to make *k* the subject sometimes went wrong. Many of the candidates who correctly found the value of *k* then went on to achieve full marks. Some, though, got an incorrect final answer through careless substitution. A common incorrect answer was 10, obtained from $\frac{160}{8}$ = 20 followed by 0.5 × 20 = 10.

Question 18

Many candidates tried to use the quadratic equation formula and often they obtained full marks. Some did not substitute correctly. Common errors were omitting the +/ – and the division line being too short. Some candidates started with 6 rather than –6 and some used c = 2 instead of *c* = –2. Errors were also made after a correct substitution as many candidates could not evaluate the discriminant as 76. By using a calculator candidates might have avoided this problem. A number of candidates missed the clue about giving solutions correct to 2 decimal places and tried to solve the equation by factorising. A significant minority tried to use algebraic methods of operations to both sides. A small minority started to use a trial and improvement method which at the very best would only lead them towards one solution.

Question 19

This trigonometry question proved beyond many. The lack of structure was significant although many candidates correctly identified that they needed to use $\frac{1}{2}ab\sin C$. Not all of those who quoted it could manage to use it and marks were lost by not substituting all the known figures before using the calculator or by not putting "= 50" to complete an equation. Rearrangement went wrong for others. Of those who correctly used $\frac{1}{2}ab\sin C$ many thought the value they had found, 8.5..., was the length of *AC* and gave it as their final answer. Those who went on to use 8.5... in the cosine rule often got full marks. However, the correct order of evaluation was not always followed. An alternative method used by a small number of candidates was to draw a perpendicular from *A* to the line *BC* and use $\frac{1}{2}\times\text{base}\times\text{height}$ and trigonometry. This approach was sometimes successful. A very common error was to assume that triangle *ABC* was right angled. Some candidates used right angled trigonometry, others used the sine rule with angle *A* as 90 degrees.

Question 20

This question was attempted by most candidates and many were successful. The most common error was to give the vector for *BA* instead of for *AB*.

In Part (b), few candidates started by writing a simple vector equation such as ON = OA + AN or ON = OB + BN. The biggest difficulty for those who made a serious attempt was getting the direction signs of the vectors correct. Candidates who worked with OA + AN were generally the more successful. Those who chose OB + BN often went on to use NB instead of BN, writing 4b + ¼(4b – 2a) instead of 4b + ¼(2a – 4b). Some candidates lost the final mark as they were unable to simplify their vector correctly. Other common errors were failing to use brackets appropriately, e.g. writing ¾ 4b – 2a instead of ¾(4b – 2a) and misinterpreting the ratio and dividing AB into thirds rather than into quarters.

Question 21

Part (a) was generally answered quite well by those who attempted it.

Part (b) was not answered very well at all. Some candidates ignored their answer from part (a) and used something completely different. A common error was for candidates to use 9.75, the lower bound of *g*, as the denominator. Some did not work with bounds and substituted 35.6 and 9.8 into the formula. Those who chose the correct values almost always got a correct final answer with only a few forgetting to square root.

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