Principal Examiner Feedback

Summer 2013

GCSE Mathematics Linked Pair Pilot
Methods in Mathematics (2MM01)

Higher (Calculator) Paper 2H

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GCSE Mathematics 5MM2H
Principal Examiner Feedback – Higher Paper Unit 2

Introduction

It was encouraging to note that most candidates showed some working for the questions that involved multiple calculations.

Many candidates lost marks for not writing complete reasons on question 5. Centres are advised to look at the list of geometric reasons sent to centres to ensure candidates know what wording to use for geometric reasons. The underlined words on the mark scheme for this question show the minimum requirements.

There were 2 QWC (quality of written communication) questions on this paper that required algebraic proof. Candidates should be made aware that an arithmetic approach on these questions is not acceptable.

Candidates should be made aware that certain formulae not included on the formulae sheet need to be learnt. In question 10 the formula for the volume of a cylinder was given but the area of the curved surface was not. Many candidates tried to use πrl to find the curved surface as this was on the formulae sheet. However this is given as the curved surface area of a cone not a cylinder.

Report on individual questions

Question 1

Most candidates attempted to find the surface area of the cuboid but many found the area of the side faces correctly but then went on to say that the other 4 faces were the same. As a result it was not uncommon to see an answer of 52 from $2(2\times3) + 4(5\times2)$ or an answer of 72 from $2(2\times3) + 4(5\times3)$ which only scored 1 mark. Those that found the volume, writing $2 \times 3 \times 5 = 30$ scored no marks. This was a common fully incorrect response.

Question 2

The vast majority of candidates found no problem with working out the correct cost of 12 cakes. Most candidates first worked out the cost of one cake and then multiplied this by 12 whilst others multiplied £11.60 directly by 1.5. A common error was to divide 6 by 7.80 which scored 0 marks.

Question 3

Part (a) proved no problem to nearly all candidates and a variety of methods were used to get 7.5.

Part (b) was also well answered although there were many that just wrote an answer of 40 (scoring 1 mark) or added 40 on to 320 rather than subtract it (scoring 0 marks). There were some candidates who felt they just had to subtract $\frac{1}{8}$ from 320 giving 319.875, as they thought they had to decrease £320 by £0.125.

Question 4
In part (a) most candidates reached an answer of 7:3 or 14:3 was seen. However candidates need to be reminded that if asked for a ratio it is not advisable to work in fractions as they could lose out on method marks if the answer is incorrect.

There were a variety of incorrect methods seen in part (b) as candidates struggled to work out how many red counters were taken from the bag. Many of the successful answers used the ratio 12:3 which then allowed them to easily see that 2 red counters were taken from the bag. A common incorrect response was to give an answer of 3 often obtained from red: blue = 7 : 3 – 4 : 1 = 3 : 2 leading to an answer of 3 red.

Question 5
Most candidates showed their working and many found x to be 40°. Candidates should be advised to write any of their calculated angles on the diagram as this could earn them method marks particularly if they struggle to write angles using the correct letter notation. However many candidates did not score the final C mark as they did not write the required underlined words on the scheme.

Many gave as reasons 'parallel lines' without talking about alternate or corresponding angles. Others wrote 'a triangle adds up to 180°'or 'there are 180° in a triangle' missing out the word 'angles' which was necessary for the reason to be acceptable.

The most common error which scored 0 marks was to assume angle ACB = angle DCQ = 52°. Candidates should be made aware that they should list each of the geometric rules used to get their answer and not just one rule.

Question 6
Part (a) was well-answered by most candidates.

There was a variety of responses to part (b) many of which scored 1 mark. Most candidates recognised the need to draw a circle on −1 and 3 but many were unsure as to which circles should be shaded or not. Others just drew a line between the two numbers. Others thought that as the inequality ended with < 3 their line or circle should be at 2 or end just short of 3 rather than at 3.

In part (c) it is best to advise candidates to work with the inequality sign all the way through. Many used the equal symbol (=) all the way through ending up not accessing the accuracy mark.

Question 7
Most candidates scored a mark for showing how to get to $4x + 6$ but many lost the final mark in part (a) by not showing this was equal to D.

In part (b) there were many correct answers. Most of the candidates who tried to do the rearrangement in one step tended to get it wrong. Others just divided D by 4 as a first step losing all the marks. Candidates who used flow diagrams to rearrange tended to be less successful in the rearrangement.

Question 8
Most of the incorrect answers in part (a) arose from candidates working out the two terms separately and then missing out a sign to get the final answer.

It was not uncommon to see $3 \times 5 = 15$, $2 \times -4 = -8$, $15 - 8 = 7$. Those candidates that put this all in one line and wrote $3 \times 5 - 2 \times -4$ tended to have more chance of success.

There were the usual misconceptions in part (b) with $(-2)^3 = -6$ a common incorrect answer.

In part (c) many candidates ignored the rules of BIDMAS and multiplied 9.8 by 6 first before squaring. 1728.72 was a common incorrect response.

Question 9
Both parts were well answered by most candidates with nearly all candidates using some sort of inequality sign. Common incorrect responses were $12 > x$ and $y < 20$.

Question 10
Even though the formula for the volume of the cylinder was given there still were many candidates who used a different formula. However, this was generally well answered by most candidates with many correct answers seen in the range 904 to 905.2 in part (a).

Part (b) was less well answered as candidates struggled to make sense of what was required. Many included the area of one or two circles, not fully understanding that only the curved surface area was needed.

Many others could not recall the formula for the curved surface area and used πrl instead ending up with $\pi \times 6 \times 8$ (thinking l was 8). Many of those who did get an answer between 301 and 302 lost the final mark for not putting any units with their answer. Those who continued beyond the correct answer to add the areas of the two end circles were only penalised one mark.

Question 11
The most straight-forward way of working out the area of the triangle was to first find the base using Pythagoras. Many did go down this route although there were a significant number of candidates who wrote the base was $\sqrt{17^2 + 8^2}$ which meant they could only score 1 mark for using their answer correctly to find the area.

The most common error was to merely write that the area = $\frac{1}{2}(17 \times 8)$ which scored no marks. Those who used trigonometry tended to be less successful.

Question 12
Many candidates did not realise that the method of reverse percentages was needed when they saw the trigger words 'original number' and simply found 15% of 323 which they then subtracted from 323 to get an answer of 274.55. Others stopped at 15% of 323. Those that did write the correct answer of 380 used a variety of methods to get there. Some candidates tried using the multiplier 1.15 and divided the amount by it whilst others who used 0.85 multiplied this by 323.

Question 13
Many candidates, seeing the shading, did not read the question, just assuming that the area of the shaded region was required. This meant they lost all 4 marks.

Many who did recognise that they needed to calculate the circumference of the quarter circle sometimes used $D = 5$ rather than $D = 10$. These candidates could score the special case 1 mark if they then went on to divide by 4 and add 10. Others either forgot to add 10 at the end or forgot to divide their 10π by 4. Overall, not many candidates scored all 4 marks but many did access some of the method marks.

Question 14
There were many correct answers to (a). It was fortunate they were not penalised for incorrect rounding after the correct answer was seen as it was not uncommon to see 0.89302... rounded to 0.903 as well as other incorrectly rounded answers.

Candidates should be encouraged not to round any numbers they work out before they get to the final answer. Many candidates stopped at 0.7975 but scored no marks when 0.7975 was not seen ... just 0.798.

Part (b) had mixed success as candidates were unsure which button on their calculator to use to evaluate the given term.

Question 15
It was surprising how many candidates did not use tan x to work out the size of angle x preferring to first use Pythagoras' theorem to find the base of the triangle and then go on to use the sine rule or another trigonometric ratio. These candidates often did not show a complete correct method which meant they could not score the mark.

A significant number of candidates used $\tan x = \frac{7.5}{14}$. Overall there were quite a few correct answers but many candidates had no idea what to do.

Question 16
Many candidates were successful in completing the table although (−2, 6) was a very common incorrect response. Candidates need to be careful when squaring negative numbers using their calculators. On the whole, most candidates scored at least 1 mark in (b).

Candidates should be advised that if their point is not able to be plotted on the grid (eg $x = -2$, $y = -6$) then they must have made an error in calculation. In part (c) it was surprising to note how few candidates opted for the easiest method of drawing the line $y = 3$ on the graph and reading the values of x from this.

Candidates preferred to either factorise (often unsuccessfully) or use the quadratic formula (with even less success as they wrote −1 instead of +1 for $-b$). Those that used a trial and improvement method only wrote one value for x and so could not score.

It would be useful for candidates to know the shape of a quadratic graph so that when the graph does not resemble a U for a positive quadratic they instantly know that they have made a mistake.

Question 17
It was pleasing to see many correct solutions to the simultaneous equations. However many did not score because they either had no idea how to go about solving the equations or they used a trial and improvement method and were not able to find the correct values of both x and y.

Many found it very difficult to cope with the negative signs when subtracting but were still able to be awarded two method marks if they had only made this error when subtracting $4y$ from $-9y$ when trying to eliminate x.

Those candidates who chose the wrong method of adding or subtracting their two equations lost all marks as this resulted in more than one error. Candidates who chose to eliminate y by adding the equations were generally more successful.

Question 18
This was a straightforward direct proportion question and many candidates got the correct answer. Many incorrect responses arose from writing $6 = 27d$ or $11.25 \div 6$.

Question 19
The vast majority of candidates were able to score at least 1 mark on this question, even if it was for finding 3.5% of 10 000. Less able candidates used 0.35 and 1.35 throughout which meant they could not score.

Part (a) was often done correctly but these candidates did not always get part (b) correct. Many did not understand that a formula required the use of letters and numbers and so lost marks for writing their formula using words. Others did use letters but they needed to define letters that were not already in the question.

Many had a good understanding of compound interest, answering parts (a) and (c) correctly, but were unable to write this as a formula. Those that were successful in part (c) tended to substitute values into their formula.

Question 20
Algebraic proof of recurring decimals was not well done by most candidates. Most had little idea of how to find two recurring decimals the difference of which was a rational number. Some candidates did score a mark for writing 0.0151515... but then gave up. Others merely worked out 1 ÷ 66 on their calculators.

Those that did write a correct proof tended to use $100x - x$ or $1000x - 10x$ although other differences such as $100\,000x - 1000x$ was also seen.

Many candidates who found $\frac{1.5}{99}$ did not show how it could be simplified to $\frac{1}{66}$ and so lost the C mark

Question 21
This question was poorly answered as candidates failed to realise that not only was a linear scale factor required (there was some success with this) but that a volume scale factor was also required. By far the most common incorrect response was 100 ÷ 16 × 1.2 = 7.5 which did not score the mark.

16 ÷ 100 × 1.2 = 0.192 was also seen many times. Those candidates that did find the linear scale factor of 2.5 often went on to write 2.5 × 1.2 = 3, losing the last 3 marks.

Some candidates realised that scale factors needed to be changed for dimensions. They often squared the area scale factor rather than square root the scale factor thereby not accessing any of the marks.

Question 22
Many candidates scored at least 1 mark on this question. Those that did generally scored a mark for a gradient of 2 (and less often a gradient of −2) or recognising that $c = 4$ in part (a).

Those that scored a mark for the gradient in part (a) often went on to score at least 1 mark in (b) for using their gradient but then did not understand that the product of the gradients of line L and the line perpendicular to it was −1 in part (c).

Question 23
It was disappointing to see how many candidates provided a proof using examples of numbers that worked. No marks could be scored using this method. Others thought that an odd numbers could be expressed by $x + 1$ and $x + 3$.

Few candidates realised that the two odd numbers needed to use different letters with many candidates finding the product of $(2x + 1)$ and $(2x + 3)$ or $(2x - 1)$ and $(2x + 1)$ rather than $(2x + 1)$ and $(2y + 1)$ or similar. However, the candidates who wrote the product of $(2x + 1)$ and $(2x + 3)$ were able to access the final C mark. Others did not understand the word 'product' and merely added their two terms.

Question 24
Working was extremely poorly shown in this final multi-step question. Some candidates were able to score a mark for $25 = \frac{1}{2} ab \sin 100$ but many just wrote $25 = \frac{1}{2} ab \sin C$ which did not score any marks. Rearranging $25 = \frac{1}{2} x^2 \sin 100$ proved a difficult task with many candidates reaching $x^2 = 50.77$ and then finding x by halving 50.77 rather than finding the square root.

Common errors included $\frac{1}{2} \times AC \times BC \times \sin 40$ as well as $25 \times 2 = 50$ so $AB = \sqrt{50}$ and $AC \times BC = 50.77$ so $AC = 50.77 \div 2$.

The few that managed to work out that AC and BC were each 7.125 cm then struggled to find a complete method to work out AB.

Grade Boundaries

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