Principal Examiner Feedback

Summer 2013

GCSE Mathematics Linked Pair Pilot
Application of Mathematics (2AM01)

Higher Paper 2H

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GCSE Applications in Mathematics 2AM01
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 showing units on QWC questions. For example on question 2, many showed calculations with answers of 562.5, 300 and 687.5 but as they did not put grams or g next to each of these answers they lost the communication mark.

Candidates frequently did not read the first line of the question. They then ended up not answering the question asked which resulted in a loss of marks. For example, in question 4b candidates were told in the first sentence that the two sides and the two ends were to be painted yet a significant number of candidates only calculated the cost of the paint for one side and one end or for 6 sides.

Many candidates knew the formulae πr^2 and $2\pi r$ but did not know which of these expressions represented area and which represented circumference. These two formulae are not on the formulae sheet and need to be learnt.

It would be helpful to candidates to remind them to show sufficient accuracy in working and to carry that through to final answers to enable them to access all the marks.

Report on individual questions

Question 1
This proved to be a good starter question most candidates scoring all 4 marks. The most common error in part (b) was to only draw the horizontal line from (2 pm, 2.5) to (2 30 pm, 2.5). A few candidates drew a line from (2 pm, 2.5) with a positive gradient and many of these candidates were able to score the mark in (c) for a correct follow through for their total distance.

Question 2
Most candidates worked out 50 cookies were required. However some candidates looked at the amount of ingredients needed for 40 people and once they had established that there was not enough butter for 40 people stopped at this. However the question did ask them to state if there was enough of each ingredient and therefore this method fell far short of answering this question.

Similarly those candidates who did work out that for 50 cookies 562.5g of butter was needed as well as 300g of caster sugar and 687.5g of flour lost the final mark as they only communicated that there was not enough butter, failing to add that there was enough caster sugar and flour for 50 cookies. Not as many candidates worked out how many cookies were able to be made from Liz's ingredients. Those that did go down this route tended to do well although these candidates also often lost the final mark for not answering the question properly.

Another common error was to fail to state the units of each amount required thus preventing candidates scoring the final mark.

Question 3
Most candidates recognised that Chloe's results gave the best estimate and these candidates generally pointed out that a larger sample was more reliable. Some candidates confused their mathematical terms and talked about this providing a larger range which was not acceptable.

Question 4
Part (a) was well drawn with most candidates scoring both available marks. Those that made errors tended to draw the roof 4 cm above the base. There were a few 3-D drawings but these were not common.

There were many errors in part (b) but nearly all candidates were able to score at least one mark for the correct method to find the area of the side. Finding the area of the end proved more problematic. The most successful method was to divide the end into a rectangle and a triangle. Unfortunately many did not halve 4 × 1 for the area of the triangle.

The most common error at this stage of the question was recognising that the area of **two** ends and **two** sides was needed which meant that could not score either of the two accuracy marks and the final method mark. Most candidates preferred to divide their area by 8 but there were others who found how much of an area each tin could cover. This was also an acceptable method.

The most common error in costing the paint after getting the correct area of 44 leading to 5.5 litres was to think there could not be any paint left over so they used 1 × 2.5 litres + 3 × 1 litre reaching a total cost of £58.95

Question 5
It was pleasing to note that most candidates were able to correctly work out the length of each piece of wood. The most common error was to divide 200 by 2, 3 and 5 getting answers of 100, 66.666 and 40 where no marks were awarded. Another surprising error was to note how many candidates wrote 2 + 3 + 5 = 8 and then go on with a perfectly correct method using 8 which still enabled them to score the two method marks if working was shown.

Question 6
Most candidates started by attempting to work out the volume of the sandpit and then multiplying their number of bags by £2.99. It was acceptable to use19.2 bags or 20 bags for this calculation. These candidates were generally successful in accessing all 5 marks. The second method on the scheme was used less frequently but was just as successful as the first method when used, though some candidates used "16.7" bags to find the volume of sand Jade could buy. This question tested QWC (quality of written communication) and it was pleasing to see that most candidates showed all their working in a logical manner. There were some candidates who rounded down to 19, which is not sensible in the given context.

Question 7
Part (a) was well attempted with many answers in the range 43 – 43.5 seen, generally with working shown. Only a few candidates stopped at 1890 without carrying on to find the square root of this value. Part (b) was started well with many candidate scoring a mark for 50 = $\sqrt{21d}$. However attempts at rearranging this to find *d* were less successful. Those that did realise they had to square 50 often wrote $50^2 = 21d^2$ or $50^2 = (21d)^2$ and so scored no more marks. Others found $\sqrt{50}$ which was equally unsuccessful.

Question 8
Most candidates had access to the correct equipment. However there were some freehand attampts at arcs. It was common to see the correct answer with the correct shading although there were some candidates who shaded the area where people could leave the boats losing out on the final mark. The most common error was to draw a vertical line parallel to *AB* rather than an arc centre *A*. It was pleasing to note that very few candidates lost marks through accuracy.

Question 9
Although most candidates had a good idea how to approach part (a) many added extra lengths or not enough lengths which meant they could not score more than 1 mark. Those that forgot to halve their $\pi \times 50$ were still able to pick up 2 marks if this was added on to the correct lengths. In part (b) most candidates scored a mark for finding the area of rectangle *ABCD* but then either used the incorrect formula for the area of a circle (or semicircle) or used a radius of 50 cm.

Question 10
Part (a) was extremely well answered with only a few errors. These were mostly for incorrectly writing the probability for failing the damage check. Common errors were 0.05 and 0.5.

In Part (b) most candidates multiplied at least 2 of the 3 required elements with a correct partial answer scoring at least 2 marks. However there were those candidates who really had little idea how to approach the problem with many dividing 9400 by 0.9 or 0.85 or both or even adding the probabilities. A significant number of candidates found the average of 0.9 and 0.85, multiplying this by 9400, which was again an incorrect method. Another common error was to find the average of 0.9 and 0.85 and use that to multiply by 2400.

Question 11
Candidates made valiant attempts at showing $x^3 + 5x^2 = 100$. Unfortunately many of these did not halve their product of x and $2x$ for the area of the triangular end. Others tried to start with $x^3 + 5x^2 = 100$ and then simplify which led to no marks being awarded in (a). In (b), most candidates used some form of trial and improvement to find the value of x with varying degrees of success. Those that did realise the answer lay somewhere between 3 and 4 generally went on to score at least 3 marks and mostly 4 marks. Many incorrectly substituted into $(5x)^2$ rather than into $5x^2$.

The most common error was to not do a trial for $3.4 < x \leq 3.45$ preferring to state that the value reached for $x = 3.4$ was closer to 100 than the value reached for $x = 3.5$ which is not a valid method. Others lost the final mark for writing their answer to more than 1 decimal place thinking this was more accurate rather than following the instructions of giving an answer correct to 1 decimal place.

Some candidates did a valid trial and improvement method with a final answer of 3.4. However, as they did not show the answers to their calculations the most they could score was the first method mark.

Question 12
Many candidates recognised they could use Pythagoras to find *CA* but then either found 16^2+16^2 (scoring no marks) or 16^2+12^2 which meant they could earn the first method mark. Those candidates that worked out 16^2-12^2 generally went on to score all 4 marks although some did stop at 10.58... forgetting then to double this answer. Others decided to embark on finding an angle using a trigonometric ratio. However these candidates generally did not go on to use a complete correct method to find *AC*. Candidates could be advised that when presented with a diagram with no angles mentioned other than 90° and only lengths given; it is easier to use Pythagoras rather than trigonometry to find unknown sides. Many candidates made the assumption that one of the angles was 45° and incorrectly based calculations upon this.

Question 13
Although it was a multi-step task to find *BC* this did not deter many candidates and it was good to see many candidates correctly calculate *AT* or *BT*. However only the minority then went on to find *BC* using a complete correct method. There were many ways to tackle this problem including the use of tan, sin, cos, sine rule and cosine rule and all methods were seen. Those who faltered at the end often forgot to subtract 95 from their calculated *AC* or thought triangle *TBC* was a right-angled triangle using sin, cos or tan for calculations. Others struggled with rearranging $\tan 50° = 95 \div AT$. Candidates need to be encouraged to annotate which side they are trying to find, as without this examiners would not be sure if their working was correct.

Question 14
Most candidates started with using a variable (generally x) and $4x$ and $x + 48$ were often seen which scored the first method mark. Candidates then either continued using algebra or attempted a trial and improvement method. Those who were able to write $x+4x>2(x+48)$ tended to reach $3x>96$ for 4 marks but then often failed to recognise that the least possible spaces in the car park was 33. Others used = signs all the way through which often meant they lost the final 2 marks. Candidates who used trial and improvement tended to just write down many trials without much improvement! If candidates are going to use this method they need to trial both 32 and 33 to score all the marks. Candidates are to be strongly advised to use algebraic methods and to use inequality signs when presented with trigger words such as 'least possible'.

Question 15
The most common error in part (a) was to provide an answer of 10.4 rather than recognise a subtraction sum was needed. Others misread 10.4 using 10.2 instead. If this was accompanied by correct markings on the graph and working shown it was possible to score the method mark.

It is useful to remind students that when presented with a graph of $A = ka^t$ it is good practice to find the initial value of A by putting $t = 0$ to evaluate k. Many tried to find k by substituting a pair of values into the equation such as $t = 4$ and $A = 10.4$ which did not lead to correct answers in (b)(i). Those candidates that did work out $k = 5$ tended to go on to estimate a as 1.2.

Part (c) proved too complex a task for most candidates. However some good attempts were seen by some candidates who scored 2 marks for $\sqrt[10]{0.5}$ or 0.933 seen but these candidates generally did not go on any further. Others did have the right idea but found $\sqrt[10]{10 \div 5}$ instead which did not score. Some tried trial and improvement, but did not use sufficient accuracy to gain marks.

Question 16
Many candidates had some idea of proportionality but some did not read the question thoroughly writing $d \propto h^2$ or writing $38 = k\sqrt{22}$ rather than $22 = k\sqrt{38}$. Some candidates, having calculated k, forgot to find the square root of 25 to obtain the final answer. There were, however, many good attempts seen with many candidates correctly working out the distance to the horizon when Amir was 25 m above sea level. The most common answers to part (b) were B and C.

Question 17
Many candidates did not realise that the question was to do with bounds and simply did 2460 ÷ 89. These candidates were able to pick up 1 mark for correctly converting from m/s to km/h. Working was poorly shown and it was often hard to decipher correct working in amongst the jumble of trials using some of the correct bounds together with conversions from m/s to km/h. Candidates should be advised to show their bounds clearly before any conversions or to clearly show their method for the conversion to score the method marks. This question tested quality of communication and it was evident that this quality was often very poor.

Question 18

It was evident that many candidates were unaware of how to tackle this sort of problem. Tangents to the curve at $t = 8$ were rarely seen and when they were, working to show their height ÷ base for a triangle was generally not present, or the area of the triangle drawn on the tangent was calculated! In many cases where the tangent was accurately drawn, candidates failed to read the scale accurately.

The most common incorrect response to part (a) was to read off the value of the velocity at $t = 8$.

In part (b) most candidates did not recognise they needed to find the area under the curve between $t = 0$ and $t = 6$. Of those that did, many just used 1 triangle or made errors in calculating the triangle under the curve between $t = 0$ and

$t = 2$.

Question 19

The most popular way of working out the volume of pot *B* was to multiply 100 by 1.5 (or equivalent) reaching an answer of 1500. Others used the area scale factor instead, writing $1000 \times 1.5^2 = 2250$. Both these methods scored 1 mark if working was shown. Less able candidates tended to write 18−12=6, 6×1000=6000. However there was a small percentage of candidates who correctly used the volume scale factor with 1000 reaching the correct answer of 3375. There were also a significant number of candidates who tried to find the radius of the base of pot *A* from the given volume and the given height of 12, incorrectly assuming this was a cone or a cylinder, and use the scale factor of 1.5 to find the radius of the base for pot *B* and hence the volume.

Question 20

The final question tested QWC and required candidates to work out the probability of winning a prize and using this to work out if Simon was likely to raise money for charity. Many candidates drew a table to show the sample space and highlighted those that were winning pairs. Unfortunately marks were lost if they missed one or miscounted the winning pairs. Although many candidates could not make a sensible start to the problem there were many good methods seen leading to a probability of 0.28 with some attempt at working out the likelihood of Simon raising some money for charity. The most successful answers tended to work out the profit for a particular number of games; eg candidates would write that if 100 games were played 100 × 40p = £40 was collected and 28 × £1 = £28 was given out in prizes leaving a profit of £12. Some candidates failed to appreciate that the 40p fee would be paid to them even in the case of a winning trial, and compared 18 x 40p to 7 x £1. A very common misconception for the latter part was candidates who forgot that "winners" also paid out to play, showing that money "in" was 18 × 40p

(= £7.20), money "out" was £1 × 7, so profit was 20p in 25 games!

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