Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Paper 2F

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Introduction
Overall, the students taking this paper seemed well prepared and most seemed to have time to complete the paper. While many showed very clear working, some omitted to do this; we must stress the need to show working to maximise mark gaining potential. A simple arithmetic slip on a 3 or 4 mark question where the student shows no working can result in no marks being gained – whereas, by showing working the student could often gain all but the final accuracy mark.

Generally, students seemed to use their calculators and had the correct equipment for drawing the triangle for question 9; although there were a few student comments suggesting they had come to the examination without a protractor and/or a ruler.

It was pleasing to see many students attempting the higher graded questions near the end of the paper and in several cases, good working enabled them to gain method marks even if they could not get to the final answer.

Question 1
Writing a number in words was almost always answered correctly. Most students could give 78 263 correct to the nearest hundred, but responses with just 300 were noticeable. Students showed a good understanding that in the number 673 000 the value of the 7 is 70 000; those who gave the 'column heading' as 10 000s also gained the mark. Finding a missing value (2000) in a multiplication calculation was extremely well-answered, with 200 being the only noticeable incorrect value. The final part required students to give 10 000 as the missing value needed to complete a division calculation; while a little over half of the responses were correct, there were a variety of values that clearly didn't relate to the given calculation. The answers to part (d) and (e) could easily have been checked using a calculator – checking working and answers should be encouraged, together with strategies for doing so.

Question 2
Recognising an even number was correctly answered by most, a little less so was finding the square number and almost always a multiple of 7 could selected. Students were a little less sure on deciding on a factor of 30, with the multiple 60 regularly seen instead of the factor 15.

Question 3
Pictogram questions gave many students the opportunity to gain 3 or all 4 of the marks, for interpreting total values from the diagram and for completing a missing entry. In part (d), where a mark was lost, this was mostly for making one or two mistakes in working out the values from the table, an error in adding the 5 values, or for forgetting to multiply by 2 for the final step. The number of candidates who used an alternative number to 18 (despite being given in the question) and used a different number to their answer in part (a) was surprising. Also, some candidates got the total wrong from correct working when they have a calculator.

Question 4
Drawing the 4th pattern in a sequence proved an easy start for the majority of students. The only noticeable error was drawing four separate 'boxes' rather than showing them joined with a common side. Finding the 4th and 5th terms also presented little difficulty and almost all students gained the mark. While many could work out the number of sticks in the 10th pattern, by continuing the sequence and some by using the nth term, nearly a quarter did not gain the mark, usually by simply doubling the number of sticks in the 5th pattern. A variety of correct explanations as to why 102 could not be the number of sticks in the 25th pattern were offered, ranging from the simple 'because 102 is an even number' to use of the nth term. While around three-fifths of

the students gained a mark, other explanations were ambiguous and contradictory, with students struggling to cope with finding the right words. Again, reference back to the 5th pattern having 21 sticks, caused a noticeable number of responses to say he should have multiplied 21 by 5 for the 25th pattern to give 105 and stating that this was why 102 was wrong.

Question 5
Mostly students find the coordinates of a given point on a grid; the only noticeable error was when the coordinates were given the wrong way round, or more occasionally by including x and y with the numbers. Locating point D for the corner of a rectangle was also well answered. Around a third of students were able to work out the coordinates of the midpoint of a line and give (3.5, 1); the most common errors were (3, 1) and (4, 1), and a few reversed the co-ordinates (1,3.5), although other more random pairs of coordinates were also seen in around another third of the responses. Drawing the line y = 4 in part (d) proved the most problematical part of this question, and a little under half of students did not gain a mark. Drawing $x = 4$ was a common error, or giving both $y = 4$ and $x = 4$, where choice of answers meant the mark could not be awarded. The line $x + y = 4$ appeared at times, as did non-attempts.

Question 6
The large majority could readily name the polygon as an octagon and almost all accurately measured the length of a given line. Many students could select the two congruent triangles from the six drawn but the pair of similar triangles was also given regularly, along with some random selections.

Question 7
Selecting the correct word to best describe the likelihood of a spinner landing on different colours was a familiar type of question and a very high majority answered correctly with unlikely for green and impossible for blue. However, a little under half were able to select evens for a probability of 0.5 for yellow.

Question 8
Given the number of rows (26) and the number of seats in each row (14), together with the information that tickets costing 15 euros each were sold for ¾ of the seats, around three-quarters of students could work out the total amount raised from ticket sales by multiplying these four values. This gained them 3 marks. Where one of these values had been omitted from the calculation, students were able to gain 2 of the marks. Occasionally division by 15 (the cost) was wrongly seen. When multiplying by a fraction in such questions, students should be aware that writing '¾ of' is not a method; this is stated in the question. They should be advised to show that mathematically this requires $\frac{3}{4} \times n$ Showing working, which is always to be encouraged, proved to be particularly important here, as numerical errors or premature rounding without showing a method denied a noticeable number of students a mark.

Question 9
Around half the students could produce an accurately drawn triangle, with an angle of 38^{o} and one side length of 6.5 cm. A good number of other responses had one of these conditions correct to gain 1 mark. It was evident from some wrong responses that candidates did not use a protractor or a ruler, suggesting they did not have the equipment they needed for the exam. Students should be encouraged to draw diagrams in pencil, thus enabling corrections to be made. When errors were made in pen it was difficult to decipher the triangle to be marked. On occasion this led to the student starting again and re-drawing the given 8cm line elsewhere on the page.

Question 10

The vast majority of students successfully calculated the amount of change due from £20 when 6 cakes at £2.20 each were bought. Those who did not achieve this, usually scored 1 mark for finding the cost of the cakes. Part (b) asked students for the maximum number of balloons costing £0.85 that could be bought from £50 Around two-thirds divided correctly to reach 58.8…. and went on to give 58 as the answer and gained the 2 marks. Some gave 58.8 or 59 and were awarded the method mark only. Others worked out that 58 balloons would cost £49.30, giving this cost as their answer, which at least gave them 1 mark provided the 58 was seen. The most common incorrect approach was to multiply the 50 and 0.85 from the question, giving 42.50 as their answer; this would actually be the cost of 50 balloons.

Question 11

A little over a third of the students were able to work out the size of an angle on a pie chart to represent 55 out of 90 people. Perhaps a little surprisingly, the most common approach was first to convert 55/90 to a percentage and then to find this percentage of 360^{o}, although the more direct $55/90 \times 360$ was sometimes seen However, a large number of students stopped after finding the percentage and gave this as their answer, which was insufficient for the award of any marks. Responses with seemingly random working with 55 and 90 also appeared.

In part (b) students were given that 195^{o} represented 39 people and were asked how many people would be represented by 75^{o}. Those who knew what to do mostly worked out how many degrees represented each person and divided this into 75 to gain 2 marks for their answer. Others gained 1 mark for some potentially relevant initial working using 195 and 39 or 195 and 75 As in part (a), random working was seen and also some non-responses, with half the students not able to gain any marks.

Question 12

Asked to work out the circumference of a circle given its radius; more students worked out the area than found the circumference. Only a little under a third gained the 2 marks for this question. Other popular, but wrong, formulae used were π × radius or $2r$ or $\pi^2 r$. Students should be encouraged to learn the circumference and area formulae and *in particular* to distinguish between them.

Question 13

Expanding a term with a single factor outside a bracket gave around two-thirds of students the opportunity to gain the 1 mark. Factorising $12a - 18b$ proved more challenging, although around half the students were able to gain either 2 marks for fully factorising or 1 mark for partially factorising. However, $-6ab$ was a regularly seen incorrect response. In part (c), students needed to write a formula for the total number (T) of slices of cheese bought, given there were 8 slices in a small packet and 20 slices in a large packet. This produced a good number of correct answers of $T = 8h + 20j$ Equally common, however, was to ignore the numbers of slices and give $T = h + j$ gaining 1 mark rather than 3 Sometimes a mark was lost by wrongly simplifying what was a correct formula, mostly seen as $T = 28hj$.

It was pleasing to see that most students understood that their answer needed to start with T as the subject, meaning a response $T = ...$ usually enabled the award of at least one mark. However, some students ignored the T= hence scoring 2 for $8h + 20j$

Question 14
This question presented students with an exchange rate for dollars to euros and for dollars to yuan.

In part (a), using one of these rates to change dollars to euros was well done by the high majority. Part (b) required the use of both rates to change yuan to euros. Where students divided by 6.45 and multiplied by 0.85 to get 340, they gained 2 marks. Of those who were not able to do this, many gained 1 mark for one of these operations. Common errors arose because students were unsure when they should multiply and when to divide. Some did the incorrect operation both times, others multiplied twice and others divided twice, with around a quarter of students not able to gain a mark.

Question 15
Students needed to understand that squaring takes precedence over addition in the orders of operations (BIDMAS) in order to explain what Finn had done wrong in a given calculation. An encouraging number were able, in variety of ways, to explain that he should have squared 3 first, before adding it to 5 Some lost marks due to an inability to express their reason in an unambiguous way and offered contradictory reasoning. Placing a pair of brackets into a calculation so that the answer was correct was well answered by two thirds of students. Quite a few wrong answers were because they put the left-hand bracket on the wrong side of the '- ' sign or bracketed the 4.

Less than a quarter of the students could correctly evaluate $x^2 + 5y$ given $x = -3$ and $y = 2$. The modal, but wrong answer, was 1 coming from $(-3)^2 = -9$ and then adding 10. 1 mark was gained by many for at least evaluating the +10. Showing the values substituted into the expression could also gain 1 mark but where this was written as $-3^2 + 5 \times 2$ the mark could not be given; the -3 needed to be seen in brackets.

Question 16
Finding a bearing (of P from Q) by measuring on a scale drawing had a very low success rate, with the majority of students measuring instead the length of the line PQ Even where students did appear to be working with angles, there was confusion as to which angle was intended. However, part (b) which asked for the speed of a plane flying from PQ in 2 hours provided half the students with 3 marks, or 2 where their measurement of the line PQ was inaccurate. The common errors were to give just the distance rather than work out the speed, or to divide by 120 minutes to find the speed without also multiplying by 60. Others rounded up their measurement of 9.4 to 10cm, hence missing out on accuracy mark.

Question 17
Overall the improvement with this style of fraction question seems to continue. Increasingly students familiar with fractions know to show all the steps to prove the given calculation is correct, right through to including the final answer as part of their working. The traditional ‘change divide to times and invert the second fraction’ is the most popular and usually successful method seen. Omission of showing 35/9 from 70/18 was the most common way in which 1 mark was lost. Where students changed both fractions to those with a common denominator, eg 70/15 ÷ 18/15, it was rare to see the next required step of 70/18 and in these cases only 2 of the 3 marks could be gained. Muddled attempts at converting to improper fractions were seen and random manipulation of the figures given in the question; together with blank responses, this resulted in a little under half the students gaining no marks.

Question 18
Given the probabilities that a spinner could land on green or yellow or brown, over three-quarters of students could work out the probability of it landing on pink, which was the only other possible colour. This was given as the answer by many, for 1 mark, but the question actually asked for the estimated number of times the spinner would land on pink in 200 spins. If an error had been made in finding the probability of it landing on pink, a method mark was available for working out the estimated number of times for their probability. 1 method mark could also be gained for finding the estimated number of times it did not land on pink.

Question 19
This proved challenging for all but a small minority of students. Those few were able to add the two co-interior angles given algebraically and equate this to 180 and continue to solve this to find the value of x. Once this was found, substitution was a relatively easy step to find the size of the largest angle in the trapezium. The first method mark could be awarded for responses that showed all four angles added, needing some kind of unknown for the missing angle, and showing this equal to 360^{o} In the event that this led to a value for x, substituting this to find a value for the angles could gain a second method mark. However, far more common were attempts that added three angles and equated to 360 and others that used the size of each angle like $3x + 46$, to create the equation $3x = 46$ or $3x + 46 = 49$, or assuming the trapezium was isosceles and writing $4x - 27 = 3x + 10$, and so on. Multiplying together the algebraic brackets like $(3x + 4)(4x – 27)$ was also seen regularly, often generating lengthy but irrelevant and incorrect algebraic manipulation. Many non-responses were seen.

Question 20
Some students were able to gain all 4 marks for working out the table of values for a quadratic graph and correctly plotting the graph as a smooth curve. Where this was the case, 1 mark was sometimes lost for drawing the curve between (0, -4) and (1, -4) as a straight line. Partially correct tables of values usually had the correct values for the positive x values. If at least 3 or 4 of the values were correct, 1 mark could be gained, leading to the opportunity in part (b) to gain another mark if at least 5 of the points were correctly plotted. Seemingly random numbers in the table followed by a series of line segments on the grid also made a regular appearance. There were also a noticeable number of non-responses and nearly half the students gained no marks. Many students incorrectly thought there was a sequence decreasing by 2, as there was a difference of 2 between some of the terms and ended up with a straight line graph.

Students should be reminded that when asked to draw a graph this includes joining the points. A surprising number of otherwise correct answers lost a mark by failing to do this. Students should be reminded that a quadratic curve must be curved around the minimum point.

Question 21
This question incorporated two ratios, although only the ratio (1 : 3) for the number of 2 pence coins and the number of 5 pence coins was explicitly given. Students needed to interpret from the question that they also needed to use the ratio relating to the value of the coins, ie $1 \times 2 : 3 \times 5$ An encouraging number of students understood this and could then work out the number of coins that made up the 85 pence total, remembering to find the difference between the number of 2 pence coins and the number of 5 pence coins for their final answer. They well deserved the full 4 marks. For attempts that progressed as far as 85/17 or 10 : 75 in various forms, 2 marks were awarded. An initial step of 2 : 15 gained 1 mark. For students who wrongly thought this was a familiar style ratio question, asking them to share 85 pence in the ratio 1 : 3, a special case mark was available

if they progressed as far as finding one, two or three shares; this mark was regularly awarded. Around half the students gained at least 1 mark but there were many who made no attempt at the question.

Question 22

Perhaps surprisingly, only a little under half the students could write 76 000 000 in standard form. Errors were to give 6 as the index number, sometimes with 76 rather than 7.6, to omit the × 10, to use a negative index number or to write the number in words. The success rate was similar for writing 5.4×10^{-4}. Often seen as the answer was 54 000, 000.54 or 0005.4 A noticeable number of students did not attempt the question.

Question 23

Although the word tangent was used to give information about a diagram based on a circle, this did not appear to prompt the majority of students to consider that the angle between a tangent and a radius is 90^{o} Had they done so, moving to the sum of angles in a quadrilateral is 360, and finding the size of the obtuse angle at *O*, might have been an easy next step, and from here finding the size of the required reflex angle. A few accurate and succinct responses were indeed seen. However, there was much working with isosceles triangles ADC and AOC, some of which were more successful than others. Those who wrote angles onto the diagram were more likely meet with some success and this is something that should be encouraged for all geometry questions. Starting incorrectly with angle AOC = 48 was seen often, as was subtracting 48 from 360 and dividing the remainder equally between the three other angles in the quadrilateral. It appeared that some loss of marks was caused by students being unclear as to which was the reflex angle. Non-responses were seen, as was muddled and incorrect working, with over three-quarters of the students not gaining any marks.

Question 24

Compound interest should be a very familiar topic and clearly it is for a good number of students, who efficiently found the new value after 3 years by calculating 680×1.04^3. Others also understood the concept but adopted the lengthier process of finding the increase after one year, adding it on, and continuing to work year by year. Although this can be prone to numerical errors, sometimes costing students the accuracy mark, many worked carefully to arrive at the correct answer. There are still a large number of students who interpret these questions as simple interest, finding the increase for the first year and adding it on three times; such responses gained 1 mark. Wrong attempts sometimes used 1.4 rather than 1.04. Overall, around three-quarters of students were able to gain at least one mark and most students made some attempt at the question.

Question 25

Changing a speed (27 kph) to a speed in metres per second is regularly seen as a topic but it continues to highlight the difficulty some students have with conversions. That the conversion factor between kilometres and metres is 1000 needs to be learnt, as does when the operation is multiplication and when it is division. As well as the correct value of 27000, it was disappointing to see values like 2700, 270 and 0.027 appear so often. Division by 60 was evident in many responses but again the need to divide by 60 twice was not sufficiently well appreciated. Regularly, students were awarded all three marks but around a quarter got only 1 mark, more usually for 27000 than for division by 3600.

Question 26

Given mean scores and the number of rounds in a quiz, the first step was to find the total scores. There were four total scores that could be worked out and finding one of these was sufficient for the first method mark to be given. Around a quarter of students were awarded at least this mark. For the second method mark, we needed to see the difference between the points gained by A or B in the last round, which meant that at least two of the four totals were also needed. This was as far as most students were able to progress. A few who had found all the totals could then go on to find the difference in the number of points scored in the last round, most of whom arrived at the final correct answer for 4 marks. Many responses worked solely with the mean scores 17, 18 and 18.5 often using subtraction in a meaningless way. Again, many non-responses were seen.

Question 27

A noticeable number of students made a confident start to this question based on a 9-sided polygon by dividing 360 by 9 This could have gained them a mark but in many instances, this was negated by showing 40^{o} as the interior angle, or even as what appeared to be the length of each side. An alternative approach to gaining the first mark was to work out the size of the interior angles; where this was done, the 140^{o} was usually correctly placed on the diagram and so the mark could be awarded. This working rewarded around a quarter of students. However, the majority made little serious progress beyond this, often assuming that angle FOD was a right-angle and that triangle *EDK* was isosceles, resulting in a variety of incorrect angle calculations. Even though the question stated that the polygon was 9-sided, we saw responses that divided 360 by 8 or by 10. A noticeable number of students made no attempt at this question.

Question 28

The most popular, although incorrect, approach here was to assume triangle *ABC* was right-angled rather than scalene and to use one of the familiar trigonometry ratios in an attempt to find the length of a side. Muddled working ensued, with students often seeming unsure if they were working out the length of a side or the size of an angle. Having found an incorrect length by an incorrect method, Pythagoras' theorem was then often seen, but because this had come from wrong working, no credit could be given. However, if the theorem was used in the larger right-angled triangle *ABD*, with $14^2 - 8^2$ rather than the too often seen addition, the first method mark was often gained. Other false starts focussed on the numbers on the diagram in creative but meaningless combinations. Where students immediately saw the diagram as a small and a large right-angled triangle, rather than simply a right-angled and a scalene triangle, they progressed more successfully, finding angle *BAD* using the cosine ratio, subtracting the given 38^{o} to find angle *CAD* and from there using the tangent ratio to find the length of *CD*. Thus, a handful of students were rewarded with all 4 marks. The majority of students were not able to gain any marks and again there were a high number of non-responses.

Summary

Based on their work in this paper, students should:

- Be encouraged to check their answers
- Show clear working out and not just give an answer
- Know the difference between mathematical words, e.g., factor and multiple
- Know the various formulae for shapes – in particular that the circumference of a circle is πd or 2π
- Read questions carefully so if they are asked for a bearing, they do not give a distance
- Not get mixed up with the interior and exterior angles of a polygon
- Know that Pythagoras' Theorem and trigonometric ratios require a **right-angled** triangle
- Ensure accuracy when copying answers onto the answer line
- To present working in a methodical way
- To make it possible for examiners to distinguish between figures if handwriting is poor

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