Examiners' Report
Principal Examiner Feedback

January 2023

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

Edexcel and BTEC Qualifications

January 2023
Publications Code 4MA1_2F_2301_ER

4MA1 2F
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Principal Examiner's report

Those who were well prepared for this paper made a good attempt at all questions.

The paper differentiated well.

Many students have got the message that it is wise to show working to maximise their chances of gaining marks. However, some methods were difficult to follow as the calculations were randomly scattered around the answer space and a more organised approach would help students to sort out what they are doing as well as making it easier for examiners to follow their thinking.

The majority of students write their numbers carefully but sometimes it was difficult to distinguish between 4's and 9's and also between 1's and 7's.

We found that students were not confident in giving reasons for angles, for e.g., corresponding angles. Some students think that showing working is the same as giving reasons.

Question 1
Almost every student could arrange four numbered cards to show the smallest possible number. Arranging them to show the largest possible even number was less well answered, with some answers neither the largest number nor even; only about 2/3 of the students gained the mark. Prime numbers were correctly given in part (c) by most students but 57 and 35 also appeared regularly. Most knew that 56 was the required multiple of 8.

Question 2
The familiar context of a pictogram gave almost all students the opportunity to score full marks for picking out the country producing the greatest weight of potatoes, for drawing the correct symbols to represent 6 million tonnes and for totalling the weights for 2 given countries. However there were quite a few students who did not answer part (b), leaving the Netherlands section of the pictogram blank, even though they answered part (c), possibly because they did not see an answer line below the question. The most common incorrect answer for (c) was 11 – 7 = 4

Question 3

While most students could mark the position of 554 on a number line, a surprising number misplaced their arrow. 544 was quite commonly seem, perhaps a misread of the given value. Reading the value 3250 from a number line was less well answered with about 1/3 of students giving an incorrect number; popular incorrect values were 3025 and 3200. Although there were four divisions between 3000 and 4000 on the line, the internal 3 notches gave rise to a noticeable number of responses like 3300 or 3333.

Question 4

Accuracy in drawing a line of length 6.5 cm was very high, with only a rare longer or shorter line drawn. Most of the incorrect responses were out by 1 cm. There were quite a few blanks, perhaps suggesting that some students did not have a ruler with them. In part (b), many students could measure the angle as 44^o but nearly 1/3 could not gain the mark. Regular answers that were up to around 10^o wrong may have been estimates from students without a protractor.

Question 5

In part (a), most students understood that a particular cost of sending a parcel covered a range of weights and could identify and sum the costs for two given weights of parcels. Others wrongly tried to combine the weights of the parcels whilst others made attempts to adjust the cost to the exact weight of the parcel. This also happened occasionally in part (b) but many students were able successfully to work out the maximum weight of a parcel, given the weights of two other parcels and the total cost of sending them all. The most common error was to give the $1 \leq w < 2$ class interval or 1.5 or 1.9 as their final answer, rather than the maximum weight of 2 kg. Adding the weights of the parcels and subtracting from the total cost showed that some students were not able to interpret this question.

Question 6

Writing 5 15 pm using the 24-hour clock proved a very straightforward question for almost all students, but less so part (b) where a time interval needed to be calculated, from 16 35 to 20 15. While a little over half the students were successful, many others could find either the number of hours or the number of minutes but not both. Subtracting 16 from 20 to give 4 hours, or counting from 16 to 20, including the 16, to give 5 hours appeared to be common incorrect methods; likewise, subtracting 15 from 35 to give 20 minutes or adding 35 and 15 to give 50 minutes.

Question 7

Simplifying a product by using an index number and solving two simple linear equations were familiar and well answered questions. Many students also showed they could expand a bracket but the mark was sometimes lost by students who correctly obtained 10 + 15h but went on to give 25h as their answer. Around half the students were able to factorise $g^2 + 7g$ with $7g^3$ being the most common incorrect answer.

Question 8

Finding an output for a number machine when given the input gave around 90% of students the opportunity to gain a mark, as did completing a different number machine with an acceptable second operation, either x 3 or + 12 It was rare to see the multiplication sign or the addition sign omitted. In part (c), students were given a word formula and were asked to calculate the cost of hiring a mixer for 3 days. A majority gained the mark for this. In part (d), when working out the number of days the machine was hired when the total cost was given, many students understood to subtract the 'one-off' 5 euro fee before dividing the remaining cost by the daily charge to give the correct answer. A common error was to add the 'one-off' fee to the daily charge and then divide by the resulting 13 euros, with over 1/3 of the students unable to gain any marks. Others failed to subtract the 5, and just divided 61 by 8.

Question 9

Most students scored full marks for entering values into a two-way table. When marks were lost it was usually on the Hybrid bikes. A high number then went on to select correct values from the table to express the number of mountain bikers (54) as a percentage of the total number of cyclists (120) Noticeably, there were responses where the students attempted instead to work out 54% of 120. The final part of the question to find the size of an angle for a pie chart to represent 41 people out of the 120 proved more demanding, with about 1/3 of the students obtaining marks. Those who worked directly with 360^o to find that 3^o were needed per person almost invariably went on to give the correct 123^o It was noticeable how many students first calculated 41 out of 120 as a percentage and then found this percentage of 360^o Working accurately provided students with a correct answer but, more often than not, rounding the percentage prematurely cost them the accuracy mark. There were also those who gave the percentage as their answer without any attempt to use 360.

Question 10

A little over half the students could identify the mode from a frequency table, although some still gave the actual frequency rather than the modal value. Part (b) asked for the median. The correct answer of 13 appeared, sometimes without working shown and sometimes coming from listing all 21 values in order and finding the middle value. However, more often, students incorrectly took the numbers from the ‘Number of cookies made’ column, ie 10, 11, 12, 13, 14 and 15, and found the median of those six numbers. Less than ¼ of the students gained marks for finding the median. Working out the total number of cookies made by calculating six products and adding them was much more successfully done. Others added the numbers from the ‘Number of cookies made’ column, not understanding that these values needed to be multiplied by the frequency. A handful of candidates gave the mean rather than the total as their answer and so could not be awarded the accuracy mark.

Question 11

In part (a), three numbers in a bracket needed to be summed and then the result squared, which around 3/4 of students understood. The common error was to square each number in the bracket first and then add the resulting values. Part (b) gave 64 as 4^n and the majority understood this and gave 3 as their value of n. However, others took this to mean $64 = 4 \times n$ and wrote 16 as their answer. Part (c) presented students with a calculation to be done on a calculator and they were asked to write down all the figures from their calculator display. Most gained both marks. From incorrect answers, it was clear that some students did not appreciate the order of operations needed nor how to use their calculator to ensure the steps were performed in the right order.
Students should be encouraged to show their intermediate steps such as evaluating the numerator or denominator to gain method marks in case their answer is incorrect.

Question 12

While ratio is a familiar topic, this question did not give a total amount to be shared in a given ratio, although that was the approach some students wrongly took. They needed to appreciate that the difference between the 4 : 7 parts of the ratio was 39 and therefore divide 39 by 3 and not by 11 Multiplying the resulting 13 by 4 to give 52 provided a good number of students with all 3 marks. There were responses that showed 4 : 7 equated to 8 : 14 and so on, until the two values had a difference of 39; this approach, although not the most efficient, showed understanding and gained some credit. Full marks were obviously awarded if the correct value was given as the answer. There were a variety of random numerical workings seen, simply incorporating the numbers given in the question.

Question 13

It was encouraging to see around a ¼ of students giving fully correct responses to this multi-step problem solving question. The main issue some students had was with the concept of there being 20 fewer students in one group compared to the other. Dividing the 380 by 2 and then adding and subtracting 20 was the favoured, but incorrect, method, though the correct values of 200 and 180 were seen; most who could do this went on to score full marks, having found 2/5 of 180 plus 32% of 200. Where the initial values were wrong, or ignored, students could gain method marks for showing a method for finding 2/5 of a number and 32% of a number. This number, however, was often 380 and many candidates worked out 72% of 380 or one of their results. Giving credit in this way enabled many students to gain at least some marks. However, it should be noted that stating, for example, 32% x *n* is not sufficient by itself for a method mark. This applies here and in general for percentage questions.

Question 14

The question presented students with a prism and they were told its volume. Dimensions were given for a number of lengths of the prism; the demand was to find one unknown dimension. A pleasing number of students were able to do this. Of the others, many were able to gain a mark for finding a relevant surface area or volume. Where this was not the case, varied and random working was seen, often mixing linear, area and volume units, or working with perimeter. Some candidates gave 7.5 cm as their answer, probably assuming wrongly that the surface area of the smaller part of the prism was a square. Others assumed that the lower horizontal surface was halfway down the 14 cm height and tried to check this with working. Although the unknown length was labelled *x*, it was rare to see any algebraic working. A little over half the students were unable to gain marks here.

Question 15

An encouraging number of students were able to calculate an unknown angle within a diagram involving parallel lines to gain at least 1 mark with many scoring another mark for giving the correct value of *w*. A noticeable error was to think that co-interior angles are equal and thus give angle *ABE* as 107^{o}. However, far fewer students were able to give acceptable reasons for the stages of their working, even when they had some knowledge of these angle facts. For example, stating the reason for corresponding or alternate angles as ‘because the lines are parallel’ is not sufficient; the use of corresponding or alternate is needed. Likewise, ‘a circle is 360’ or a hand-drawn circle with 360 written inside, does not gain a reasoning mark; angles at a point add up to 360 needs to be seen. The use of 3 letters to describe angles was seen but, on the whole, was not well done. Students should mark the angles that they calculate on the diagram to make their method clearer.

Question 16

Students' ability to show working for fraction questions has improved and a good number gained full marks for showing the division of two mixed numbers through to a full conclusion. Some omitted one step and were able to gain 2 of the 3 available marks. In particular, for those who found fractions with a common denominator, (208/91 ÷ 91/56) most did not show 208/91 before writing 16/7 There are still a significant number of students who are not able to make any progress with these questions, and again random and confused working was seen. The use of decimals was not an acceptable method. There were also a noticeable number of blank responses. Nearly half of the students did not gain marks.

Question 17

This question to change 90 kilometres per hour to a speed in metres per second highlights that many students have not learnt basic conversions, like kilometres to metres; those who had, gained a straightforward first method mark for 90,000 metres. Multiplication by 100 was seen and also division by a power of 10. Some candidates went on to divide 90,000 by 60 x 60 usually gaining full marks. Division simply by 60 was also very common but did not reward the student with any further credit. Again blank responses were noticeable.

Question 18

Completing a Venn diagram proved a very accessible question for most students, who gained either 3 or 2 marks. Where only one region was correct, this was most often the intersection. Having been explicitly told that set A was even numbers, the outer part of set A was also usually correct. It appeared that some students were unclear which numbers to put in set B as this was not listed but needed to be deduced from the given information.

Question 19

A relatively small number of students appreciated that because two opposite sides of a rectangle are equal, they could equate the algebraic expressions given for two such sides. They mostly were able to continue from that first step to find the value of x. While a good number of these substituted to find the actual length of the two sides and then found the perimeter, it was disappointing that some used the value of x as the length of those two sides and gave an incorrect value for the perimeter. Other students started with an algebraic expression for the perimeter; simplified or un-simplified, this gained them one mark. Others attempted to multiply the two algebraic expressions. A noticeable number stated that $5x - 1 = 4$ and $3x + 7.4 = 10.4$, sometimes retaining an x, and used these values for the two equal sides of the rectangle to try to find its perimeter. Many students who found the value of x to be 4.2 then decided that 4.2 was the length of the sides getting a perimeter of $24 + 24 + 4.2 + 4.2 = 56.4$ Trial and improvement working rarely led to successfully finding the value for x. A noticeable number of blank responses were seen. However, over a ¼ of students were awarded at least 1 mark.

Question 20

Parts (a) and (b), where students were asked to find the lower and upper bound of 2.75 given correct to 2 decimal places, were not well answered, with about 90% not being awarded marks. The answers given were so varied and apparently unrelated to 2.75 that it is hard to generalise. For the lower bound, 2.75 as the answer appeared fairly regularly but so did values like 1.38 For the upper bound, 2.80 and 3 were seen but also values like 3.49 Disappointingly, the large majority of students did not realise what was being asked in part (c) They needed to round the 3 values used in a calculation each to 1 significant figure to find an estimate for the calculation, to show that the original answer to the calculation was not sensible (being 10 times the correct answer). Where there was some understanding of the question, many attempts rounded 81.3 and 59.2 to 2 significant figures not 1. Far more students worked out the exact answer to the calculation, sometimes rounding this step by step towards 1 significant figure; others attempted similar rounding for the original incorrect answer. Of those who gave each value to 1 significant figure, some did not work out an estimated answer but gained 1 mark for this. A few other students were able to gain one of the 2 marks for rounding at least 2 values to 1 significant figure.

Question 21

Finding the *x* coordinate of the midpoint of a line, given that the *x* coordinates of the endpoints were 6 and 17, proved challenging for the large majority. A commonly seen error was to subtract 6 from 17 to give 11 as the answer and some students divided by 2 to give 5.5 Slightly more challenging was to find the *y* coordinate of one endpoint, given the *y* coordinates of the other end, 4, and the midpoint, 15. Again, many subtracted to give 11 There were some attempts to sketch a grid; other answers appeared to be random numbers with little or no working seen. Many blank responses were noted. Several candidates scored 2 marks for one correct coordinate with little or no working but were not able to go on to score full marks.

Question 22

Solving a pair of linear simultaneous equations was a familiar and straightforward question for a few students who could show clear and succinct algebra to arrive at correct solutions. Other responses showed understanding of the method but numerical errors, particularly with the addition or subtraction of the questions where negative values were involved, made further working more complicated with decimal values to contend with. Around 1/3 of responses gained some credit. Students often seemed unclear as to whether they were adding or subtracting the equations, often applying a mixture of both. Other attempts were to work with the original equations and add or subtract directly, sometimes resulting in both *x* and *y* still appearing, or simply with one of these terms ignored. Beyond this, working seemed random and blank responses were noticeable.

Question 23

It was encouraging to see a significant number of fully correct responses to this percentage problem. These students were able to work out the interest earned on an investment with Bank G after 2 years with 1.6% compound interest. They also understood that the 2.9% interest on the same investment amount with Bank H after 2 years was a total and not per year or compound interest, which was an error made by some. Correctly finding the difference between the amounts of interest gave students the opportunity to gain 4 marks. The most common error was to work out only simple interest for the investment with Bank G, either for one year or for two, but this at least provided 1 method mark. It was common to be awarded 2 marks for the sight of 145 and 160, with students using simple interest for 2 years rather than what was required.

Such students were often also able to work out 2.9% of 5000 and this also gave them 1 method mark. Over half the students gained some marks. Given a rate of 1.6%, some students multiplied by 1.6 or by 1.16 or 0.16 and likewise with 2.9% thus denying themselves any marks.

Question 24

In part (a), about 1/3 of the students could give the value of $(m + 2)^o$ as 1 Commonly seen incorrect answers were 0 and 2m but there was a high number of blank responses. Expanding $(3a^2b^4)^3$ resulted in some fully correct answers but more often partially correct, particularly those with 9 or 3 rather than 27 but with the a and b terms correct. The most common incorrect answers were those where the powers had been added to give $3a^5b^7$
Fully correct factorising was seen in part (c) and some partially correct answers, but most did not understand what was needed. Many added the 14 and the 21 and the powers, producing answers like $35x^5y^6$ Other answers showed variations on, for example, $7(2x^2y^4) + 7(3x^3y^2)$ often with errors within this. A number of students gave no response.
In part (d), while a noticeable number of students wrote down $y = mx + c$ few understood how to use this to give the equation of a line drawn on a grid. A handful of correct answers of $y = -2x + 4$ were seen for 2 marks, along with some responses given 1 mark, for example for $y = mx + 4$ or
$y = -2x + c$ where m and c were incorrect values. Although the $2x$ was often seen, I don't think many realised it was a negative gradient hence $-2x$. Most answers gave variations on a pair of coordinates using 2 and 4 or $x = 2, y = 4$ or $2x + 4y$

Question 25

The modal answer for this question, which gained students 1 mark, was 15 cm for finding the length of the equal sides of an isosceles triangle, given the length of the base and the perimeter. A small number of students were then able to use Pythagoras' theorem to find the height of the triangle and from that work out the area of the triangle. These students were rewarded with all 5 marks. Some who recognised that Pythagoras' theorem was needed, wrongly added rather than subtracted. However, most students, having found the length of the side as 15 cm used this as the height of the triangle and were unable to gain any further marks. Some random working involving 24, 54 (the given perimeter), 15 and 12 often appeared, as did blank responses and many candidates stopped after finding the 15 cm side(s). Some students used trigonometry to find the height of the triangle. Although not the most efficient method, marks were gained when used correctly.

Summary

Based on their performance on this paper, students should:

- show clear working even when this is not specifically asked for.
- Make sure that numbers are distinguishable, especially 1's & 7's and 4's & 9's
- Learn angle reasons

- Read questions very carefully
- Do not prematurely round values from your calculator
- Make sure you know Pythagoras's theorem and know when to add and when to subtract to find the length of sides

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