Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Foundation (Calculator) Paper 3F

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Edexcel GCSE Mathematics Summer 2022

Report on Paper 1MA1/3F

Introduction

It was pleasantly surprising to find students making improvements in their approaches to questions that required a written response, and in longer multi-step questions. In particular written responses in questions 8, and 14 showed improvements. Multi-step questions 24 and 25, towards the harder end of the paper, were answered quite well and demonstrated a desire of students to pursue the challenge of the paper through to nearly the end. Centres are to be commended for the preparation that must have gone on to ensure students had the confidence in their approach to the paper.

In terms of presentation of their working, students still have some way to go. Of greatest concern is the proportion of work that is spoilt by miscopying of figures, either from the given question, or students who miscopy their own figures in working. This was most prolific in questions 7, 11, 19, 24, 25 and 27 but was also seen in other questions.
There were also occasions where students prematurely rounded or truncated their figures, either their own figures or whilst in the process of taking them from the calculator. This was seen in questions 15, 19, 22, 24, 25, 27 and 29. This type of error prevents the award of any accuracy marks, but allowance can sometimes be given for the award of method or process marks, as long as the question has not been made any easier.

When drawing or measuring diagrams students need to ensure they use a ruler accurately. There were surprising errors shown in questions 6, 13 and 16 where evidence suggests that students either did not have a ruler or were using a ruler incorrectly. There was evidence that students had a calculator for this paper and used it well. However, there were occasions when break-down methods were used in attempts to work out percentages, usually far less successful than a more direct approach using a calculator method.

Within a broad range of questions, the paper was able to discriminate well. Weakest areas continue to be the application of ratios, scales and rates, but also algebraic manipulation and problem solving. Time remains a weakness as in question 27, where many students were treating 40 minutes as 0.4 or 0.6 for the purposes of calculation. Strengths included knowledge of basic probability, number sequences, averages, and working with questions related to real life problems.

Questions which had a slightly unexpected approach, that is required more thought, caused immediate problems for some, even in the earlier part of the paper. This includes questions 6, 12 and 13. Question 27 to 30 were the more challenging questions for those striving to demonstrate ability at the highest grades available, and a significant proportion of students therefore failed to score on these questions, but this did not stop them from having a go.

The inclusion of working out to support answers remains an issue for many; but not only does working out need to be shown, it needs to be shown legibly, demonstrating the processes of calculation that are used. This is most important in longer questions, and in “show that” questions. Examiners reported some difficulty in occasionally interpreting complex responses, poorly laid out, in questions 19, 24, 25 and particularly in questions 27 and 28. Contradictory work was also seen in question 20.

REPORT ON INDIVIDUAL QUESTIONS

Question 1

Most responses were correct for this question with the most common answer of $\frac{35}{100}$.

The simplified version of $\frac{7}{20}$ sometimes followed or was the only answer given.

Question 2

Working out $\frac{1}{4}$ of 28 wasn't a problem for most students.

Question 3

Most students answered this factors question correctly with many giving more than the requested two factors. This still gained full marks as did writing their answer as factors pairs being multiplied together. The most common incorrect answer was students giving multiples instead of factors.

Question 4

This question was well answered with most giving the correct answer of $6m$. Common incorrect answers were $5m$ or $2m^3$.

Question 5

Most students responded with the correct answer. Occasionally $\frac{13}{10}$ was seen; students need to be reminded to turn off the fraction mode on their calculators, unless working with fractions.

Question 6

Very few students scored 2 marks by correctly drawing a parallelogram.

Students usually understood the definition of a quadrilateral (although there were a number of triangles, and polygons with more than 4 sides). Although students were able to draw a quadrilateral, a significant number were unable to use properties of quadrilaterals to draw a parallelogram. The majority of students who gained one mark for this question drew quadrilaterals without any lines of symmetry. Another common shape for 1 mark was a rectangle where students had understood the question but couldn't find a shape that matched both criteria so went for one of the criteria to secure 1 mark.

Where 0 marks were scored for a quadrilateral the most commonly seen were a square or an isosceles trapezium. From this question it was clear that students, on the whole, understood how to draw a shape with no lines of symmetry but it was the rotational symmetry that most did not understand.

Question 7

This question was answered well, though there was a significant minority who did not attempt the question or fail to gain at least one mark. The main issues for students who did not earn full marks were either poor numeracy skills (not using a calculator), misreading numbers from the table, or only working out the difference for one week. They rarely opted for the method of finding the difference for each week, this method was very poorly executed as they tended to either ignore the -5 altogether or simply ignore the negative. A surprising number of students appeared not to use a calculator.

Question 8

Most found the two terms 28 and 33 in part (a).

In part (b) most students could work out the next two terms but justifying why 50 wasn't in the sequence was not done as well; a significant number of students left this section blank. The most common and efficient answer was to state that all the terms end in a 3 or an 8.

Students who chose another method were not as consistent with achieving the mark. A number of students would state the 48 or 53, but not the two together and therefore not fully proving why 50 was not in the sequence. Some stated the nth term as $5n - 2$ but this needed to be supplemented by a further statement linked to the question. Students should be encouraged to always write out the sequence if it is possible; those who did this secured a sound answer for both parts on this occasion.

Question 9

In part (a) most students were able to correctly give the number of faces of the triangular prism but sometimes a response of 6 was seen (maybe confusion with a cuboid).

Part (b) was less successfully answered than part (a). The most common incorrect answer was 6, possibly due to the face that the diagram showed 2 triangles, 6 bold edges or 6 vertices.

Question 10

This question was well done with most students making an attempt at all parts.
Students were largely confident with part (a) but struggled more with part (b) with many putting a cross at $\frac{5}{8}$.
Part (c) was mostly accurate, with correct notation in fraction, decimal or percentage form, although some only gained one mark by using incorrect notation such as 5:8 or 5 out of 8.
Some did not relate the question to the list at the top of the page and gave an answer of $\frac{1}{2}$, presumably from the probability of choosing an even number from all numbers.

Question 11

This question was answered well by most students**.** A few students did not give a final conclusion and therefore could not achieve full marks**.** The most common approach was to multiply to find the number of nails needed and the number of nails they had. Other preferred methods included working out how many nails they had and divide by 4 to find the number of frames that could be made. A small number of students misunderstood what their values represented and therefore said she didn't have enough and needed 4 more nails instead.

Students need to ensure they use their calculator to check their final values as some showed a correct method, but their multiplication skills meant their values were not correct to get full marks.

Question 12

This was well done by the majority of students who gained 2 marks. They knew how to write 60 as a fraction of 1000 and then correctly simplified the fraction. Those that did not fully simplify were able to gain one mark for $\frac{60}{100}$. A few students did not use fraction form giving their answers in ratio or decimal form but as long as they wrote $\frac{60}{100}$ as the starting point they were awarded the method mark. Students should be encouraged to always show the first step from the information given in the question.

Question 13

Part (a) was well attempted by most students who were able to measure accurately and convert to metres. It was pleasing to see that most showed the calculations required for the conversion. The majority of these went on to gain full marks correctly, adding the appropriate two distances and subtracting the other to find the difference in the overall total. There were a few who used their measurements to calculate the difference of 2 and then multiply by 150 which is a very efficient method. Those that did not measure accurately often went on to gain one mark for showing clear working for conversion and then the difference between the distances, but it was disappointing to find students using measurements that were more than $\frac{1}{2}$ cm different to the diagram, leading to the suspicion that they either did not have a ruler, or did not know how to use it accurately.

In part (b) the vast majority were unable to tackle this bearings question. Of those who did attempt this question it was common to see the bearing of C from A given. There were very few correct answers in the range with quite a few answers of 285 seen, which was just out of range.

Question 14

Part (a) was well answered. A minority gave the answer 7,7 without realising that only one 7 was required highlighting the misconception for how to calculate the median.

Part (b) was also well answered. Some lost the mark because, although 9 – 4 was seen, it was evaluated incorrectly.

For both parts (a) and (b) some students answered incorrectly, giving values for the mean (6.8) and the mode (8).

In part (c) most students attempted an answer. Marks were credited for comparisons using the words median and range (or the acceptable alternatives) but many students did not know that this was the required approach, instead using the words shoe size, feet or distribution. Some simply described the data, listing it or using ‘whereas’ rather than using a comparison word such as larger, smaller.

Question 15

This question was generally answered well. Most common errors included students rounding, not fully simplifying the fraction and incorrectly entering numbers into the calculator by multiplying the top, then dividing by 10 and then subtracting 1.97

The most successful approach is always to work out and state the numerator and denominator separately, and then divide them.

Question 16

In most cases students knew what an isosceles triangle was and were able to draw one. However, students struggled with the concept of the base multiplied by the height is twice the area of the triangle; a common mistake was to draw an isosceles triangle which had an area of 6 cm^2 or one of 24 cm^2. Students need to be aware that accuracy of the drawing is important in this question: it was the drawing on the grid that was marked, and not working or labels that accompanied it.

Question 17

Part (a) was generally well answered. Some students only partially processed the answer leaving it as $12 + -\ 6x$. Others went on from the correct $12 – 6x$ to write $6x$ on the answer line, this scored no marks since it is the answer on the answer line which must be accepted.

In part (b) the vast majority of students made some attempt. For those students who were successful their answers mainly came from an informal method of inverse operations, usually showing $12 \times 4 \div 3 = 16$ with a few using the formal approach of $3y = 48$. Another alternative method was to see $0.75y = 12$ as the first step. Students scoring one mark mainly got this for $3y = 48$ or an embedded answer of 16, usually shown as $3 \times 16 \div 4=12$; unfortunately, many then wrote the 12 on the answer line rather than the 16. Students who knew to multiply by 4 as the first step often failed to apply this to both sides of the equation and only stated the 48, which resulted in no marks since they wrote $4 \times 12 = 48$ rather than $3y = 48$. Students scoring zero were usually unsure of how to approach the first step and would try to add or subtract 4 rather than multiplying.

In part (c) students with understanding of factorisation in algebra did well. The most popular incorrect answer was $10p$ where students simply added $4p$ and 6 together without appreciating that these were unlike terms.

Question 18

In part (a) most students were able to correctly round to 2 significant figures if they attempted the question, but a common incorrect response was 25 showing they thought 2 significant figures meant the first 2 digits.

Part (b) was answered less successfully than part (a). Some incorrect responses included

0.1, 0.08, 0.0900 and 1, showing the students were less confident dealing with smaller numbers rather than larger ones.

Question 19

The vast majority of students attempted this question with a fair proportion getting full marks. The majority found 150 for red, thus gaining the first mark. The most common approach was then to subtract this together with 82 from 400 to get 168 green counters and thus scoring two marks. Some just subtracted 82 from 150 getting 68 instead of 168. If they knew how to find the percentage of amount, they rarely made a mistake for the last two marks, so 3 out of 4 marks was rare.

The most common error was to subtract the 82 from 400 as a first step and then try to find $\frac{3}{8}$ of 318 which resulted in no marks. Another incorrect method seen was converting $\frac{3}{8}$ to a decimal and then adding it to 82.

It was very rare to see students using the alternative method of converting both $\frac{3}{8}$ and 82 to percentages. Some students converted $\frac{3}{8}$ to 0.375 or 37.5 and then added this to 82 before subtracting. There were a fair number of students who managed to add together 82 and 150 then covert this to a percentage (58%) but this was as far as they got, not realising that this was not the percentage of green counters.

Generally, the major weakness was a failure of students to understand how to convert to a percentage for the final answer, which therefore limited the number of marks to just 2.

Question 20

Full marks on this question were rare. It was clear that students knew a lot about angle rules and were able to apply some of this knowledge in the question, but unfortunately, they were frequently let down by their understanding of angle notation and their ability to accurately state the angle facts they were using. It was rare to see students using three letter angle notation so working out under the diagram was often likely correct but unable to score marks as it wasn't clear which angle a student was working out. Students who wrote their answers on the diagram tended to fare better. Students underestimated how to explain their reasons for their working out although those giving reasons usually gained one mark for “vertically opposite” or “opposite angles”. However, phrases like "opposite equal" and "triangles add up to 180" were common, missing the key words necessary to gain the communication marks. Reasons using angles on parallel lines were either often not given or were incorrect.

Students who did not use an angle rule relating to parallel lines sometimes did 180 − 62 (*PQR*) and then divided their answer by 2 to incorrectly work out *CQP*. Others didn’t seem to understand which angle was actually *CQR*: it was not uncommon to see, using angles about point *Q*, the incorrect calculation 180 – 62 = 118.

Question 21

Those who had a clear idea of LCM usually wrote a list of multiples of 24 and 56 until they found the first multiple in common which was 168. This was the most successful method used, which usually resulted in the award of full marks.
The other approaches were linked to the derivation of prime factors, using a variety of factor trees, Venn diagrams or tables, sometimes more than one. Whilst these were usually correctly presented for 1 mark, students rarely knew how to find the LCM from their prime factors, though Venn diagrams were sometimes successfully used.

Question 22

Many did not recognise the need to use Pythagoras' theorem and therefore gained no credit. Some found the difference between the two sides given and produced an answer of 4.5 which attracted 0 marks. Some students wrote the difference of the squares the wrong way around, which gained no marks, unless they corrected this by giving the correct answer. A common incorrect method was for students to assume the perimeter was 20, and then subtract 8.5 and 4 to give an answer of 7.5, which could not be awarded any marks since it was from an incorrect method.

Question 23

In part (a) most students failed to understand the algebraic meaning of $4m^2$. Fortunately, they were usually able to gain a mark for substituting −3 in the expression. Common errors for dealing with $4\times(-3^2)$ included: $4 \times -3 \times -3 = -36$ -11 with the answer of -47 being most popular. Also common was $4 \times 3 = 12^2 = 144$ which could not be awarded any marks. A successful answer of 25 was usually as a result of using brackets around −3.

Part (b) was poorly answered by most students. Many chose to try to simplify the expression, ending up with $7p$. Some felt they should simply swap the d with the p to get $p = 3d + 4$. Of those who realised it required inverse operations to rearrange, most were unable to perform these in the correct order. $p = \frac{4-d}{3}$ and $p = \frac{d}{3} - 4$ were common, or an answer written ambiguously such as $p = d - 4 \div 3$. Most frequently students obtained no marks on this question due to the error in their first step. Function machines were used by a small number of students but even when these were used correctly, the students could not then write the equation with p as its subject.

Question 24

In this question many students were able to find the number of counters each person would get. There were two main routes to these values: algebraic and numeric. Weaker students started by dividing 54 by 3 but were then unsure of where to go from there.

Students who adopted a clear algebraic approach often went on to solve the question completely. However, students occasionally ended up with $4x - 6 = 54$ rather than $5x - 6 = 54$, due to not understanding that Tony had six less counters than Selma rather than Rick.

Most students adopted a numeric approach, and most were successful in arriving at the three numbers 12, 24 and 18 scoring three marks.

Students were less successful in converting the counters each had into a ratio between Rick and Tony. Where students managed this, they usually then went on to gain the full marks for p = 1.5 but those who did not recognise this unitary ratio expression were sometimes put off from writing their ratio of Rick to Tony.

Question 25

Despite being later in the paper it was pleasing to find many students gained full marks on this question with the vast majority able to gain at least 1 mark. There were various methods used but the most popular was to find the cost of 15 rolls for each shop. It was common to find the values £180 and £184.80 clearly stated with the correct conclusion of Chic being the cheapest. The next popular method was to work it out for 5 rolls each. Those that did not gain full marks generally made an error in calculating the percentage discount for Style Papers because they used the breakdown method with the common error of showing 2% as 0.14 rather than 1.4; a correct method to calculate an appropriate percentage was essential to proceed through this question.

Question 26

Most students gained at least one mark, either spotting that the 40 was missing from the frequency scale or that the last point was plotted incorrectly. Clear statements were often given which made the marking more straight forward. Common incorrect statements included that the first and last points should be joined to make a polygon, the graph should start at 0 or that a line of best fit would be better.

Question 27

The most common method for this question was to find the distance of 7.5 by working out the two parts of the journey and adding them together. The difficulty came when trying to find the average speed for Amy and using the time converted to a decimal. Other students used the other method to get to the final answer of 10 by doing 450 ÷ 45 but this was not as common. Students who were successful in following this question through, often worked in minutes using 15, 40 and 45 which gave the correct answer without having to convert them first. Very few students converted the times into hours and when they did, a common issue was the use of 0.6 for $\frac{40}{60}$. A good proportion of students scored full marks for this question though many students just found the average of the two speeds.

Question 28

Most students left this question blank. Almost all of the successful students split *QRVU* into a rectangle and a triangle but complete methods were rare. A few were able to gain a mark for the area of the rectangle or triangle. Students showed a lack of understanding in cases where attempts were made by trying to find the area of the trapezium by using numerical values for the sides of the rectangle, trying to write an expression by adding the perimeter or parts of the perimeter or trying to rearrange A= $2x^2$ +$20x$. The majority of the marks that were given were for $4x \times 5 = 20x$.

Question 29

Most found this question challenging. Many students just offered the wrong answer of 3000 or 30000 or 300 on the answer line. One of the most common errors was converting metres to km by multiplying by 1000. A significant proportion divided by 1000, correctly, to convert metres to kilometres and thought they had finished. The majority of the marks given were for seeing 0.03 or 108000.

Question 30

Most of the students did not recognise that this was a reverse percentage question so just found 15% of 13600 and added it on. This is a very common misconception. Those who were awarded full marks mostly used the method 85% = 13600, 1% = 160, 100% = 16000
Those who used the multiplier of 0.85 often incorrectly used it to multiply rather than divide. Even when students correctly identified that they had 85%, they did not understand that they needed to divide by 85 and multiply by 100 to get back to 100%.

Summary:

Based on their performance on this paper, students should:

- ensure that their written work is legible. Figures taken from the question, and taken from student's own work, need to be transcribed accurately.
- avoid rounding or truncating answers to calculations and use the most accurate values where possible.
- practise algebraic manipulation and derivation, application of ratios, scaling and rates, and time.
- learn to use their calculators for working with percentages, rather than always using a break-down / partitioned approach.
- include working out to support answers.
- be confident in their use of measuring equipment in drawing and in measuring.

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