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Examiners' Report
Principal Examiner Feedback

November 2023

Pearson Edexcel GCSE (9 – 1)
In Mathematics (1MA1)
Foundation (Calculator) Paper 2F

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Foundation Paper 2

Introduction

This paper was accessible to all students with working clearly shown on the majority of questions on the paper. Some questions, mainly towards the end of the paper, were not as well answered by students but this was due to the differentiation and ramping of the level of demand of the questions. However, it was pleasing to see 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 12b, and 22 showed improvements.

There is evidence that some students continue to use non-calculator written methods and as this paper requires the use of a calculator, students are expected to have access to and have a reasonable working knowledge of how to use it. When a calculator is not used, students appear to be less successful in calculating accurate final answers and written calculations are often more time consuming as well.

Students should carefully read the question fully and ensure the magnitude of answers seem appropriate for the question. Students should be encouraged to write down the calculations entered onto their calculator for all questions rather than only giving an answer as there is some evidence that a correct intermediary process may have been used but unfortunately a lack of working often meant that no partial credit could be awarded. Layout of working should also be set out in a clear and logical way, particularly on the larger problem solving questions.

REPORT ON INDIVIDUAL QUESTONS

Question 1

A good accessible start to the paper with this question being well answered with most students scoring the mark.

Question 2

Another accessible question with the majority of students correctly writing the decimal as a fraction.

Question 3

Over two thirds of students could change between metres and centimetres. Converting between metric units still remains challenging for some students with many forgetting the conversion factor to use.

Question 4

Writing a square number between two given values appeared to be challenging for some. Common incorrect responses included 4^2, 5^2 and similar but gained no credit.

Question 5

The majority of students were able to find a simple percentage of an amount in this question which was very pleasing to see.

Question 6

The majority of students were able to score full marks for finding the amount paid per hour. The final answer was often presented in a variety of ways including £12.5, £12.50 and £12.50p, all of which gained full marks. A small number of students lost the accuracy mark by writing 12.40, 12.45 or 12.05, however these students often still scored 1 mark for showing a correct method. There were a significant number who did not show any method and potentially risked both marks had they evaluated incorrectly. The most common incorrect response was to multiply rather than divide.

Question 7(a)

The one mark available for stating that the 3-D shape was a cone was awarded to a great many students. Common incorrect answers often included a combination of a number of 3-D shapes and sometimes a mixture of 2-D and 3-D shapes but this was less common. Triangle cone, cylinder cone or cylinder pyramid were the most commonly seen answers that gained no credit.

Question 7(b)

This question was answered very well by students, with many able to show a clear intention to draw a triangular prism. Unfortunately, not all students were able to show 'hidden' lines but this did not detract from their understanding of what the shape looked like and credit was still given. The most common incorrect shape was the drawing of a triangular pyramid.

Question 8

The first multi-step problem on the paper was tackled well with most students able to work with the different multiples of objects and obtain the correct cost for at least 2 different items using the constraints given. The presentation and amount of explanation varied, with some showing calculations to gain £188.5 only and others annotating to explain that £188.50 is less than £200 or calculating the amount of money left over. Each of these responses were sufficient for the award of all four marks.

Some mistakes were often made, the majority of which seemed to be related to misreading or misinterpreting the information. Common mistakes were that 4 tennis balls cost £4 rather than £5 or that the hockey sticks were £30 each. The majority of students who did not score full marks were able to score partial marks by clearly showing their processes for multiplication and addition, however there were a few who missed out on marks due to not clearly showing their process. For example, writing £80 for hockey sticks without showing where this came from.

Question 9

Listing possible combinations was generally answered very well, with many students who took a systematic approach to listing the combinations, (eg starting with WP, WS, WC) having the

most success. Some started with WP, BS, GC and sometimes went wrong or omitted one or more combinations or gave repeated combinations.
Some responses showed the combinations written in full words, rather than using the letter given in the question. This was, of course, acceptable, but may have taken longer than necessary. Some answers failed to list all 9 combinations, and so students should be encouraged to check that they have the correct total based on the options available for each variable.
A few students repeated combinations (eg WP and PW), which tended to score only 1 mark.

Question 10

Many correct ratios in the simplest form of 3 : 5 were seen and gained full marks. Where 2 marks were not awarded, the majority picked up the method mark for using the information given in the question to set out the ratio as 24 : 40. If the ratio was not fully simplified, students usually stopped at 6:10 and occasionally further incorrect simplifications were shown or changed to a fraction leading to the loss of the accuracy mark. When no marks were awarded it was often due to writing fractions rather than using ratio notation or writing the ratio 24:16 instead of 24:40.

Question 11

Both part (a) and part (b) required students to select an appropriate description of the likelihood of an event occurring. A correct selection in part (b) occurred more frequently than in part (a), with over three quarters of the cohort correctly identifying evens for part (b).

Question 12

This simple speed/distance/time question produced a lot of fully correct responses, with most students demonstrating they were able to multiply the speed and time to gain the correct answer. The most common incorrect method involved dividing 37 by 3 or doing an extra step such as dividing by 2 or multiplying by 60. Sometimes, students incorrectly believed that they needed to convert one or more of the figures by multiplying or dividing by 60.

Question 13

Both parts (a) and (b) required students to identify errors made in calculations or answers to calculations and were generally well answered. The main loss of marks was where the students contradicted their otherwise good response with incorrect statements such as an incorrect figure or correctly identifying that Milo needed to multiply the length and width once only BUT then added that Milo had found the perimeter or volume.

Similarly, in part (b) many students answered this question really well, referring to the need for square units. Some said ‘Anya should have squared’ which was ambiguous and scored no marks. Of the students not gaining the mark in part (b), it was often due to not referring to units at all and focussing on what the answer should be based on part (a). Centres should make students aware that a contradictory, or wrong, response on an explain question loses the marks.

Question 14

This question involving the use of direct proportion in a multi-step problem was answered correctly by more than half of the students which was very pleasing to note. Almost all students

were able to find the cost of 1kg of flour by dividing 4.05 by 3 to get 1.35, with many then gaining the second mark for beginning to work with the cost of the sugar using a variety of methods. A larger than expected number of students misinterpreted the information with many assuming that 6kg of sugar was £11.85 and then dividing £11.85 by 6 to find the cost of 5kg sugar without considering whether their answer was feasible. Students who found 5.10 often then correctly found the cost of 5kg of sugar and stopped. Many found 6.95 as the answer but some found the separate costs (2.70 and 4.25), which were also awarded full marks.
For this question involving a large number of figures to use and interpret, students may have benefitted from labelling each calculation with what the value represented, as students who showed their processes clearly and methodically were often more successful.

Question 15

Most students were able to find 72% of 120, but it was disappointing to note that many still used a build-up method with this topic as several correctly found 70% but struggled to find the 2% accurately using this method. If the full process was not shown, due to listing their values for e.g. 50%,10% and 1%, the process marks could not be awarded for incorrect values. Of those correctly finding 72% of 120, many went on to incorrectly subtract 30% of 120 from 86.4 rather than find 30% of the value just found. It was common to see an incomplete answer of £25.92 from correctly finding 72% then 30% of the answer, but not subtracting this to find the amount remaining. Centres should encourage students to write a valid process when calculating percentages of amounts and ensure they are aware that simply writing 120 × 72% is not acceptable unless an accurate answer is shown.

Question 16

It was pleasing to note that a good number of students used two-way tables in this unstructured problem and using this method often yielded full marks. Other successful approaches involved using a flow diagram for children and adults which again yielded a high success rate. Most students gained at least one mark for using the initial given information to find either the total number of adults or adult romance, children adventure and many then calculating the number of adult horror. Finding the number of children horror was more troublesome for many students not gaining full marks. One notable error was for the students to add the various totals together to get 116 and subtract from 160 and continuing to divide by two as they misinterpreted the part about two sections being equal. This gave an incorrect result of 22. Many students unfortunately, just had numbers written in the answer space not linked to anything specific.
Students should be encouraged to approach this style of question in a systematic way such as using a table or labelling when calculating values as this may allow them to keep track of the information they have found and guide them as to which information they still need to find.

Question 17

A standard question requiring students to draw an ordered stem and leaf diagram with key for given data. Almost all students attempted the question, with many scoring full marks and nearly all students gaining at least one mark. Where marks were lost it was often due to a missing or an incomplete key, not ordering the leaves, or an ordered diagram with one omission. Learners should be encouraged to count the number of digits in their answer and check that it agrees with the number of values in the initial data. Where no marks were awarded, it was often due to not demonstrating an understanding of a stem and leaf diagram, some using the number 1 as

the stem, listing all numbers as leaves or trying to complete some sort of pictogram or tally chart.

Question 18

This familiar calculator use question was generally answered well and the award of 3 marks was common. Some students only scored one mark in part (a) for either 8.82 or 16.6 and some scored a mark for 1.88 rather than writing all of the digits on their calculator, as instructed in the question. As with previous similar questions, writing an answer containing at least 3 decimal places is sufficient to gain full marks in part (a). A small number gave a fraction so again only scored 1 mark for not fully evaluating their answer.

Whilst the majority of students gave 1.88 in part (b) some rounded to 1.8, 1.87 or 1.90. Follow through from their answer in part (a) was allowed and this was frequently awarded when only partial marks were given in part (a). A small number of students multiplied their answer in part (a) by 10 or 100, but this was not very common.

Question 19

Although many students were able to make a start on this geometry question utilising angle facts, fully correct responses were rarely seen. Students could gain the method marks either from labelling the diagram or from calculations in the working space, and many were able to identify an angle in the equilateral triangle for the first mark. Completing the method as far as 78 degrees was more challenging, however, usually because they were unable to identify the alternate angle in the quadrilateral as being 60 degrees or subtracting from 180° rather than from 360°.
The question asked for a reason for each stage of the working that was relevant to their chosen method, and the attempts at these were generally poor or completely absent. Some students managed to gain one of the C marks, usually for reasons involving angles in a triangle or a quadrilateral, or for identifying the equilateral tringle. Acceptable reasons relating to the parallel lines were seldom seen, without which students were unable to gain full marks.
Centres should give students guidance and practice in how to express their reasons for angle work. The minimum wording accepted when awarding marks is indicated by the underlining in the mark scheme. Students should also be encouraged to only list angle facts used as part of their working.

Question 20

A large number of students assumed the graph would be a straight line and completed the table to suit their line with no calculations using the given equation being shown. Some students gained 1 mark by correctly evaluating the y coordinate for the positive values of x only, although very few gained both marks for part (a) as they struggled evaluating the y coordinates for the negative values of x, indicating difficulty in carrying out calculations with negative numbers. Similarly, many students achieved the method mark in part (b) for correctly plotting 4 of their points correctly but plotted the points with negative x and/or y values incorrectly. Very few students produced a fully correct curve, with a very small number who evaluated and plotted all points correctly losing the accuracy mark as they joined all points with line segments rather than a curve or did not show the minimum point of with a clear curve.

Question 21

Describing a single transformation is still found to be challenging for a large number of students. A high proportion of the students thought that it was a rotation of 180 degrees, not a reflection. Of the students that gave the single transformation as a reflection, very few scored the second mark for stating a correct equation of the line such as $y = -x$. Incorrect terminology was also used in place of reflection such as mirroring or flipping the object.
It was rare to see any fully correct answers with the majority of students including a centre of rotation, angle of rotation or stated a translation vector which provided a contradiction by implying a second transformation, thus leading to no marks being awarded.

Question 22

Success in expanding and simplifying an expression in part (a) varied considerably. Many fully correct answers were seen, and of those not gaining full marks, a mark was often awarded for either expanding one bracket correctly or collecting like terms for one variable, often y, correctly. Many expanded the brackets correctly but then did not know how to simplify either ignoring the signs or adding all terms together to give a single term as an answer. The importance of adding / subtracting negative numbers correctly in algebra questions appears to be challenging for Foundation tier students. A small number of students confused this type of expansion with multiplying 2 brackets resulting in having a term in y^2 but this was less common than in previous similar style questions.

Part (b) was answered with moderate success with a pleasing number of students able to factorise the terms to identify the HCF of $3x$ in order to obtain their answer of $3x(2x+5)$. However, a large number of students appear to not know what the word 'factorise' means; with several students trying to add the terms together or attempting to solve and find a value for x. There were a few students who knew what factorising meant, but due to the x squared term, thought this was a two bracket factorisation and subsequently failed to achieve any marks.

Rearranging a formula proved to be challenging for the majority, with very few students being able to rearrange fully or partially. The most common errors included simply transposing the f and g in the original equation or stating the correct process but failing to apply this correctly to one or both sides, eg stating -11 and/or $\div 3$ but not applying this to both sides of the equals sign.

Question 23

It was pleasing to note that students were able to access this calculating the percentage profit after working with income and outgoings in this small problem, with some students successfully reaching the correct answer and a large number gaining partial marks. Responses to this question often started well, with many students gaining 1 mark for finding both the income and outgoings. A second mark was also often awarded for beginning the process to find the percentage profit, commonly by finding the difference between income and outgoings. Unfortunately, many who found the difference did not seem to know what to do next with this value, with a variety of attempts to work with it being seen. It did not seem to be clear to most in this cohort that percentage profit means percentage of outgoings. Incorrect next steps that were frequently seen were writing 10.5 or dividing 105 by 100 or by 405. Others instead worked out 300 as a percentage of 405 or attempted to add 300 to 405, meaning that there was no work with profit and only 1 mark was scored.

Question 24

The vast majority of students achieved 1 mark in this standard compound interest question, for finding the amount in the savings account after 1 year including interest. Some students successfully found the interest for one year or embedded this by finding simple interest for two years, showing that they could work with percentages but not all could distinguish the difference between simple and compound interest. Some students, however, found the interest for one year but did not gain the mark as they failed to add it to the starting investment amount, and a small number also failed to gain any marks as they successfully found the simple interest but then incorrectly subtracted it from 4500. A very small number of students simply multiplied or divided 4500 by 3.4 or 6.8, showing no understanding of how to calculate with percentages.

Question 25

The level of success when solving this algebraic equation with the unknown variable on both sides varied greatly. Students appeared to find this question challenging with a very small number not attempting at all. A correct 1st step of adding x or adding 14 was often indicated as the intention but incorrectly executed leading to $4x = 38$ or similar. A common error was to subtract x from both sides instead of adding. Elimination of -14 was more commonly carried out correctly. Most students attempted to answer the question algebraically, but a larger number than expected attempted an entirely numerical approach. Trial and improvement methods usually led to no marks, but some obtained the correct answer of 11 and therefore gained full marks.

Question 26

This question was poorly answered with the vast majority of scoring students only scoring one mark for identifying and working with the given amount of £120 equating to four parts of the ratio. The ratio 90:120:60 was often seen and awarded the first mark. Of those scoring no marks, it was often due to interpreting the question as being to share £120 in the ratio of 3:4:2 rather than considering the information as being a part to whole problem, with the most popular incorrect value seen as £30. Of the students who successfully worked with the initial ratio correctly, a few continued to complete the question correctly and divide the total of the initial ratios of £270 by 10 to give one part of the new ratio as £27. Hence, obtaining the correct answer of £21 difference.

Question 27

Very few students were able to demonstrate an ability to calculate with bearings in this question. A common incorrect answer was 360 – 147 = 213 and suggests a lack of understanding of this type of bearings question. Very few students attempted to draw a diagram, which would have been helpful in calculating their answer and occasionally gained 1 mark. Students should be encouraged to draw a diagram as a starting point for this type of question.

Question 28

This multi-step question required the use of a variety of skills being combined to solve a problem and appeared to be very challenging to a large number of students. Whilst many students knew they needed to find the volume, only a very few students were able to correctly

calculate this, with many simply multiplying the radius by the height or the circumference by the height. Converting cm^3 to litres or 0.47 litres to cm^3 was generally only seen in fully correct responses. The final skill of working with a flow rate was often the only mark being awarded, namely for [volume] ÷ 0.47 to find the time taken. However, a large number multiplied by the flow rate rather than divided.

Question 29

This standard question involving trigonometry was not answered well. Of the students able to link the question to trigonometry, many used the formula sheet to effectively rewrite SOHCAHTOA next to the question but many were unable to identify the correct trigonometric ratio to use. When tangent was used, the answer was often calculated correctly and given to the appropriate degree of accuracy but some often incorrectly substituted the angle in place of a side in the formula. Quite a few students tried using Pythagoras' Theorem to calculate the lengths or tried to use angle properties of a triangle to try to find the unknown angle.

Question 30

This final question appeared to be challenging for a great number of students. Of those students who tried to create a multiple of one or both equations and identified the need to subtract the equations to eliminate a variable, most struggled with the negative numbers or forgot to multiply all parts of the equation. A negative sign was frequently lost in the working and calculating with negative values caused a large number of arithmetic errors. When students successfully showed a correct method and were awarded the first mark, the majority often went on to substitute successfully to earn the second method mark. It was rare to see a fully correct response. Some students used checks of their answers, with many then able to correct any earlier arithmetic errors. When students gained no credit at all, it was often due to either trying to combine the initial equations without first altering either equation or attempting to use a trial and improvement method which scored no marks unless correct values for x and y were found.

Summary

Based on their performance on this paper, students should:

- ensure they have access to a suitable calculator and have a good working knowledge of how to use it
- read questions carefully, including after reaching a final answer to check whether the magnitude is sensible, units are appropriate, and the level of accuracy required is shown
- practice questions involving proportion and manipulating algebraic expressions
- be able to recall formulae and angle facts to solve problems and support working shown.

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