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Examiners' Report
Principal Examiner Feedback

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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 appears to have been generally accessible for the majority of learners, particularly with the types of questions which are more familiar to the learners, and these were generally well attempted by most. Overall, the paper was answered well, and there is evidence to show good differentiation between the learners achieving higher grades and the learners achieving lower grades.

The learners appeared to be well prepared for many topics, particularly in the first half of the paper. It was pleasing to see the learners making improvements in their attempts to answer questions that required explanations, with Q8a and Q8b in particular being very well answered. In the second half of the paper, the greatest success was seen in more familiar questions. For example, showing inequalities on a number line in Q19a, interpreting scatter graphs in Q21, and drawing a quadratic curve in Q24. However, there was a lack of working shown in questions such as Q6, Q16, Q22 and Q25, where the learners were directed to show all of their working. This occasionally led to marks not being able to be awarded. The presentation of calculations was not always clear, particularly in problem solving questions where a decision was required, such as Q22. In these questions, the working was often messy with calculations spread across the page and therefore difficult to follow. The inclusion of working out to support answers is essential to gain full credit. Working out not only needs to be shown, but it needs to be shown in a clear and logical way, demonstrating the processes of calculation that are used.

Many of the learners' work was also inaccurate due to miscopying figures, either directly from the question or their own calculated values, found most frequently in Q12 and Q15, but also found in other questions. Contradictory work also remains a common cause of lost marks due to a range of approaches being attempted, and the method intended to be marked was not always being clearly identified.

This paper requires the use of a calculator. All the learners should have access to a calculator and have a reasonable working knowledge of how to use it. There is evidence that some learners are continuing to attempt to use written methods, which has also been seen in previous series. This often means that calculations take longer, and there is an increased chance of the final answers being inaccurate, often due to premature rounding. This was most noticeably seen in Q17(a) and Q22. Build-up and build-down methods were often used when division or calculating with percentages was required, which has also been seen in previous exam series. This approach is often far less successful than a more direct approach using a calculator method.

REPORT ON INDIVIDUAL QUESTONS

Question 1

The opening question was accessible to all learners and was well answered with very few learners not being awarded the mark, often due to writing 17% as a decimal rather than a fraction or having an incorrect denominator such as 10 or 1000 with 17 as the numerator.

Question 2

It was pleasing to see that the majority of learners could correctly convert minutes to hours and minutes successfully.

Question 3

Ordering decimal numbers by size was not as well answered as expected. The most successful approach seemed to be those who added trailing zeros to ensure each number had the same number of decimal places to allow an easier comparison to be made.

Question 4

Naming the shape in this question appeared to cause very few issues for the majority. Incorrect spellings were often seen but learners were rewarded with the mark if the intention was clear.

Question 5

Finding the number halfway between the two given values was also well answered, with many responses showing the use of a list of numbers to identify the correct answer.

Question 6

Whilst many correct responses were seen to this question, a lack of working often led to full marks not being awarded. This question directed learners to show all of their working, which meant evidence of working with both bead colours was required, but it was common to see only the red beads being worked with despite an often correct answer of 10 being shown. This level of working only gained the first mark. Learners showed a variety of approaches such as divisions of $52 \div 5$ and $80 \div 7$. The most commonly seen approach was repeated addition of 5 and 7 or repeated subtraction from the available beads. Whilst build-up and build-down methods did gain some credit, occasionally arithmetic errors were made in one or both lists so learners should be encouraged to use their calculators to save time and avoid such errors.
A common incorrect approach was to divide the total number of beads available by the number required for one bracelet, $132 \div 12$, giving an answer of 11. This gained no marks.

Question 7

There were occasions in this question where learners confused the statistical terms mean, mode, median and range, resulting in an incorrect method being used in either part (a) or more commonly in part (b).

Part (a) was answered well, with many learners aware of the need to sum the ages and divide the total by 8. There were a few arithmetic errors when adding, but if the full method was shown, learners could still gain 1 mark.

A variety of incorrect answers were seen, and very often these seemed to be statistics other than the mean. The most common errors seen were 10 (the mode), 11.5 (the median) and 6 (the range), all of which gained no marks.

Part (b) also had many correct answers from working out the range. Sometimes either the maximum or minimum was incorrectly chosen, and as in part (a) we also saw some incorrect statistics, most often the mean.

Less success was evident in part (c), with a larger than expected number of learners not being able to show the probability correctly on the scale provided. The most common incorrect response was to misinterpret the divisions shown on the scale and mark at $\frac{1}{8}$ rather than $\frac{1}{4}$.

Question 8

Both parts of this question required learners to use reasoning skills, with part (a) requiring a written explanation and decision and part (b) requiring learners to show a correctly evaluated counter-example. A lot of learners gave very good answers to part (a), demonstrating an ability to clearly explain why the statement was wrong. The most common ways that they did this were either to point out that 10^2 is 100 or to explain that 10 had been multiplied by 2 rather than by itself. The mark scheme shows other acceptable ways of answering the question, but these were less commonly seen.

In part (b), many learners gave a wide range of acceptable examples of a division that produced an odd number or any non-integer. The result of the division did have to be evaluated correctly so unfortunately responses without showing the result or containing an arithmetic error did not get the mark. A significant minority of learners used odd numbers instead of even numbers, preventing the award of the mark.

Learners had to give clear, correct answers to both parts of this question, and if there were incorrect elements to their statement, or contradictions, they did not gain the mark for that part of the question.

Question 9

Success with this familiar style of question on writing figures in a ratio in its simplest form was evident, with many fully correct responses being seen. Most learners correctly showed 90 : 150 and gained the first mark. They usually then tried to simplify it, with varying degrees of success. Some made errors in the simplification, others stopped too early, and others carried on to successfully reach 3 : 5 for full marks. A small number of learners seemed unaware of correct ratio notation and, although some began by writing a correct starting ratio, chose to then write it as a fraction and were then unable to gain any marks.
It was quite rare for learners to write the numbers the wrong way round. Where they did this, they could gain a maximum of 1 mark if they simplified all the way to 5 : 3.

Question 10

This problem-solving question presented a challenge to learners, with many not able to reach the correct answer and only being able to gain one of the three marks available by making a valid start to solving the problem. The most common error was to add up the perimeters of all five of the squares seen in the diagram, taking no account of the fact that this included lengths on the interior of the shape. These attempts led to answers of 200 and scored only 1 mark. Where learners began by working out that the side length was 10, often shown on the diagram, they tended to have more success. Sometimes they had difficulty counting up how many 10s were needed to go round the outside, so answers of 110 and 130 were often seen.

Question 11

Simplifying the algebraic expression involving multiplication in part (a) was well done by a large majority of the cohort. Success in part (b) was more varied though, with scores of 0, 1 and 2 marks being awarded in equal proportions. It was common for learners to become confused with the minus sign, and one of the most common wrong answers was $5d - 5e$ but such answers were awarded 1 mark for correctly showing a partial simplification and $1d + 5e$ due to dealing with the signs incorrectly. Answers of $5d + - 3e$ scored only 1 mark as they were not fully simplified, but this was rarely seen.

Question 12

This was the first multi-step question on the paper which combined the skills of finding a percentage of a quantity and using proportion, with a large number of learners being able to follow the necessary steps through correctly to gain an accurate answer. When errors were made after correctly finding 60% was 108, it was often due to becoming confused and selecting the wrong figures to use in their next set of calculations. Encouraging learners to label what intermediate figures are in their working would help here.
Another common issue was incorrect percentage work. It still remains a problem for learners to simply write 60% of 180 or try to use a build up method, namely 10%, without using their calculators and without showing their calculations and therefore gaining no credit if arithmetic errors were made. Evidence also suggests some may be trying to use the percentage function of their calculator unsuccessfully.

Question 13

Performance in this angle reasoning question was varied, with the full range of marks between 0 and 4 being awarded. Whilst the majority of learners were confident to attempt this question, with many gaining 2 or 3 of the marks available, it was very rare to see a fully correct response worthy of 4 marks. A good start of working correctly with angles at a point or angles on a straight line to find missing interior angles of the triangle was common to see. This gained the two method marks and many also gained a communication mark for stating a valid angle fact if this linked clearly to their method used. It is surprising to note the number

of learners who misunderstand the concept of angles on a straight line, believing that angles at two different points on the line will also sum to 180°rather than angles at a single point on the line.
However, the quality of the reasons stated for the stages of their working was very mixed and some learners wrote no reasons at all. Others attempted reasons but were not able to do so clearly enough to gain credit due to not including the underlined words on the mark scheme which indicate the minimum requirements. To gain the final mark, learners needed a statement that two angles were equal or similar, correct figures, and fully correct reasons for each stage of their method, with the statement confirming the triangle was isosceles or clearly identifying the size of angle *CBA* being the most commonly omitted elements.

Question 14

This question assessed the ability to interpret and complete a travel graph, with responses to part (a) typically being correct to gain a mark. A large number of good responses were seen in part (b), with many learners able to draw a horizontal line of the correct length, followed by a correct straight line back down to the time axis. Sometimes only one of the two was correct, which gained just 1 mark. In responses where the horizontal part was incorrect, it was usually either the wrong length or completely missing, rather than being drawn at an angle. For the part representing the journey home, some learners incorrectly drew an upwards-sloping line, and others drew lines to the incorrect time on the x-axis or drew lines which were either not a single line or were curved rather than straight, which were not acceptable.

Question 15

Performance in this question assessing the use of a ratio scale was poor but in line with similar questions in previous series and fully correct responses were rarely seen. A large number of learners were able to get started, usually by using 14 cm with the scale partially to gain the first mark but many were then unable to convert between cm and km, often just dividing by 1000 and not able to show an understanding that 25 000 represented cm rather than metres. When full marks were awarded, learners often showed the required division by 100 000 in stages of dividing by 100 followed by 1000. Some learners attempted no conversion at all.
In some cases, there was confusion about how to use the scale, with wrong attempts such as $25000 \div 14$ as a first step but this was less commonly seen.

Question 16

This question required learners to show working to support their choice and many showed a valid start to the problem by finding one suitable probability or proportion to gain the first mark and credit was often given for responses using ratios of 10 : 30 or 7 : 18. Comparable probabilities in a common format such as percentages, decimals, or written as fractions with common denominators or even common numerators were required for the second mark. However, whilst an initial probability or proportion was commonly seen, many learners made

no attempt to convert to a common comparable format so gained no further credit. Of those who recognised the need to compare in a common format, many gained full marks for providing accurate comparable figures and a correct decision.
For those working with ratio, many were unable to find two ratios with either the same left-hand side or the same right-hand side in order to make a comparison, with some then attempting to convert to fractions unsuccessfully.

Question 17

Part (a) of this question was well answered, with many learners successfully performing the percentage decrease accurately. Most began by calculating the 7% and then subtracting it, rather than working directly with 93% but both methods were acceptable. The most common cause of the loss of marks was to work with percentage methods that were inefficient and avoided use of the calculator such as using partitioning to build-up towards 7%, often via amounts such as 10%, 5% and 1%. Such methods are frequently used and often lead to inaccurate values being calculated compared to learners using a more efficient method such as decimal multipliers.

Part (b) was poorly answered but in line with performance in questions from previous series using this skill. Whilst some learners were able to find the bonus of £400 which also gained the first mark, many were then unable to continue with a correct calculation to demonstrate that £400 represented 5% and use this to work back towards 100%. A very common error was to find 20% of 400, and these responses only gained the first mark, but it was more common to see learners gain no credit due to either working out 5% of £1700 and adding it on or finding 5% of £2100 and subtracting it. The most successful learners were those who wrote statements such as £400 = 5% and then continued to either divide by 5 then multiply by 100 or used a build-up method to show £800 = 10% and continued to build until 100% was reached.

Question 18

This familiar and standard question required learners to describe a single transformation using a given diagram. When marks were awarded, a partially complete response was given, and it was common for the centre of enlargement to be omitted. Many learners were only able to identify the transformation as an enlargement and give the scale factor of 2 which was described in a variety of ways but with the intention needed to be clear for credit to be given. No marks were awarded if learners described more than one transformation, but this was seen less frequently compared to previous series which was pleasing and when seen, it was invariably a translation that was described, sometimes using informal language such as “then move right and up”. When marks were not awarded, it was often due to either only one element of the three being provided or for simplistic statements such as “its doubled in size” or is “twice as big” which were unacceptable descriptions on their own.

Question 19

Fully factorising the expression in part (a) proved challenging for many learners and whilst some learners knew what to do, the correct response was not seen regularly. Of the learners gaining credit, the majority gained both of the marks available for a complete factorisation shown. The award of 1 mark was awarded less often than full marks for any partially correct factorisation, with the common factor of 5 or w being the most frequently seen.
Some learners showed incorrect use of algebra, sometimes attempting to write the expression as a single term such as $10w^2$ or by including w in a factorisation where w had already been removed as a common factor which resulted in no marks being awarded.

In part (b) there were a great number of fully correct responses with 2 marks being frequently awarded. Some learners were confused about which circle should be open or closed, but these usually gained 1 mark for showing the line from -2 to 4. Alternatively, just one correct circle drawn open at -2 or closed at 4 was also given 1 mark to learners. Crosses or circling of the correct numbers on the number line were not acceptable in place of the endpoint circles, and nor were arrows. Similarly, the use of the number line to join correct endpoint circles is not acceptable for full marks but often gained the partial mark.

Question 20

This very familiar use of a calculator question was very well answered by most learners, showing that they were able to use a variety of functions on their calculator to reach the accurate answer. Learners who showed figures that implied a partial evaluation, were awarded 1 mark for reaching an intermediate value or for an answer of 4.64 but a response gaining 1 mark only was rare compared to previous series. When errors were made, it was often due to incorrect use of the square root which was commonly only applied to the numerator rather than the whole fraction.

Question 21

This three part question centred around interpreting a given scatter diagram. Most learners were able to identify that the type of correlation was positive in (a). Common incorrect answers included ‘negative’, ‘increasing’, attempts at a description and a range of other wrong guesses but blank responses were seen less frequently.

In part (b), many learners were able to draw an acceptable line of best fit and gained the mark. When the mark was not awarded, it was often due to drawing a line from the origin to the corner of the grid which was outside the range of tolerance or simply joining the points in a dot to dot fashion. Learners should be reminded regularly that a line of best fit does not need to start at the origin and that the line must be straight and not curved.

Many learners reached an answer within the acceptable range in part (c), with some doing so even if their line of best fit was omitted or not fully within tolerance. For learners who drew a

line of best with fit with positive gradient such as from the origin, their reading was followed through and credit given if correct for their line, even if the previous mark had not been gained. Of the learners who had gained the mark in part (b) for a suitable line, some were unable to interpret the scale correctly and didn't recognise that each small square on the vertical axis represented a width of 0.5 m and interpreted each small square as representing either 1 m or 0.1 m leading to a frequently seen incorrect answer of 25.6.

Question 22

A large range of approaches to find comparable figures were possible and seen in this best value for money involving a currency conversion question, and quite often learners lost track of what they were doing and did not complete the processes required and responses gaining full marks were rarely seen. Partial marks, commonly 1 mark, was very common for a correct starting calculation and this was most often for a process to perform a currency conversion. Despite correct use of the conversion factor, the majority of learners were not able to use direct proportion effectively or at all in order to find the cost for the same weights in both places. The most successful weight comparisons made were learners who used a unitary method to find comparative figures for either 1 gram, 100 grams or 1800 grams. Some learners attempted to convert the price and then simply double the cost in London to compare 400 grams to 360 grams but this kind of comparison was often insufficient to gain full credit. Units were not required for the final answer, but if stated they did need to be correct to gain the last mark.

It should also be noted that the working for this question was often presented in a very messy and unstructured way that was often difficult to follow, particularly when a variety of approaches were shown in a single response with no clear indication as to which method the candidate wished to be marked as their final answer. In such cases, the general marking guidance is to mark each method and then award the lower number of marks. Premature rounding or truncation was also evident but was not penalised if correct to 2 significant figures.

Question 23

As with many questions requiring a written explanation about errors made in the way information is presented, this question appears to have been challenging for many learners. To gain the marks, learners needed to give clear statements about both the incorrectly placed 17 and the omission of 1 from the diagram. General comments such as "add the missing odd numbers" were incomplete and gained no credit. Many also gave ambiguous comments about "removing the 17 from the 'A' circle", which suggested that they thought the overlap was not part of Set A and was considered to be a contradiction. When comments were not fully clear, credit could still be awarded if the diagram contained evidence to support the statements, for example in cases where learners had clearly indicated which 17 they wanted to remove or had added the number 1 in the right place.

Question 24

A standard and familiar topic, this question discriminated well, with a range of different scores seen. Many learners were able to gain 2 marks of the 4 available for either completing the table correctly in part (a) or finding at least 2 correct values and beginning to plot points. The most common error when completing the table predominantly involved the negative x value or when $x = 0$. Another commonly seen wrong answer was an attempt at an arithmetic sequence to give 1, (0), −1, −2, (−3), −4, −5 which gained no marks.
When plotting the points in part (b), most learners could do so accurately and gained one mark for plotting. Most attempted to join them with a smooth curve but where points were joined with clear line segments between points, a maximum of 1 mark could be awarded. Pleasingly, this was less frequently seen compared to previous series.

Question 25

Whilst the majority attempted this question learners historically find this particular topic more challenging and this series is no different to previous series. Whilst, many learners were awarded the first mark for a suitable starting process to find one or both increases via subtraction, many also continued to use the values found incorrectly and evidence suggests that many learners are not confident in the process to calculate a percentage increase. The most commonly seen incorrect next step was simply to compare the 9 and the 1 by subtracting them from each other, dividing them or then finding 9% and 1% of the old or new prices.
Although the question asked learners to compare percentage changes, alternative acceptable methods seen included working with decimal equivalents throughout. Some learners were also unsure whether to find the percentages of the old price or the new price, performing incorrect divisions such as 9 ÷ 85 or 1 ÷ 66 and so could not gain more than the first mark.

Question 26

This 5 mark multi-step problem required learners to use a variety of topics that learners find more challenging such as forming and solving equations and using Pythagoras' Theorem. Whilst many attempts to begin to solve the problem were shown, there was often not enough working to gain credit, such as forming a suitable expression for the perimeter but not setting this equal to 72 to form an equation for example. Of the learners who were able to gain the first mark for forming a suitable equation, many then usually managed to get the second mark for correctly isolating terms in x. After finding a value for x, many correctly substituted to find the length of all 3 sides of the triangle but unfortunately, did not know what to do next and it was very rare to see any attempt to use Pythagoras' Theorem. The most commonly seen next step was either attempting to find the area by treating one of the slant lengths as the perpendicular height, or simply stopping.

The layout of working was often unstructured and multiple processes, both correct and incorrect, were attempted which again often led to fewer marks being awarded due to not

clearly identifying the work they wanted to be marked. Learners should be reminded that when providing a choice of methods, the appropriate marks for the lowest scoring method will be awarded unless one of those methods is crossed out or leads to the answer on the answer line.

Question 27

This question was not attempted well by the majority of the cohort. Learners often attempted to convert from standard form to ordinary numbers, which gained no credit and was not necessary, but rarely recognised that they should then be attempting a division. Sometimes a partial mark was awarded for finding the figures 3125 but this was rare. A very small minority were able to reach the accurate answer for 2 marks. Practising use of a calculator for manipulation of numbers in standard form would be helpful for learners.

Question 28

Although it was the last question on the paper, many learners attempted it and very few blank responses were seen. The majority were not able to calculate the volume of the cylinder correctly, with a wide variety of wrong attempts, mainly calculating the area or circumference of the circle instead, seen. However, when marks were awarded, it was often a single mark for realising the need to divide the mass by the volume, and they were able to gain the second mark for showing this even when the first mark was not awarded. Work on finding volumes of cylinders and prisms would be helpful for future exam practice.

Summary

Based on their performance on this paper, learners should:

- ensure they are well-practised in efficient use of their calculator, especially unfamiliar functions such as standard form
- read questions carefully, including checking whether the magnitude of an answer is sensible, units are appropriate, and the level of accuracy required is shown
- show every stage of working, particularly if the question specifically requests this
- practice questions involving percentage change
- practice questions requiring learners to form algebraic expressions
- use formal methods when working with percentages
- remember to cross out incorrect work or positively identify their chosen method when using a range of approaches to avoid losing marks due to choice.

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