Examiners' Report
Principal Examiner Feedback

Summer 2018

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

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GCSE (9 – 1) Mathematics – 1MA1
Principal Examiner Feedback – Foundation Paper 3

Introduction

A minority of students found this paper difficult and were clearly unprepared for some of the questions but performance generally appears to have improved since last year, particularly in respect of those types of questions that required a written response from students. Performance was not always consistently good across the paper, but with a broad range of questions the paper was able to discriminate well. There appeared to be more instances this year of examiners reporting written work that was illegible. Despite procedures to refer such work for scrutiny to several examiners, sometimes work that remains illegible cannot be credited.

Weakest areas included application of ratios, scales and rates, but also algebraic manipulation and derivation. Most demonstrated the use of a calculator, though on some occasions it was clear that they did not have an understanding of the way in which their calculator worked or did not have one at all.

Questions which assessed the use of mathematics across a range of aspects of the specification were sometimes done poorly, such as 12, 16, 17 and 21. There was also inconsistency of approach to questions that might be considered more traditional where the process of solution might be considered predictable, such as poor attempts in questions 9, 11, 18 but good attempts at questions 14 and 22.

There were far fewer attempts using trial and improvement approaches. Approaches to questions that required some interpretation or explanation were inconsistent. Questions 4(a), 15 and 22 were questions in which many students scored well, but poor attempts were made in question 19 and 24(b). On too many occasions students included contradictory or incorrect statements with an incorrect statement, which cannot be credited.

Students need to read the questions carefully. There were too many cases where students misread the question and failed to give the answer asked for; equally too many cases where figures given in the question (and sometimes in their own working) were misread.

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 frequent difficulty in interpreting complex responses, poorly laid out, in questions 9, 12, 24(a) and 26.

Report on individual questions

Question 1

A very well answered question. Most common errors were writing as 0.09, writing as an equivalent fraction or writing a percentage

Question 2

Just over three quarters of students were able to give the correct percentage. The most common incorrect answers included 3 % or 0.3 %, or giving the answer as a fraction

Question 3

This was a well answered question. Common incorrectly rounded answers included 3000 or 2600.

Question 4

Sequences questions are usually popular, but students need to ensure they are answering the questions as stated. In part (a)(i) the correct answer was usually given, although a few students correctly identified "add 7" either in words or on the diagram for (a)(ii) but failed to correctly add 7 onto 23 for part (i).

In part (a)(ii) the most common response seen was to give a simple sentence of "+7" or similar in words. Some students chose to over complicate their response by giving a step-by-step guide to checking the difference through the terms; these types of responses still managed to score the mark, provided they eventually stated the increase required or expressed this within the sequence. Unfortunately, some students failed to score the mark by not quantifying the addition or referencing an amount that the sequence increased by. Those students that opted for a n^{th} term rule, although not required, were generally unsuccessful in arriving at the correct formula, a statement of $7n - 5$ was awarded the mark as long as there was no contradiction elsewhere.

In part (b) the most common method was to find all the terms of the sequence up to the 10th term, even if the expression $7n - 5$ was seen. It was obvious that not all had used calculators to help with this part.

Question 5

Part (a) was generally well done, however some failed to get the mark because they wrote a four-digit number.

In part (b) some added up all the different pairs of numbers, showing little understanding of place value, but still the majority gained the mark.

Question 6

The most successful responses that scored full marks, opted for a systematic pairing of the factors. When there was no clear method seen, students often missed some of the factors required; 1 or 30 being commonly missed factors. Some students confused the requirements of this question and instead expressed 30 as a product of its prime factors; when this was completed correctly then there were able to pick up one mark for finding three factors. It was rare to see any other numbers that were not factors of 30.

Question 7

The correct response of 24 was common and gained both marks. Some gained a mark by identifying the need to work with 6, 2 and 2. Those who made errors tended to get an answer of either 12 as they only multiplied by 2, or 18 because they added 6 three times rather than doubling.

Question 8

Both parts were answered well, with very little working shown. In part (b) this meant that if their answer was incorrect they lost two marks. A number of students did not use the brackets and so gave an answer of −1.4776 or squared the terms in the brackets separately and so gave an answer of 7.514. Other students multiplied 2.58 by 2 rather than squaring. Some students, as the question was two marks, tried to complete the question in stages in order to achieve both marks. This sometimes led to students rounding early and not using all of the numbers on their calculator display.

Question 9

In part (a) very few methods were seen. Some used a number line method, showing 08.25 to 09.00 and 09.00 to 10.05. 80 minutes was the most common wrong answer, probably obtained from an attempt on the calculator to subtract 0825 from 0905.

Part (b) differentiated well with the complete range of marks awarded. The responses for this question varied in the amount of working out given by students, even though the question required them to show all working. The best students showed all steps of the journey in a logical well-laid out way, which ensured that, given they had used the correct timings, they received all the marks. Generally, students were able to add 17 mins to the leave time of 8.45. Where students had used the length of the bus journey and added this to the two walking times, they often missed off the two minutes waiting time, meaning they could not achieve full marks. A number of students did not take into consideration the length of bus time and so got there around 9.17. A few indicated the bus time from Bury to get to Manchester at 9.35. There were very few responses that started at 10am and worked backwards. Some students did not use a bus time at all and used only the walking times with the start time. It was encouraging to find that nearly all students gave a conclusion with their answer.

Question 10

This question was answered well as most students were able to understand the context of this question. The omission of the final zero in £190.40 was condoned, however students should be encouraged to use correct money notation. Further work that led to students stating the difference was not necessary. Some students that did not understand the context of the question decided to share the 8 or 20 hours between days, while others multiplied the two numbers given in the question by the two rates stated. The most common error was to simply multiply one of the hourly rates by 20.

Question 11

The most common first step to this question was to find the increase of £40; this gained one of the two marks unless it was replaced by an alternative set of working that led to the answer on the answer line. It was not unusual see 40 written as the numerator of the answer, but with an incorrect denominator such as the final price (or 100) instead of the original price. Of those who started by looking at 600/560, this was often converted to a percentage without going on to find the increase as a fraction as specified in the question.

Question 12

This question assessed a number of key aspects where it was possible for students to pick up some marks. It was, however, disappointing that about half the candidature failed to gain any marks in this question. The lengths were measured accurately by most who had a ruler and many students were able to find the perimeter from their lengths.

Use of the scale or conversion to metres was the step most likely to be missed, leading to the award of only three of the five available marks. This might have been because they thought the value in centimetres for the perimeter was in fact already in meters. A small number of students believed the side lengths to have values of 1 and 200. Some had trouble distinguishing between perimeter and area and subsequently multiplied the lengths they had measured which gained no further marks. There were a number of blank scripts which could have been from the lack of a ruler, or not realising that a single measurement in the accepted range would have scored. On completing a multi-step question students should be encouraged to re-read the question to check they have met all the requirements.

Question 13

Only about a fifth of students gained two marks for all graphs identified correctly but most students managed to gain one mark for one or two of the correct graphs, usually correctly recognising $y = 2$, giving 'D' in the first box. The most common incorrect answer was DCA, confusing $y = x$ with $y = -x$.

Question 14

The majority of students knew what a stem and leaf diagram was in part (a) and most of those who had done an earlier unordered version completed their ordered diagram successfully to gain 2 marks. There were cases of an omitted number in the leaves; a simple check that there were 20 pieces of data would have been beneficial for these students. A key was not always present, but when offered was usually correct.

In part (b) many students were able to identify 6/20 (or equivalent) from their data, though some students miscounted the number of students failing, with 7 seen quite often. Others that lost marks were comparing those that had passed instead of those that have failed. One mark was achieved by either identifying the correct number of fails (6) or by knowing a quarter of 20 was 5. Some students worked on the misconception that 71 was the percentage who passed rather than the value of the pass mark. Also, a lot of students commented on the denominator being 4, when there were 20 pieces of data, therefore not understanding the probability. It was common for students to make observations which did not make for a comparison. Many responses were not specific enough making vague statements about more or less than a quarter passed without evidence.

Question 15

About half of all students gave a correct response in part (a), this rose to around three quarters of all students in part (b).

In part (a) many indicated that multiplication should be done first; but stating BODMAS or BIDMAS alone was insufficient. A common error for some students was to indicate multiplication first then −12 which then made the calculation incorrect. Those who merely gave the correct solution did not gain the mark unless they showed the correct order of operations used.

In part (b) the mark was gained by either stating that the largest and smallest numbers were needed or commenting on putting the numbers in order. Saying it should be 8 – 1 = 7, or commenting that 5 and 3 were not the highest and lowest numbers were all frequently seen The explanation of why 5 – 3 was wrong seemed to be more accessible that asking for the range of a list of numbers. A few students tried to find the median or mean but the main mistake involved contradictions such as 7 – 1 = 6

Question 16

Fractions and ratios are a weakness in many students, but here there was a genuine attempt by many to see what they could do.

In part (a) many arrived at the correct answer of 10. If they did not get that far then many were capable of showing the working 8 × 2.50 for 1 mark. Fraction work was rare.

Some obviously had not read the question carefully and assumed they were going to be asked for Chan's amount and gave £7.50 on the answer line although Bispah and £10 could be seen in their working. Some calculated £20 − £2.50 but then shared it equally.

In part (b) 2.50 : 7.50 was commonly seen, but a significant minority were unable to convert this to a ratio involving whole numbers as required. Many went on to give the correct ratio of 1:3 and some did well giving an equivalent ratio e.g. 250 : 750 or 5 : 15. Many gained 1 mark for Chan's £7.50; if this was seen in part (a) it was still credited. Of those who did not gain the final mark, some replaced Chan with Bispah, possibly confused by the form a:b. Some misunderstood giving the answer as whole numbers and rounded up to 3:8. Many students assumed that units should be left in a ratio, giving £2.50 : £7.50, or even 2.50a : 7.50b.

Question 17

Very few gained full marks on this question, the main error being a failure to use the correct formula for the area of a triangle, usually missing dividing by 2. A common wrong answer was 54.

Of those minority of students who used an algebraic method many forgot to find the square root of 36 in the final step and so lost the final mark or incorrect simplification of equation showing $6x$ or $9x$ instead of $9x^2$. Students that turned the right-angled triangle into a square were often successful in using a numerical approach in finding a solution of 6. A common incorrect response was to try to involve Pythagoras. A lot used a trial and improvement approach which had to be completely correct and give the correct answer to be awarded the marks.

Question 18

Many students were able to use their calculator to work out the value of the calculation and get 2300000. These students scored at least one mark, but many of them were not then able to write the number in standard form, or perhaps failed to notice that this was the requested form of the answer. But it was also evident that a significant minority of students did not use a calculator. Common incorrect answers here were 23×10^5 and 2.3×10^{12}. Few students wrote down the intermediate steps showing 2645000000 and 1150. A common misconception was that the number of zeros equates to the index number resulting in 2.3×10^5 as the most common incorrect answer.

Question 19

In part (a) most students gave the correct answer "negative". Students who used other descriptions for example descending, decreasing, falling and going down gained no mark. Only a very few students tried to describe the relationship. Some students also tried to describe the negative correlation with adjectives such as weak/strong, which was quite acceptable as long as they were not contradictory.

In part (b) many students attempted to provide an explanation by making an observation without sufficient detail. Many considered the point only in terms of other students (for example her age) or observed that Kristina had the fastest time. Few considered the point in terms of its distance from the line of best fit, the way the other points correlated or how it matched the rest of the points. Use of the word “anomaly” was not enough. There were a lot of statements similar to "she was the fastest" but to be identified as an outlier it needed further expansion such as "she was much faster than all the other girls.”

In part (c) few students recognised that this question was asking them about the known data range. Many agreed with Debbie using the correlation of the known data points to extrapolate for a 15 year old but failed to demonstrate the understanding of the limitations of using that correlation outside of the data range. Some students approached the question from a health or fitness point of view rather than a statistical one and commented on a girl’s running ability or general health, or provided statement such as “the older the girl, the quicker she should run”, none of which addressed the issue of lack of data at the extremity of the diagram.

Question 20

This question provided the challenge of multiplying the terms in a single bracket by a negative value; this was a step too far for many students. Most students were successful in expanding the first bracket to gain 1 mark but then spoiled further work by unsuccessfully multiplying through the second bracket and either missed the required bracket after multiplying by 2 or wrote the incorrect sign for the final term. Other students spoiled further work by failing to simplify terms correctly or went on to add all the terms together numerically.

Question 21

Very few students were able to use the formula for the area of a trapezium to calculate the area of the trapezium. It was very common to see squares being counted, which often led to an incorrect area, however credit was given if these responses then went on to give a triangle of equal area, as long as the figure for the area of the trapezium was clearly stated. The use of a compound approach, through splitting the trapezium into a triangle and parallelogram or two triangles and a rectangle, were usually successful in finding the correct area. The usual misconception seen was when students forgot to divide the product of the triangle base and its perpendicular height by 2. The other misconception observed was when responses were worked in terms of the perimeter. Students should be encouraged to use the grid provided as some responses were drawn off the grid.

Question 22

Most students recognised that the probabilities for the first throw did not add up to 1. Many lost out on a second mark because they were not clear in their explanation as to which of the second throw branches had an error. Very few students annotated the tree diagram, but those who did generally got at least one mark. The misconception that the dice had been thrown 3 times was stated but only rarely.

Question 23

It was not uncommon to find that part (a) was not attempted. Of those who recognised that it was trigonometry most were able to identify that it was the cosine ratio but some used 11/7 instead of 7/11. Some incorrectly used the rounded value of 0.63 which then led to an answer of 50.9°, which was outside the acceptable range for the final mark. Others found cos (7/11) rather than cos $^{-1}$ (7/11). The most common incorrect solution was to use Pythagoras to try to find the answer though the area of the triangle was sometimes seen.

Part (b) was very poorly answered. The vast majority of those who did attempt it stated 'decrease ' as the reason, mistakenly thinking that the question was about the size of the angle and not the cosine of it. Some assumed that the angle would stay the same. Very few actually compared the two fractions 7/11 and 7/10 but most of those who did this gave the correct reason. Other incorrect answer included explanations that that because the length decreased, cosine or the angle decreased. An extremely common misconception was that they found out what happened to the inverse cosine (which decreased) and gave this as their answer (a decrease).

Question 24

Many responses in part (a) were able to demonstrate the understanding that the four probabilities summed to one. When shared in the given ratio, the second mark was awarded for the correct probability for red or white, though some gave 0.15 and 0.15 or 0.1 and 0.2 rather than the correct 0.2 and 0.1. The other main method seen for this item was to calculate the total number of counters in the bag by taking a proportional approach to the 18 blue counters. Those responses that achieved the correct red probability then sometimes either failed to achieve the full correct method and no further marks were awarded or went on to achieve the correct total of 8. It was surprising to find answers as fractions or decimals (usually based on assuming that 18 was the total number of counters).

In part (b) many responses focussed on the fact that two halves make a whole. Most common was to comment on the splitting of an odd total and incorrectly stated that this was not possible. The best responses were able to articulate the connection to the context of this problem and that halving an odd number of marbles would result in splitting a marble – therefore there would need to be an even number of marbles to begin with.

Question 25

This question was beyond the algebraic skills of many. Of those who did make a start, there was a frequent intention to multiply both sides by 2, but a common error was to then go on to state $10 - 2x = 2x - 7$ or $5 - x = 2x - 14$. Those who did give the correct equation sometimes lost the next marks because of incorrect rearrangement, for example adding 5 to both sides or subtracting x from both sides, and some had difficulty in dealing with negative numbers, showing $-14 - 5 = -9$ not -19. The best students did arrive at the correct value of 3.8, but there were many who did not attempt the question.

Question 26

Again, there were many blank responses for this question and it was rare to see the correct answer of 140. The weakest students were confused as to which angle was needed and a few thought that *BCD* meant *B+C+D*. The majority of students did not know that the sum of the interior angles of a pentagon is 540 and had no way of working it out. Without this it was difficult for a student to gain marks. Some credit could be gained by subtracting the sum of the known angles from a value in excess of 400 as this was an independent process mark. Some failed to spot that there was an angle of 90 degrees. Where students did move on and find 210 there was a tendency to divide the angle by 2 instead of splitting it in the ratio of 2:1. A small minority managed to find the correct angle of 140 with sufficient working to justify allocating full marks.

Question 27

This question was attempted by most students but rarely with any success. Those who understood about scale factors usually gained full marks, but they were in the minority. The most common answers were (a) 10.6 and (b) 10.8 obtained from finding the numerical difference between 12.6 and 8.4, that is 4.2 added or subtracted from the lengths. Again, Pythagoras was seen far too often, and some seemed to think that the triangles were identical, writing down 6.4 and 15. The small number of students who understood this concept and were able to find the scale factor (1.5) were generally successful in answering both parts.

Question 28

This question was an opportunity for students to demonstrate correct algebra. However, very few could make the correct first step of squaring both sides or multiplying by root 2. Only a few made any progress with this question. Sometimes a string of errors led coincidentally to the correct answer, but in this case no marks could be awarded.

Summary

Based on their performance on this paper, students should:

- present working legibly and in an organised way on the page so that the order of the process of solution is clear and unambiguous
- show all working out particularly in questions where this is explicitly stated
- ensure that they are familiar with the correct use of their calculator
- practise algebraic manipulation and derivation, the application of ratios, scaling and rates
- spend more time reading the fine detail of the question and avoid giving answers that do not answer the question posed
- use the correct figures given in the question

Grade Boundaries

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