Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2022

Pearson Edexcel GCSE (9-1)
In Mathematics (1MA1)
Higher (Non-Calculator) Paper 1H

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

November 2022
Publications Code 1MA1_1H_2211_ER

GCSE Mathematics 1MA1
Principal Examiner Feedback – Higher Paper 1

Introduction

The early questions on the paper were generally answered well. Questions towards the end of the paper were more challenging and it was clear some students struggled with these.

Students appeared well prepared for topics such as prime factors, fraction arithmetic, using the pressure formula and simultaneous equations. There were also many well plotted cubic graphs. Problems with algebraic manipulation prevented many students from making progress in Q16 and Q19. Geometric reasoning and communication was generally weak in Q11 and Q18.

Poor arithmetic often let students down on this non-calculator paper and multiplication and division calculations were often carried out poorly. Many simple arithmetic errors were made when students knew the correct processes and these errors resulted in a loss of marks. Students should be encouraged to check their calculations, especially in the easier and more straightforward questions.

Report on individual questions

Question 1

The majority of students gained at least two marks for a complete factorisation of 500, usually by using a factor tree, with relatively few students failing to gain at least one mark. Answers of $2 \times 2 \times 5 \times 5 \times 5$ did not gain the final mark because this question asked for 500 to be written as a product of powers of its prime factors. This requirement was often overlooked. Some students gained the two method marks for drawing a correct factor tree with branches ending at 2, 2, 5, 5, 5 but then made no further correct progress. Students who showed a complete method and made only one arithmetic error gained the first method mark. When no marks were awarded, this was usually because the method was incomplete or because there was more than one arithmetic error. Relatively few students used the division method to find the product of prime factors.

Question 2

Part (a) was generally answered well. The most common method was to convert both mixed numbers into improper fractions and then write both fractions over a common denominator. Many students gained at least one of the two marks for getting this far. The accuracy mark was often lost because students failed to write their answer as a mixed number or made an arithmetic error. Fewer students chose to add the whole numbers and deal with the fractional parts separately but those that did were often successful. Considering that this is a familiar question early in the paper, a surprising number of students were unable to achieve both marks.

A similar proportion of students gained full marks in part (b) as in part (a) but a greater number of students gained no marks. Students who showed a correct method usually went on to get full marks. Most of the successful students started with $\frac{8}{3} \times \frac{1}{6}$ and evaluated this as $\frac{8}{18}$ or cancelled to get $\frac{4}{3} \times \frac{1}{3}$. Some students answered the question by showing that $2\frac{2}{3} \div \frac{4}{9} = 6$ or $\frac{4}{9} \times 6 = 2\frac{2}{3}$ but these approaches were rare.

Question 3

Many students made a good start by working out $2^{-5} \times 2^{10}$ as 2^3. Others gained the first mark for squaring 2^{-5} or 2^8. Not all these students went on to complete the simplification correctly. A common mistake was $(2^3)^2 = 4^6$. A significant number of students could not show a correct first step and gained no marks. In some responses 2^{-5} was identified as –32.

Question 4

Multiplying 0.004 by 0.32 often resulted in an answer with the digits 128 and this was sufficient for the method mark to be awarded. Failure to place the decimal point in the correct position was a common error and this meant that many students did not gain the accuracy mark. Students making one arithmetical error were also able to score one of the two marks by giving an answer with the decimal place correctly positioned. This question exposed weaknesses in multiplying without a calculator, especially when decimals are involved.

Question 5

Students who showed a correct method to work out how many model B cars the factory should make generally went on to give the correct answer. Some, however, made an arithmetical error when working out 40000 ÷ 80 × 15 and gained one mark only. A common incorrect method was 40 000 ÷ 15. Some students attempted to find 15% of 40 000 leading to an incorrect answer of 6000.

Question 6

In order to make progress in part (a)(i) students needed to associate corresponding parts from the two ratios. Those that wrote the ratio 1 : 3 as 2 : 6 were often able to go on and write down the ratio $a : b : c$ as 2 : 6 : 5 although 2 : 6 : 10 was quite common. Some used a common multiple of 3 and 6 to get a common element representing the value of b and 6 : 18 : 15 was a common correct answer. Many students did not understand how to combine the two ratios. A very common incorrect answer was 1 : 9 : 5 from students simply adding the two values of b.

In part (a)(ii) many students gained both marks for expressing a as a fraction of their three numbers a, b and c. When students gained one mark only this was usually because they made an arithmetic error when adding the values of a, b and c or they gave an answer such as $\frac{1}{6.5}$ where the denominator is not an integer. Students who had not given a correct ratio in (a)(i) could still gain both marks in this part for writing a correct fraction for their values of a, b and c.

Students found part (b) quite challenging. After writing $p = 10m$ or $m = \frac{n}{2}$ or $2m = \frac{p}{5}$ and gaining the first mark many students did not find a correct ratio. The statement $p = 10m$ was quite often followed by $m : p = 10 : 1$. By leaving their ratio as $\frac{n}{2} : 5n$ some students failed to achieve the final mark. A few students answered the question by assigning values in the ratio given and were often successful. A large proportion of the students were unable to make any meaningful progress with this question.

Question 7

Many students gained the first mark for using the area of the base in the pressure formula. The accuracy mark was sometimes lost because of arithmetic errors when dividing 10 000 by 8 or because of an inability to divide 10 000 by 8. A few students used the formula incorrectly and worked out 10 000 × 8 rather than 10 000 ÷ 8. Many attempts failed at the first hurdle when students used an incorrect method to find the area of the base, e.g. 4 + 4 + 2 + 2= 12, or did not realise that they needed to find the area of the base. These students gained no marks.

Question 8

A good proportion of students found a multiple of 5 and an even number with a highest common factor of 7, often with little or no working, and gained both marks. The most common correct pair of values was 35 and 14 but 35 and 28 and 35 and 42 were also seen quite often. When students scored one mark only it was often for either $m = 35$ or $n = 14$. Some scored one mark for finding a multiple of 7 and an even number with a common factor of 7, e.g. 70 and 70. Listing at least 5 multiples of 5 also gained the first mark but this didn't always lead to a successful outcome. Nevertheless, many benefitted from this way of earning one mark.

Question 9

This question was answered quite well by the majority of students. The table in part (a) was often completed correctly. Most errors occurred with the substitution of the negative values of x into the equation and evaluating y as 4 when $x = –2$ was a common error.

In part (b) the plotting of the points was usually accurate. Most students realised that a curve was needed to join the points and it was pleasing to see many freehand curves drawn that passed through all the points. When the points were joined with line segments a maximum of one mark could be awarded. Students who had gained just one mark in part (a) generally went on to gain one mark in part (b) for plotting at least five of the points from their table correctly. Students should be encouraged to make sure that their curve passes through all of the points and doesn't consist of more than one curve between any two points.

Question 10

Part (a) was answered quite poorly. Those who used the table to find that the probability of getting a 5 is $\frac{10}{40}$ gained the method mark but many students ignored the fact that the spinner is biased and gave the probability of getting a 5 as $\frac{1}{5}$. Using $\frac{10}{40}$ to work out an estimate of scoring 5 both times proved to be beyond many students. A common incorrect method was $\frac{10}{40} + \frac{10}{40} = \frac{1}{2}$ and often $\frac{10}{40}$ or $\frac{1}{4}$ was given as the final answer.

In part (b) many of the students who gained the method mark for identifying the proportion of 1s as $\frac{6}{40}$ were able to write this as 15%. Some students showed a method to write $\frac{6}{40}$ as a percentage, e.g. $\frac{6}{40} \times 100$, but could not complete the calculation whereas others did not know how to write it as a percentage. Dividing 40 by 6 was a common error. There were many students who did not identify the proportion of 1s as $\frac{6}{40}$.

Question 11

Descriptions of the transformation were generally very poor and surprisingly few students gained full marks for giving all three aspects of the description. Stating an incorrect scale factor of 3 or –3 was a common error and the centre of enlargement was often incorrect or not given. Many of the students who stated that the transformation was an enlargement did not get a mark because they failed to give either a correct scale factor or a correct centre of enlargement. Two of the three aspects of the description were needed for 1 mark. Some students tried to describe a combination of transformations – it was common to see translations combined with enlargements – and this gained no credit.

Question 12

Many of the students appeared familiar with simultaneous equations and started by multiplying both equations to make the coefficients of *x* or *y* the same. Most then subtracted one equation from the other to eliminate one of the variables and gained the first method mark. Accuracy was sometimes lost through arithmetic errors in the multiplying or subtracting. Some students got to $7y = -14$ or $-7y = 14$ and then wrote $y = 2$. Students who used a correct method to find one value usually went on to substitute this value into an equation in order to find the other value and gained the second method mark. Eliminating one variable by rearranging one equation and substituting into the other equation was attempted by a few students but this method rarely led to a fully correct answer. Responses which scored no marks tended to involve an immediate addition or subtraction of the equations before balancing coefficients.

Question 13

This inverse proportion question was presented in an unfamiliar format but a good proportion of students managed to gain at least one mark. Many completed the table correctly, often without showing any working out. Students who wrote down the equation $p = 100/t$ nearly always found at least one correct value. A common mistake was using direct proportion rather than inverse proportion.

Question 14

The students who worked out frequency densities and used these to draw a histogram often gained all three marks. Some students drew the first three bars correctly but then made an error drawing the bar representing the interval $90 < w \leq 110$ and gained two of the three marks. A few students with the correct frequency densities did not draw the bars in the correct intervals and gained one mark only. Weaker students often did not recognise the need to find frequency densities and drew a bar chart. Some students used the midpoints of the class intervals and the frequencies to get values which they then used to draw a frequency polygon.

Question 15

This question was not answered as well as might have been expected and a large number of students failed to gain any marks at all with many not attempting the question. Many of those with some knowledge of sectors of circles went wrong at the first step, using πr^2 or πr instead of $2\pi r$ and gained no marks. A good proportion of those who did make a correct start went on to get full marks.

Question 16

In part (a) few students used the difference of two squares to prove that $(2m + 1)^2 – (2n – 1)^2 = 4(m + n)(m – n + 1)$ but those that did were usually able to complete the proof without any errors. The majority of students started by attempting to expand $(2m + 1)^2$ and $(2n – 1)^2$ and many were able to gain the first mark. Some students gained the first mark by correctly expanding the right-hand side. For the second mark it was necessary to see a correct expression for the left-hand side after expansion. Many of those who attempted to subtract $4n^2 – 4n + 1$ from $4m^2 + 4m + 1$ were not able to write a correct expression with or without brackets - their omission was usually followed by sign errors - and it was common to see the subtraction written as $4m^2 + 4m + 1 – 4n^2 – 4n + 1$. After showing that the left-hand side can be simplified to $4m^2 + 4m – 4n^2 + 4n$ students were still left with the task of showing that this is equal to the right-hand side. Many attempted to do this by expanding $4(m + n)(m – n + 1)$ and arriving at the same simplified expression. Some attempted to do it by factorising $4m^2 + 4m – 4n^2 + 4n$ to get $4(m + n)(m – n + 1)$ but convincing attempts at factorising were rarely seen.

Very few students were able to give a correct and complete answer in part (b) and this part was often not attempted. Many students made the wrong decision and said that Sophia is not correct. Some of those who made the correct decision tried to justify the decision using numbers and consequently did not gain the mark. Students needed to explain that $2m + 1$ and $2n – 1$ are odd numbers and the right-hand side is a multiple of 4.

Question 17

This was one of the better answered questions towards the end of the paper. Many students gained at least one mark and a good proportion of students gave the correct answer. A surprising number of students got as far as $\left(\frac{2}{3}\right)^4$ but then failed to evaluate this correctly.

Question 18

This question was answered very poorly. Some students scored the first mark for angle *OBC* = 90º which was often marked on the diagram but could then make no further meaningful progress. Many could not even get that far. Some students correctly identified an isosceles triangle, but used arbitrary numerical values, e.g. 45, instead of an algebraic approach. Those with some idea usually found expressions for angles in terms of x although other approaches were occasionally seen. Some students labelled angle *OBA* or angle *ABC* as y and used the relationship between x and y to show the required result and a few students marked a point on the circle and formed a triangle with *AB* as the base. Full marks were awarded surprisingly rarely. Some answers were let down by poor algebra but some students who did show correct working leading to the required result then failed to correctly state the one circle theorem that was needed for the final mark. Some gave no reason, others gave a description which did not include the required key words.

Question 19

Some students correctly wrote the two fractions with a common denominator and gained the first mark but many were then unable to carry the algebraic solution any further. Those that did reduce the equation to a 3-term quadratic sometimes made errors when rearranging and did not get the second mark. Substitution into the quadratic equation formula was generally done well. Some students who did not get a correct quadratic equation were still able to gain the third mark for dealing correctly with their 3-term quadratic equation. The first of the two accuracy marks was awarded for two correct values of x, e.g. $\frac{-4 \pm \sqrt{32}}{8}$. Some students gave this as the final answer and others made errors when attempting to write it in the required form. Only a few students could demonstrate the necessary skills of algebraic manipulation to solve the equation and give the answer in the required form.

Question 20

Many of the higher attaining students made a good start to this probability question, showing understanding that the first card is not replaced. They often wrote at least one correct product of two fractions with denominators 11 and 10 respectively and gained the first mark. Only a small proportion of students showed a complete process and considered all six possible ways of taking cards of different colours. A common mistake was to use only three of the six ways. The majority of those that did show a complete process were able to complete the arithmetic and give a correct final answer. Some students approached the problem by finding the probability that Alfie takes two cards of the same colour and then subtracted the result from 1. A surprisingly large number of students thought that the first card is replaced before the second one is taken and used a denominator of 121. Those giving an answer of $\frac{62}{121}$ were awarded 1 mark. For some students a tree diagram was often all they managed; they did not know what to do with the probabilities. Some added rather than multiplied the probabilities.

Question 21

This question proved to be a good discriminator between the most able students. When only one of the two values was correct it tended to be the *y* coordinate and (90, – 1) was a common response that gained 1 mark. There were some students who gave the answer as (–1, 180) instead of (180, –1) and they gained 1 mark.

Question 22

A small proportion of students gained at least one mark for giving the value of sin30 as 0.5 or for a correct sine rule statement with 6.5, 10.7 and 30 substituted. Students who did not know the correct value of sin30 were still able to gain two of the four marks if they showed a complete process to find $\sin ABC$. Many of those who gained the first three marks by showing a complete process to find $\sin ABC$ using sin30 = 0.5 did not gain the accuracy mark because they did not give their answer in the form $\frac{m}{n}$ where *m* and *n* are integers. The final answer was often given as $\frac{3.25}{10.7}$ or $\frac{6.5}{21.4}$. Many students showed a lack of understanding of the mathematical requirements of the question, resorting to right-angled trigonometric calculations and/or Pythagoras' Theorem.

Question 23

For a question towards the end of the paper part (a) was answered reasonably well. Some students started by using consecutive terms to find the common ratio. Having identified the common ratio as $2\sqrt{5}$ many worked out the next term as 4000 but $400\sqrt{5}\times 2\sqrt{5} = 8000$ was a common error. Instead of finding the common ratio some students used alternating terms of the sequence and the calculation 200 × (200 ÷ 10) gave the next term without them having to deal with surds.

Part (b) proved to be a challenging question with very few students knowing how to work out the first term of the sequence. Some students gained the first mark for finding the second term of the sequence and others gained it by finding the ratio of the 4th and 6th terms. Those who were able to show a complete process to find the first term usually went on to gain full marks. The most common misconception was to create an arithmetic sequence of the denominators of the fractions leading to the final answer being given as $\frac{5\sqrt{2}}{-2}$.

Question 24

In part (a) many of the students who gained the first mark for equating the two volumes were not able to go on and find the correct ratio. Those that got as far as writing $4r = h$ often gave the ratio $r : h$ as 4 : 1 instead of 1 : 4.

The majority of students made no attempt at part (b) and very few managed to gain more than one mark. The first mark was awarded for equating the surface area of the sphere with the surface area of the cone but a common error here was to omit the area of the base of the cone and write $4\pi r^2 = \pi rl$. Students making this error could still be awarded the next two process marks if they went on to substitute for l and isolate the terms in r^2.

Summary

Based on their performance on this paper, students should:

- practise their arithmetic skills, particularly division and operations with decimals
- take care when carrying out arithmetic operations and check their working to avoid careless errors
- read each question carefully and ensure that their final answer matches the question asked
- practise subtracting one algebraic expression from another, especially expressions with negative terms, and use brackets more efficiently
- practise finding angles using the circle theorems and stating the circle theorems used

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom