Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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International GCSE Mathematics

4WM2H/01R

Principal Examiner's Report

This paper was suitable for the full range of ability of the candidates who sat it. Questions nearer the beginning of the paper were accessible to all and many candidates did very well, whereas the questions nearer the end of the paper were clearly found to be very challenging by many candidates, although there were some easier marks that weaker candidates could have picked up too. Hence the initial instruction "Answer ALL TWENTY FIVE questions" has added significance for those needing to pick up marks where they can, rather than leave blank responses.

There were numerous occasions where candidates clearly had not read questions carefully. There were cases of candidates misreading or miscopying information, highlighting the need for candidates to check and re-check both the question and their workings. There were also cases where a correct answer was found but was not given in the required form, again, candidates need to refer back to the question to check they have fulfilled its requirements.

While calculators are allowed throughout the examination there are many questions where calculators are expected not to be used and the full algebraic working should be shown. Some candidates gave very limited workings to support their answers, and in some cases, they did not gain full marks for correct final answers. These questions are clearly signposted with appropriate instructions that must be heeded, e.g. "Show clear algebraic working". On the other hand, there were many opportunities for candidates to check their answers with their calculators, potentially saving marks by finding errors, but this was not often evident in candidate responses.

Comments on individual questions

Question 1

Part (a)

Most candidates were able to write down the modal class from the given grouped frequency table. Some candidates selected the frequency for the correct modal class, which was not acceptable.

Part (b)

In working out an estimate for the mean from the grouped frequency table the majority of candidates found the correct answer. Most of the rest gained no credit, usually this was because they did not attempt acceptable products of values within the intervals with the corresponding frequencies, including a surprising number of cases where the frequencies were multiplied by the class widths. Of those who selected the correct method some made arithmetical errors in the products, or the sum of their products, but were able to gain credit when showing their method. Some candidates incorrectly divided their sum of products by the number of groups in the table rather than by the sum of the frequencies.

Question 2

A large majority of candidates were able to write 1400 as a product of its prime factors while showing their working clearly. These candidates showed their method in a variety of ways including factor trees, tables, and lists. Some candidates lost the final mark for not expressing their answer as a product of prime factors, indicating the importance of referring back to a question in order to check its requirements have been satisfied before moving on. There was some credit available for those candidates without a correct answer but who had showed sufficient stages in prime factorisation. Those candidates who only stated the answer without showing any working did not gain credit, which highlights the importance of not relying too much on calculator technology rather than demonstrating an understanding of method.

Question 3

The large majority of candidates were able to show clear algebraic working in solving the given pair of simultaneous equations. The most common approach was to subtract the equations to gain the direct elimination of x terms, although many other examples were seen where one or both of the equations were scaled prior to addition or subtraction. Reduction of the equations to one equation in only x or y via substitution was also seen. Arithmetic errors occurring in any of these stages were seen but some credit was nonetheless available for correct method in these cases. Many responses contained multiple attempts with confusing workings that were at times difficult to follow, indicating the importance of setting out methods clearly.

Question 4

Part (a)

Only a slightly higher proportion of candidates managed to correctly rotate the given triangle 90° anticlockwise about the point (1, 2) than those who either drew a correct triangle with the correct orientation but in the wrong position or who drew a correct triangle with incorrect orientation. There were many attempts seen involving ray lines, indicating confusion over which method was required to complete the required transformation, highlighting the importance of associating the correct method with the corresponding key word in the question.

Part (b)

Candidates were required to describe fully the single transformation mapping one given triangle onto another. Only slightly more candidates were able to score for stating one or both of "translation" and the correct vector than those who did not score at all. Many incorrect responses were seen where the vector was described in words, e.g. moves 9 left, 3 up. Candidates need to understand that when a translation like this one is to be described in a single transformation then this means a vector will be required. Some vectors that were given as answers were unfortunately incorrect or stated in the form of coordinates.

Question 5

This question concerned finding the percentage profit for tiling a floor given the area of the floor, the coverage and cost of a box of tiles, the cost of adhesive, and the charge to the customer. A very high proportion of candidates were able to determine the total cost or the profit. There was roughly an even split amongst these candidates of those who incorrectly attempted to calculate the percentage profit by dividing by the charge and those who correctly divided by the cost. Only a small proportion either did not score or gained partial credit for showing correct method to work out the cost or number of boxes of tiles needed, or cost of the adhesive.

Question 6

Part (a)

This question required 82000000 to be written in standard form, which was done very successfully by the overwhelming majority of candidates. The small proportion of incorrect answers was generally numerically correct but not in standard form or with only an incorrect index.

Part (b)

This question required a number in standard form to be written as an ordinary number, which should have been 0.0000058, and was answered only slightly less successfully than part (a). The incorrect responses mostly had either 4 or 6 zeroes between the decimal point and the digit 5. Some responses had a string of zeroes followed by "58" but no discernable decimal point.

Part (c)

This question required a very large number in unnormalised index form to be written in standard form. While answered correctly by the large majority of candidates it was answered slightly less successfully than part (b). Most errors were seen in the index, in incorrect responses this typically ranged from 298 to 301, whereas the correct answer had an index of 302. Some candidates seemed confused that they could not use their calculators to answer this question directly and it is important to note that non-calculator questions can be expected on this topic.

Question 7

Candidates were required to work out the mean of 4 numbers given the means of 7 and 3 numbers with the 4 numbers respectively included and excluded. A significant minority of candidates showed that they did not really know how to proceed in this question. A small proportion gained a mark for finding the totals of one of either of the 7 or the 3 numbers. An even smaller proportion realised they needed to subtract these totals, sometimes making no further progress. However, just over half of all responses were fully correct.

Question 8

In this question candidates needed to find the original price of a dishwasher given its sale price and the percentage reduction (15%). The majority of candidates were awarded all the marks however a considerable proportion gained no marks by incorrectly attempting to increase the sale price by 15%, or by other incorrect methods involving 15%. Only a very small proportion of candidates did not make further progress after realising correctly that the sale price was 85% of the original price.

Question 9

Part (a)

This question required candidates to solve a linear inequality with the unknown on both sides, showing clear algebraic working. A small proportion of candidates made no progress owing to poor algebraic working although many more succeeded in correctly collecting constants and terms in x on opposite sides of their inequality. The majority of candidates found the correct answer, however some lost the final mark for presenting their answer with an incorrect inequality symbol, which was condoned only for the method marks.

Part (b)

Candidates were shown a shaded region bounded by three straight lines on a coordinate grid and they needed to write down three inequalities that defined the region. Only around half of the responses were fully correct with a significant minority gaining no marks. Partial credit for presenting one or two correct inequalities was as common as gaining no marks, helped in part by special cases on the mark scheme for all inequalities being reversed or all answers being presented as equations rather than as inequalities. For all marks, the inequalities were allowed whether expressed strictly or not.

Question 10

This question involved a regular decagon sharing a side with an irregular hexagon with one unknown interior angle; candidates had to find a labelled angle between the shapes at a common vertex. A large majority of responses were fully correct and only a small proportion gained no marks. The most common partial credit awarded was two marks for getting as far as finding one of the unknown interior angles. There were many instances seen of incorrect method to find the interior angle of a regular polygon and some cases where the sum of interior angles of a hexagon or decagon was recalled incorrectly, which prevented further credit being awarded. This highlights the need to be able to recall key formulas and facts accurately.

Question 11

Part (a)

Candidates were shown a cumulative frequency graph about Ehrick's driving distance each day for 60 days, and needed to use it to find an estimate for the median of the distances. A high proportion of responses gave a value in the acceptable range although a significant minority did not.

Part (b)

Candidates needed to use the graph to find an estimate for the interquartile range of the distances. The majority of candidates gave a value within the acceptable range. A significant minority gave an incorrect value, often due to not working with the upper and lower quartiles.

Part (c)

The majority of candidates gained full marks for working out the percentage of days Ehrick drove more than 75 kilometres. A small proportion of candidates were able to take an acceptable reading from the graph at 75 kilometres but either found the percentage of days below 75 kilometres or did not divide the number of days above 75 kilometres by 60.

Part (d)

Given interquartile ranges for the driving distances in 60 days for Tomas and Alison, candidates were required to say which was more consistent in the number of kilometres they drove, and to give a reason for their answer. This 1-mark question was fairly evenly split between those who gave either correct or incorrect answers. Many did not make the connection between more consistency and lower IQR, many answering "Alison" correctly without an acceptable reason or "Tomas" with the reason being that Tomas had a higher number for IQR.

Question 12

This question involved finding the depreciation rate for a third year given the rate for the first two years, the initial amount, and the amount after three years. The majority of candidates were able to gain full marks. A small proportion made no further progress after finding the value at the end of the first two years and fewer still stopped at finding a complete method for the percentage decrease or the multiplier for the third year. A significant minority gained no credit for only working out the value after one year, for setting up an incorrect equation, using the incorrect number of years, or using simple interest.

Question 13

Candidates were required to find the distance in light years from Earth to Andromeda Galaxy in standard form, given the distance in astronomical units and the numbers of kilometres in one astronomical unit and one light year. A significant minority correctly combined the three given values to obtain the answer in standard form. A small proportion only went as far as correctly combining two of the given values. A significant proportion used incorrect methods and gained no credit, some of which did not bracket standard form numbers when dividing by them.

Question 14

This question involved changing the subject in an equation where *p* was given in terms of an algebraic fraction in k^2. Just under half of candidates scored full marks, and a significant minority gained no credit, as the first step of multiplying across the denominator and expanding the brackets proved to be very challenging for many. A small proportion did not progress further than the first stage where collecting k^2 terms on one side was required, or to the third stage where correct factorisation by k^2 was required. There were also errors seen in taking the square root of both sides at the final step and it is important to note that the square root symbol should cover the whole fraction unless it is properly bracketed.

Question 15

In this circle theorem question, points *A*, *B*, and *C* on a circle centre *O* were connected such that *AOC* and *ABC* formed two triangles with chord *AC* as the base. The two angles between the triangles were given and angle *ACO* needed to be worked out. A wide variety of methods was seen with differing amounts of working offered, some of which could only be found on the printed diagram. By drawing additional chords and tangents on the diagram candidates were able to apply a number of different circle theorems that may not have been expected. It was good to see inventive problem solving in candidates' solutions although it is advised to set out the steps of solutions while clearly referencing the angles used in order to help markers to follow the methods. A number of incorrect routes to the correct answer were seen, e.g. the angle *ABC* = 180° − (36° + 21°) = 123° giving the obtuse angle *AOC* = 246° and finally the angle *ACO* = (246° − 180°)/2 = 33°, which highlights the importance of checking values.

Question 16

This vectors question gave a triangle *OAB* with vector *OA* = 4**a** and vector *OB* = 4**b**.

Part (a)

This was a straightforward question that was answered correctly by a large majority of candidates. It was required to find the vector *AB* in terms of **a** and **b**. Some incorrect responses showed poor understanding of the use of vectors while others simply had the signs in the expression reversed.

Part (b)

It was given that point *P* was on *AB* such that *AP* : *PB* = 1 : 3 and candidates were required to find vector *OP* in terms of **a** and **b**. A narrow majority did not gain marks for this part, sometimes because they did not have an acceptable follow through available from their answer to the previous part and sometimes because their method was incomplete, e.g not adding 4**a** to one quarter of vector *AB*. There were very few examples of scoring 1 mark by using the correct method from an incorrect but acceptable previous answer.

Question 17

In this functions question it was given that g(x) had 3x on the numerator and x − 2 in the denominator.

Part (a)

Candidates were required to state the value of x that cannot be included in the domain of g. A significant majority of candidates gave an acceptable answer but many responses showed a lack of understanding of the question or gave an incorrect value.

Part (b)

In this part it was required to find the inverse function and a majority of candidates gained full marks. However, the algebraic manipulation of multiplying across by the denominator, expanding brackets, collecting terms in the alternate variable before refactorising and dividing was too challenging for some and only a small proportion gained partial credit. Some cases were seen in which the inverse function was confused with the reciprocal and others were seen in which algebraic manipulation skills were poor.

Question 18

This was an intersecting chords theorem question in which no progress was possible without recall of the theorem. Candidates were required to find the area of a circle where three out of four sections of the two intersecting chords were given. A slight majority were able to score in the question, with a small proportion not going on to find the correct radius or diameter. A still smaller proportion failed to use their radius or diameter to find the correct area to 3 significant figures, although the exact answer of 100π was allowed and sometimes seen.

Question 19

Candidates were given a curve plotted on a coordinate grid for an unknown function and were asked to estimate the gradient of the graph at the point with x = 3. The majority of responses gained no credit and it is worth pointing out that any topic in the specification can be questioned in the examination, no matter if it has appeared less frequently than others in the past. Only a small proportion gained partial credit and the minority who were able to draw a tangent line to the graph at x = 3 were able to go on to score full marks. Some candidates did not gain full marks because their readings of coordinates from their graphs were not sufficiently accurate.

Question 20

This was a straightforward quadratic inequality question which can be solved with modern calculator technology and so candidates are asked to show clear algebraic working. Nonetheless candidates could have checked their answers using their calculators which may have helped improve scores for some. A significant majority of candidates were able to find the critical values from a correct method, however around half of these were not able to identify the correct region and express it correctly. A large minority failed to score at all which was mainly as a result of showing incorrect method or no method.

Question 21

This question was based on finding the maximum volume of a cuboid with sides given in terms of *x*. A small majority of candidates were able to score the first mark only for giving a correct expression for the volume of the box. A small proportion of candidates scored only as far as differentiating the volume and solving that equal to zero. Many made the mistake of finding the second derivative and solving that equal to zero or of otherwise finding the maximum of the first derivative, e.g. by completing the square. Possibly learning about the second derivative at this level causes confusion, and it is not required. A moderately small proportion did manage to score full marks.

Question 22

Candidates had to solve a pair of simultaneous equations where one was quadratic and the other was linear, with the instruction to show clear algebraic working. The majority of candidates who substituted the linear equation into the quadratic equation then formed and solved a quadratic in one variable only also went on to gain full marks. Credit was also given for solving an incorrect quadratic provided the mark for substitution had been given. A common error was when a quadratic in *y* was solved but candidates notationally switched to *x* in their method and proceeded as if they had found values for the *x* in the question, which had to lose the penultimate mark for an incorrect substitution, and the final mark.

Question 23

In this question candidates were shown the graph of a transformed sine function and had to find three unknown values in the given equation for the graph. Just over half the responses were either incorrect or blank. A small proportion for each found one, two or all three values, and there were many incorrect attempts seen for each of the values from misinterpreting the graph.

Question 24

Candidates were told about two arithmetic series *P* and *Q*. The first term and common difference for *P* were *a* and *d* respectively whereas for series Q they were 2*a* and 3*d*. It was also given that for *P* S_{40} = 2070 and for series Q U_{25} = 186. It was required to work out S_{40} for *Q* showing clear algebraic working. Only a small proportion of candidates were able to set up two correct equations from the given information; some cases were seen where S_{25} = 186 was attempted rather than U_{25} = 186, perhaps indicating that the required formula had not been learnt. From those that formed and solved correct equations in *a* and *d* only a moderately small proportion managed full marks, and some failed to secure the last mark by not using 2*a* and 3*d* in the final substitution into S_{40} for *Q.*

Question 25

In this question candidates needed to work out the total surface area of a hemispherical bowl formed by removing one hemisphere from another leaving a circular annulus on top. The volume of the original hemisphere was given in terms of π and the answer was required in terms of π. A moderate proportion gained no marks in this question, but of those who scored at all the most scored 2 marks for finding the radius of the original hemisphere by using the correct formula for the volume of a hemisphere. Sometimes π was omitted, the volume of a sphere formula was used, or square root was used instead of cube root. A small proportion managed to progress only as far as finding the area of the annular top, or the total curved surface area by adding the inner and outer hemispherical surfaces. Sometimes the annular top was simply left out of the calculations despite being the easier area to work out. Many gained no credit if they only attempted to subtract the curved surfaces. A moderately small proportion was able to complete the question and gain full marks.