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Principal Examiner Feedback

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GCSE Mathematics (1380)
Paper 3H

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1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 3

1.1. GENERAL COMMENTS

1.1.1. Many candidates struggled with basic arithmetic processes on many questions.

1.1.2. Candidates appeared to be able to complete the paper in the allotted time.

1.1.3. It was encouraging to note that most candidates did try to show their working. This led to method marks being awarded in Q2c, Q3, Q6 and Q9 when the final answer was incorrect. However, some candidates produced such a jumble of numbers that it was hard to distinguish correct working from a choice of methods which would score no marks.

1.1.4. It is advisable for candidates to draw lines on the graph as part of their working to score method marks on these questions when their answer is incorrect. This might have proved very useful on Q11, Q14 and Q15d. Candidates should be advised to ensure that all lines drawn are clearly visible to the examiner.

1.1.5. It is also advisable to fill in angles on diagrams that involve geometric calculations. This might have proved very useful on Q3, Q10 and Q19.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

Part (a) proved to be a good starter question with over 80% of the candidates scoring both marks. Some candidates failed to cancel their fraction to its simplest form. It was pleasing to note that only 8% of the candidates failed to score.

The most common error in part (b) was to give their answer as a fraction although 65% of the candidates could provide the correct answer of 30%. Many found 10% to be £2, but then were often not able to write 30% for £6.

Part (c) was poorly answered with over 68% of the candidates failing to score. A large proportion halved 10 then added £1.50 to get £6.50 whilst others managed to subtract £1.50 from £10 but then went no further. Only a small handful of candidates used the approach of setting up an equation. There were many attempts at trial and improvement. Candidates need to be encouraged to check their answers. Had they done so they would have realised that £6.50 and £3.50 do not have a difference of £1.50. Only 29% scored both marks.

1.2.2. Question 2

Nearly all candidates got part (a) correct and many were able to get at least two of the three required columns in part (b) correct. The most common error was to provide Line Number 5 rather than Line Number 10. An incorrect calculation for 244 was the most common error where common wrong answers were 246 (wrong order of operations) or 144 (just squaring the 12). Square numbers were occasionally confused with doubles and 11^2 and 12^2 were clearly not known. 43% of candidates scored all 3 marks for the first two parts with a further 28% scoring 2 marks.

Over 66% of the candidates failed to spot the pattern in part (c). Many of these tried to calculate $999^2 + 1001^2$ using long multiplication techniques, rarely meeting with success or continued the table to 6^2+8^2.

Some did attempt $2 \times 1000^2 + 2$, though a surprising number could not calculate the square correctly, giving answers of 2000, 10 000, 100 000 as well as 4000 after multiplying by 2 before calculating the square. Others failed to correctly square 1000, double their result or forgot to add 2. Only 22% of the candidates scored both marks.

1.2.3. Question 3

There seemed to be much confusion over interior and exterior angles. Many correct angles were seen but the method used to achieve them was not always very clear. Having obtained 150° a few went on to calculate 360 – 150 = 210 as their final result. Indicating angles on the diagram may have helped to identify the required angle.

There were many instances of dividing 360 by 5 rather than by 6. Others calculated 60 but indicated this on the diagram as the interior angle of the hexagon.

25% of the candidates got the correct answer from valid methods with a further 22% scoring 2 or 3 marks. It was disappointing to find that over 40% failed to score.

1.2.4. Question 4

Many candidates located the correct item, knowing the 11^{th} value, but were unable to interpret the key correctly, thus 31 or 1 was a very common incorrect answer. Some confused median with mode and therefore thought 35 or 3.5 was the answer. Another common error was $21 \div 2 = 10.5^{th}$ term, with average of 29 and 31 given. Many candidates wasted time rewriting all the numbers out below the table even though they were provided with an ordered table. Overall 32% of the candidates gave the correct answer with a further 34% scoring 1 mark.

1.2.5. Question 5

64% of the candidates scored 1 mark for any translation of the given shape in part (a) with a further 21% translating the shape correctly. The scale seemed to confuse candidates with many moving 8 squares to the left and 2 squares down rather than using the scales on the axes. Candidates might have realised something was amiss when their final shape ended up partly off the grid.

Part (b) was less successfully done with over 70% of the candidates failing to score.

8% of the candidates did score a mark for correctly drawing the line $y = x$ or producing a correct reflection in the line $y = -x$. Translations and reflections in the x axis or y axis were common incorrect responses.

1.2.6. Question 6

Using the information in the distance table appeared to cause some difficulty. Most seemed to add distances together but not always the correct ones or not just the 3 required distances. The alternative approach using individual times was dealt with no better. In some cases 2pm appeared on the answer space without any method shown. This is a risky strategy as it denies the award of method marks should the answer be incorrect.

A few confused abbreviations of miles and minutes, using m for both, which resulted in adding a combination of times and distances eg adding the distances onto their 9 am and 3 hours or changing the 3 hours for the meeting into 150 miles! There was a spread of marks awarded with 28% scoring all 4 marks and 34% failing to score. 21% scored exactly one mark generally for adding 3 appropriate distances or working out one of the times correctly.

1.2.7. Question 7

Part (a) was a seemingly innocent algebra question which if attempted in logical steps yielded the correct value of x. Unfortunately many missed the correct expansion of the left hand side of the equation and floundered in further simplification with only 48% of the candidates scoring all 3 marks. 18% of the candidates did manage to score 1 mark for either expanding the bracket correctly or rearranging their equation with at least the terms in x or the constant terms isolated correctly. However a significant number made mistakes with signs when rearranging ending up with $8t$ or 0 rather than $4t$ and 24. 25% failed to score.

In part (b) 57% scored one mark as large numbers of students failed to correctly expand the 2nd term of the 2nd bracket with $-3x - 6y$ seen rather than $-3x + 6y$. Most managed to expand the first bracket correctly. A significant minority treated the question as expanding double brackets to obtain a quadratic equation. Only 21% of the candidates expanded and simplified correctly.

Part (c) was generally well done with 43% getting it fully correct and a further 24% scoring 1 mark for either writing down 4 correct terms with incorrect signs or 3 correct terms out of 4 with the correct signs. Many students used the grid method which generally resulted in at least 1 mark. There are still many candidates who do not realise that the expansion should contain a term in x^2 and many who combine the constant terms to get +2 or –2 rather than –35.

1.2.8. Question 8

65% of candidates scored 1 mark. They were able to show they had used 0.5 or 0.6 but gave the final answer as 0.9 rather than 0.09. Others tried to calculate rather than estimate or rounded 0.61 to 1. Only 10% of the candidates gave an answer of 0.09.

1.2.9. Question 9

Not many candidates took the easiest route of using 22½% – 17½% and then finding 5% of £180. Numerous different attempts were seen, some of which were productive. Most candidates made a good attempt at this question and encouragingly lots of working was shown with 43% scoring all 3 marks.

However a high proportion of candidates made arithmetic errors in their calculations. The most common method used to find the percentages was to break them down to 10%, 5%, 2%, 1% and ½%. Mistakes came from an error in this or an error when adding them. 26% of candidates failed to score.

Workings were too often slanted on the page and scattered everywhere. A more organised approach should be encouraged.

1.2.10. Question 10

Many misread the isosceles triangle thinking that the base angles were *CBE* and *BEC* leading incorrectly to state *CBE* = 48°. The follow through applied to angle *ABC* meant all was not lost with 23% scoring 1 mark in this situation. It was disappointing to note that 54% failed to score. Candidates should be encouraged to write their calculated angles on the diagram particularly as they find it hard to express angles in 3 letter notation. Only 14% were able to write 42 on the answer line.

1.2.11. Question 11

In part (a) many candidates plotted the two points correctly and then went on to provide an acceptable description of the relationship between the 2 variables. 64% of candidates got both part (a) and part (b) correct with only 6% failing to score.

Many lost a mark in (b) by only writing 'negative' rather than 'negative correlation'.

In part (c) many found the approximate value without drawing a line of best fit on the diagram. Whilst this was not penalised, candidates risked losing all the marks if they wrote down an incorrect value.

In part (d) many statements referred to the physical attributes of the situation. There was not a great appreciation that correct comments had to refer to the data stopping at 70° or a reference to the line of best fit extending to negative time, not the laws of physics. Some candidates gave irrelevant information about the graph needing to be in seconds or information about the boiling point of water rather than answer the actual question which concerned why Suzy's data cannot be used. There were many interesting, unacceptable comments which referred to ice cubes melting and water boiling at 100°. Only a quarter of the candidates were successful in both parts (c) and (d) with around half the candidates not scoring in part(d).

1.2.12. Question 12

There were some good starting points with the realisation that the equations needed multiplying to make either the x or y terms the same. Nearly 30% of the candidates continued to find both correct values. It was encouraging to note that the majority appreciate they are being asked to perform algebraically rather than an endless testing of values. However, many candidates had no idea what to do or added their new equations rather than subtract. As a result 58% of candidates did not score on this question.

Elimination followed by substitution was the favoured method but there were lots of arithmetic errors when multiplying through the equations and difficulties when trying to eliminate one of the variables. There was confusion over whether to add or subtract the equations. If subtraction was chosen then some could not cope with the solution of $-y = -32$ and went on to substitute $y = -32$.

1.2.13. Question 13

Most candidates had an idea of what to do in part (a) although 29% only scored 1 mark for either leaving the answer as 24×10^{15} or 24 000 000 000 000 000. A significant minority managed to get the 24×10^{15} but then incorrectly changed this to 2.4×10^{14}. It was not uncommon to see both numbers converted to ordinary numbers but all too often candidates were let down by their inability to multiply these. 23% got part (a) fully correct.

In part (b) 67% failed to score. Some gained 1 mark for writing out the 2 numbers and attempting to add. However, there were place value issues with many adding the 6 to the 4 resulting in 100000000 or equivalent. Only 18% wrote the correct answer.

1.2.14. Question 14

Many candidates that attempted the question did not seem to have any idea what was required. Only 11% of the candidates were able to find an estimate for the solutions to (a)(i) and 10% to a(ii). Attempts were seen at solving the equation by factorisation and some crude, unsuccessful attempts to use the quadratic formula. Those candidates that were able to use the graph to find the solutions to $x^2 - 5x - 3 = 6$ generally gained full marks, reading the graph correctly to within the tolerance of $\pm$ 0.2; marks were not lost by inaccuracy. The line $y = 6$ was seldom seen.

In part (b) drawing the line $y = x - 4$ on the graph was not handled well with many unable to produce a worthwhile attempt. Not all the attempted lines drawn actually intersected the given curve thus making the solutions of the equations somewhat alien. 91% of candidates failed to score. If the line was drawn correctly points of intersection were often identified, although many candidates failed to appreciate the difference in scales. Many responses only gave x values instead of the co-ordinate pair, failing to appreciate that they were solving simultaneous equations.

1.2.15. Question 15

66% of candidates spotted the correct class. Some candidates lost the mark by giving the frequency that corresponds to the correct class. There were also incomplete answers when candidates gave the lower or the upper limit of the class.

71% of the candidates completed the cumulative frequency table correctly. The most popular incorrect answer to (b) was to use the frequency in each group as the cumulative frequency. Some made an error with one or more additions and followed that through to give various incorrect final values. A few thought that the first cumulative frequency value had to be 0 whilst others used multiples of 10 for the cumulative frequencies.

On the whole part (c) was well done with most candidates correctly plotting their values from an acceptable cumulative frequency table correctly, mostly at the top of the class intervals. Common errors were not joining the points together and not placing points at the ends of intervals. Bar charts were also evident and there were many lines of best fit drawn. In part (d) many candidates did not subtract their reading from 50 to get the correct answer. Just under 20% of the candidates got parts (c) and (d) fully correct with 30% failing to score in either part.

1.2.16. Question 16

Many candidates split their cross-sectional area into triangles and a rectangle, some doing it successfully and completing the question. Few could remember or correctly apply the formula for the area of a trapezium, or multiplied all the numbers they could see (or a selection of) or found the total surface area. For some, the step by step requirements of the question prevented them from following any sort of logical process, with the cross-sectional area just being the first hurdle. This was evident in the written work which was often chaotic and lacked any methodical approach. Many gained the latter two marks for correctly multiplying their volume by 5 and then converting correctly to kg by dividing by 1000. However there were equally as many candidates who tried to convert g to kg by dividing by 100 or 10, or who tried to find the mass by dividing by 5. Only 9% of candidates scored full marks on this question with 68% failing to score any marks.

1.2.17. Question 17

Even at this level, in part (a) many struggled to square –5 in the context of the question. 68% of the candidates failed to score. It was clear that a number of candidates had a poor knowledge of the order of operations. 10 + 150 = 140 or –140 were common incorrect responses. Overall only 17% of candidates were able to work out that $y = -160$.

In part (b) most candidates found the changing of the subject of the formula quite challenging. Recognition that the term in x needed to be isolated was not always seen as the first step. Addition and subtraction took preference over division in subsequent working. Many students 'lost' the minus sign on the $-2qx^2$ although some were able to carry on and successfully divide by 2q, then square root their answer. In the more successful processing, methods dealing with the introduction of the square root presented further challenges. Many only placed the square root round the numerator. 78% of candidates failed to score with the percentage of candidates scoring 1, 2 or 3 marks evenly spread.

1.2.18. Question 18

It was pleasing to see that many less able candidates were able to write down the value of 2^0 with 59% of the candidates getting this correct. The most frequent incorrect answers were 0 and 2. There were a few more creative individuals who gave other answers such as $\frac{1}{2}$, 20 and 0.2

It was quite evident that very few candidates understood what they were being asked to find in part (b) as the most common response was a nil response. 86% of candidates were not able to write down the value of y.

There were some confident approaches amongst the more able candidates in part (c) with almost 20% of the candidates scoring at least 1 mark. Dealing with the negative sign in the power tended to be the first priority in these cases. Even if the final answer did not appear, marks were being gained by writing down the stages in the working.

1.2.19. Question 19

Many candidates were able to give the correct response of 45, but few gave valid reasons for their answers. Many started with angle *CBD* = 90° rather than starting with angle *ACB* being 90° as it was an angle in a semicircle. The reasons given were often missing or incomplete and few were correctly able to cite the necessary circle theorem rule. Many students spotted the isosceles triangle, though several referred to the triangle incorrectly as equilateral. Many picked up a mark for an answer of 45°.

Correct angle notation was not widely used and many reasons were not well written so candidates should be encouraged to annotate diagrams as much as possible. Overall 54% scored 0 marks, 17% scored 1 mark and 5% scored all 4 marks.

1.2.20. Question 20

Candidates answered part (a) quite poorly without a clear understanding of how to factorise. Some candidates had an idea and put two empty brackets or had put $2x$ in one of the brackets. On a positive note, where $(2x\ldots..)(x\ldots\ldots)$ was shown, they were nearly always correct. 85% failed to score and 14% scored both marks in part (a).

In part (b) candidates who achieved marks usually attempted to expand the right-hand side of the equation; only on very rare occasions did the answer from part (a) appear and then only really to produce $x = -3$ since $(2x - 1)$ was cancelled on both sides and not equated to zero. Expanding $(2x - 1)^2$ often led to $4x^2 + 1$ or $4x^2 - 1$ which then prevented any further marks. 80% of candidates could not make any headway in this part with only 2% arriving at both correct solutions.

1.2.21. Question 21

An application of Pythagoras Theorem was required to find the height of the right-angled triangle. Most realised this but did not always apply it correctly. A few assumed that k was the height of the triangle and went on to give the area as $\frac{1}{2}\ k\ 2\sqrt{3}$ resulting in an immediate dead-end. In others there was a reluctance to show much working with just the value 6 on the answer line. As a proof was required this could not score any marks. 88% failed to score with 5% scoring 1 mark for a valid statement of Pythagoras or adding rather than subtracting the squares of the two sides and reaching $\sqrt{48}$. Many were unable to square $2\sqrt{3}$. Of the candidates who successfully used Pythagoras a number forgot to divide by 2 for the area of the triangle.

1.2.22. Question 22

The first branches on the probability tree were nearly always correct but the second branches caused much more difficulty starting with exactly how many there were of each colour in the boxes. The most common error in the second branch was to use 10 as the denominator rather than 11. It is disappointing at this level to see how many candidates just put a single number on each branch eg 6, 4 on the first branch followed by 7, 3, 7, 3. This would not score any marks.

Part (b) made use of the values on the probability tree but using this information correctly involved a clear understanding of the question which was frequently not the case. Some, after writing the incorrect probabilities, did go on to multiply across the correct branches and even to add their totals, thus securing method marks and showing recognition of BB or WW.

However, there was a lot of confusion with some multiplying across all branches and adding all totals, others thinking that the required combination was BW and WB rather than BB and WW. Overall half the candidates failed to score on this question with a further 28% scoring 1 mark, generally for the first branch in part (a). Just over 6% of the candidates got the question fully correct.

1.3 GRADE BOUNDARIES

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