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Examiners' Report November 2009

GCSE

GCSE Mathematics (1380)

Higher Calculator Paper (4H)

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November 2009

1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 4

1.1. GENERAL COMMENTS

1.1.1. The paper proved to be accessible to most candidates with the majority of the candidates attempting all questions.

1.1.2. Candidates are to be encouraged to show working, particularly when a question is worth more than one mark.

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

1.1.4. There was evidence that even the more able candidates had little idea how to solve equations that contained algebraic fractions as evidenced by the poor performance on questions 19(b) and 29

1.1.5. Candidates need to look at the formulae page more carefully and take note when using some of these formula. It was not uncommon to see candidates copy a formula incorrectly (or write down the formula incorrectly without using the formulae page). This was particularly noticeable in question 26, parts (a) and (b), and in question 29 by those candidates who tried to solve the quadratic by use of the formula.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

The introductory question to this Higher Tier paper was dealt with very efficiently with 93% of the candidates scoring all 3 marks. However, in those cases where one error occurred, it sometimes had the effect of escalating the error throughout the rows or columns of the table. It is important for the students to reflect on their initial entry into the table to ensure that it does not cause further errors. Some candidates showed written working out, around the two way table, indicating that they failed to use their calculator.

1.2.2. Question 2

This question was well done on the whole, with over ¾ of the candidates earning 2 out of the 3 marks. Students should be encouraged to write down the answers to the denominator and numerator separately as if they then either fail to write down sufficient digits or get the answer incorrect, they are still able to score a mark in (a). The most common incorrect response to (a) was 5.5342105 which was the usual error of working 8.7 × 12.3 / 9.5 – 5.73. Those candidates who inserted brackets around the numerator and denominator before starting tended to get the correct answer.

Rounding to one significant figure in (b) was extremely poorly done even by those candidates on target for an A grade. Answers of 28, 28.3 and 28.4 were extremely common. Those that did have a partial understanding of the concept then often supplied 3 as their rounded answer.

1.2.3. Question 3

Evaluating the expression was handled confidently in over 80% of the scripts. In a minority, however, there was a reluctance to dispense with the p and the q in spite of having made use of the values $p = 2$ and $q = -4$ thus giving rise to $6p$ and $-20q$. Others had difficulty in dealing with the negative sign such that both 6 and −20 were evident from their working but evaluated as 26 rather than −14

Only 60% of the candidates were able to factorise $3m - 6$ correctly with $3(m - 6)$ being the most common incorrect response from those candidates who knew that they had to take out a common factor and then have a bracket afterwards.

1.2.4. Question 4

This survey question posed significant difficulty for many students as they failed to grasp what was required. Perhaps a sound approach would have been to focus on the key word 'survey' thus generating the idea of either (i) the first two pages not being a representative sample, or (ii) the sample size being too small. In many descriptions the focus was more inclined towards the size of the picture(s) or the dimensions leading to the area. In some cases it was suggested that all 60 pages should have been used for the survey with little notion of what constitutes a 'reasonable' sample size. Only 27% of the candidates scored a mark on this question.

1.2.5. Question 5

In (a) many candidates managed to put in at least two adjacent lines of one of the planes of symmetry but were not quite accurate enough with their positioning at the halfway point and ended up scoring nothing. The vast majority just put in one line of symmetry, scoring one mark.

In part (b) many more students were successful with adding lines at the vertices being the most common error. Many of those who scored no marks just drew a 3-D shape.

Around 90% of the candidates scored at least 2 of the 4 marks on this question which is encouraging.

1.2.6. Question 6

The correct answer of 45° in (i) was by far the most common answer with over 90% success rate. Unsurprisingly, the most common incorrect answer was 135°.

Part (ii) was not as well answered as part (i) as candidates struggled to give a valid reason that involved one of the rules resulting from parallel lines. Many just wrote that the lines were parallel which was not sufficient for the mark. Only 35% of the candidates scored in (ii) which was disappointing.

1.2.7. Question 7

Finding the area of the circle seemed to be a well rehearsed routine and it was encouraging to find that the solution was set out in an organised fashion. It certainly helped to write $A = \pi r^2$ as the first line of working followed by $A = \pi \times 5^2$ giving a final answer in the range 77.5 to 78.6. The two main errors arising were to use the formula for the circumference rather than the area and also to evaluate $A = (\pi r)^2$. Very few candidates scored the method mark only and 2/3 of the candidates got the question fully correct.

1.2.8. Question 8

This question was answered well by most candidates with over ¾ scoring all 3 marks. Only about 12% scored no marks at all. The most popular calculation was to work out price per kg for both boxes, (with 86p and 85p) followed very closely with the calculation of the cost of 9 kg of powder for each box. Some students worked out the cost of 18 kg for each and then compared their results. Any valid method was acceptable. Those who compared 8 kg of one powder with 9kg of the other, or 9 kg and 10 kg usually lost all available marks. It was not unusual for students to fail to interpret their two method results correctly and consequently lose the final mark.

1.2.9. Question 9

Only 28% of the candidates managed to fully describe the rotation. Some omitted the word 'rotation' (using 'turn' instead) whilst many could not identify the centre of rotation. Those that did often had difficulty with coordinate notation either leaving out the brackets or writing the centre as a vector. 36% scored no marks at all, often because they did not take notice of the question asking for a single transformation, providing a selection of transformations instead which scored no marks. The most common combined transformation was to start with a rotation and then do a translation.

1.2.10. Question 10

This was a very straightforward percentage question with over ¾ of the candidates gaining full marks. Some had problems finding 10% making it 3.6 There were very few 360 × 1.175 A common error was to fail to add the 63 or even subtract it from 360.

1.2.11. Question 11

This was a well answered question by candidates at all levels with over 80% of the candidates scoring 2 or 3 marks. Only the weakest candidates failed to gain the mark in part (a), with some incorrect responses being to either try to describe the relationship (usually incorrectly), write 'positive', or just leaving the answer space blank.

In part (b) both marks were usually gained, often without a line of best fit.

1.2.12. Question 12

Combining the three algebraic expressions to find the perimeter of the triangle was well understood in so far as what was required. In practice it proved to be rather more challenging than might have been expected with only 55% scoring all 4 marks. Reward was given for attempting to add together the three expressions and this mark was often awarded. The x- term did not appear to cause too much difficulty with $2x + 2x + 4x$ and $8x$ being shown in the final expression. However, evaluating $9 - 3 + 5$ did, however, not always produce 11. It was disappointing to find that over 17% of the candidates failed to score any marks at all even though part (b) was awarded follow-through marks from (a).

1.2.13. Question 13

On the whole this was answered well with 77% scoring all 3 marks. By far the most common error, which accounted for most of the 23% of candidates who failed to score, was to evaluate $180 \div 2$, $180 \div 3$ and $180 \div 4$. A surprising number of candidates showed their working and wrote $2 + 3 + 4 = 8$, with perfectly correct methods. It was pleasing to note that most candidates did read the question and provided their largest piece as their final answer.

1.2.14. Question 14

Although trial and improvement is often tested, nearly ¼ of the candidates failed to score. Those candidates that did not give an answer to their calculations, often just writing 'too big' or 'too small' scored no marks. The remainder of the candidates were equally divided between those that scored all 4 marks or those who lost a mark. The latter tended to lose a mark for either writing 3.75 or 3.8 as their answer or failing to test a value between 3.7 and 3.8 Candidates should be encouraged to only test the mid-value of 3.75 to see what the final answer should be. Too many candidates only went as far as evaluating 3.7 and 3.8 as their values of x and then stating that 58.05 was closer to 60 than 62.47. This is an unacceptable method as this method does not always lead to the correct answer. In this question the minimum required to score all the marks was to test 3.7 or 3.8 and 3.75 correctly and provide an answer of 3.7

1.2.15. Question 15

Well over 80% of the candidates got both parts (a) and (b) correct. The most common errors were to ignore the rules of indices and write m^{12} and $t^{7/3}$. Occasionally $m7$ or $7m$ was seen. In part (c) 1/3 of the candidates failed to score any marks (often writing $12+x^2+y^5$) with a further 20% making one error, generally for writing $7x^3y^5$. Many others did not realize that x has a power of 1 and wrote $12x^2y^5$. In this type of question it would help to group the like terms together by writing $4 \times 3 \times x^2 \times x \times y^3 \times y^2$ first.

1.2.16. Question 16

This was a standard Pythagoras question and it was pleasing to note that the 62% that scored all 3 marks did show their working out clearly. 1/3 of the candidates failed to score often for attempting trigonometry or subtracting the squares of 12 and 14. Others saw a pattern of 12, 14, 16 and wrote 16 as their final answer! A few used trigonometry to find an angle and then used the sine rule to find AC. Unfortunately this method often led to errors and so only the method marks could be scored if it was applied correctly.

1.2.17. Question 17

Completely correct solutions were not very common with only 20% scoring all 4 marks. Many did not get the first coordinate of (−2, 9) getting (−2, 1) instead. Plotting was generally accurate but potentially fully correct solutions were spoiled by joining the two y = −3 values with a straight line. Many candidates failed to gain a mark because they made no attempt to join their plotted points or used straight lines rather than a curve. It was a pity that candidates were not aware of the symmetry of a quadratic graph so that they could check their calculations. 14% failed to score with those scoring 1, 2 or 3 marks evenly spread.

1.2.18. Question 18

Only a third of the candidates scored in part (a). Common incorrect responses were $140 \leq h < 150$ (the middle class interval), 25 (the middle frequency) or 155 (identified the correct class interval and then wrote the mid-value). In part (b) over ½ the candidates failed to score with 31% scoring all 4 marks. Many multiplied the frequencies by the correct mid-values but then did not know what to do with them. 725 ÷ 5 = 145 was a very common incorrect response (adding the mid-values and dividing by 5). A remarkable number added the correct fx's and got 14000 instead of 14900 probably for typing 100 rather than 1000 into their calculators for the first fx. A significant number of candidates found fx for each interval in the table, or even Σfx but then continued with a totally unrelated incorrect method to find the mean, ignoring the work they had just done. This was considered a choice of methods and as their answer then followed on from the incorrect method, no marks were scored.

1.2.19. Question 19

65% of the candidates scored at least 1 mark in part (a) for either providing 4 correct terms, ignoring signs, or 3 correct terms with the correct signs. Candidates often just squared each term writing $x^2 - 15$ as their final answer. Quite a few candidates used the grid method successfully. Around 45% scored both marks.

Most candidates struggled to solve the equation in (b) with 68% failing to score. The first step was to multiply $x + 5$ by 4 and it was not uncommon to see $4x + 5$ as the result of this attempt. Reward was given for seeing the correct arrangement of *their* four terms to separate the x terms and constants from the initial processing but in many instances recognising *their* four terms, from the working, was not at all obvious. 23% were successful in obtaining the correct answer.

1.2.20. Question 20

It was pleasing to note that around 30% of the candidates were able to provide the correct moving average. Many worked out the three-point moving average whilst a large number of candidates looked for a pattern and wrote 89 with the trend given in part (b) being +3, +2, +1.

In part (b) many focused on how a family would use more gas in the winter than in the summer. Others felt that the amount of gas used had increased rather than focus on the cost of the gas.

1.2.21. Question 21

The solution to this question was more often incorrect than correct. The vast majority of incorrect solutions found 12% of 132.88 and added this on, either by finding 12% then adding or 112%. There were some candidates who equated 132.88 to 112%. Even when candidates stated 132.88 = 88%, they often either went no further or found 112%. Nearly 70% of candidates failed to score on this 'reverse percentage' question.

1.2.22. Question 22

Very few method marks were scored in this question which was disappointing. Finding the scale factor of enlargement should have been a first step. Candidates either failed to score (43%) or scored all 4 marks (50%). 11 and 7 were the most common incorrect answers found by adding 5 to 6 and subtracting 5 from 12 … following the pattern of 10 + 5 = 15 for the two equivalent sides. There were a few students who decided that the two sides were equal ie $QP = PS$ and $AB = AD$ therefore writing 12 and 6 as their answers.

1.2.23. Question 23

This seemed to be a question that distinguished the less able candidates from the more able candidates. The latter were able to gain all three marks, and usually showed all the correct lines of working. If the correct trigonometric ratio was chosen and the first method mark awarded, it was usual to award all 3 marks in the majority of cases. Candidates with correct working almost always used their calculator correctly although a few rounded their value of 8.2 ÷ 10.6 early and lost the accuracy mark. Less able candidates picked the wrong ratio, usually tangent, or left the question blank. Occasionally Pythagoras was used to calculate the length of AB and then sine was used to find the angle. This was quite often carried out correctly but in many of these cases the length of the side *AB* was truncated early to give an inaccurate value for *x*. 57% of candidates failed to score and 35% scored all 3 marks.

1.2.24. Question 24

Very few seemed to understand what a 'stratified sample' was, and those who did struggled to select the correct values to process from the table. Many used the total number of girls (179) rather than the final total(382) giving rise to '85/179' rather than '85/382'. For those who were able to evaluate 85 × 50 ÷ 382 as 11.11... they tended to realise that a fraction of a girl was incorrect and gave the answer correctly as 11. This topic is not always understood and this was indicated by the 75% who failed to score on this question.

1.2.25. Question 25

Many students struggled to write a formula for x in terms of y with 35% failing to score. However, it was pleasing to find that 45% managed to score at least 3 marks on this question. A common error was to give the answer as $y = 50x$ in (a) whilst others had a notion of the correct answer but did not know how to express it properly. Candidates were more successful in part (b) as they could start again to get $y = 7$

1.2.26. Question 26

The correct answer to (a) was not as common as an incorrect one. When answered correctly (30% of the candidates), working was usually seen and it was rare to award the method mark without the accuracy mark as well. When answered incorrectly, candidates did not seem to be aware of the formula for the area of a triangle on the formulae page, and often tried to apply the formula $a = ½\ b \times h$.

82% of the candidates had no idea that the cosine rule was needed for this question. Of the 18% that did, many substituted correctly but then did not apply BIDMAS and subtracted 80 from 89 before multiplying the 80 by cos 75°. A small number forgot to take the square root. An attempt at Pythagoras was the most common incorrect method employed.

1.2.27. Question 27

This was usually either all correct (28% of candidates) or all incorrect (66% of candidates). Most students treated this as a bar chart and considered the heights of the bars only. Those who did understand the term 'histogram' usually scored full marks.

The students who had part (b) correct usually seemed to use the 'frequency density' method rather than the 'counting squares'.

1.2.28. Question 28

Over 80% of the students did not understand what was required in this question at all and either did not attempt the question or used the given values, suggesting that the topic had not always been covered. A large number did not consider bounds at all. Of those who did the main errors were 5.144 and 6.434 used as the upper bounds or calculating 'upper bound ÷ upper bound' and 'lower bound ÷ lower bound'.

1.2.29. Question 29

Answers to this question rarely gained full marks - about 5% of responses seen. About 80% of candidates gained no marks at all. Problems with algebraic manipulation of fractions were widespread. Most candidates who attempted to multiply through by the two denominators did not do this to the right hand side of the equation as well. Others struggled to multiply the two denominators correctly. A number of students substituted values attempting to find solutions by trial and improvement and some succeeded in finding one solution this way. This did not score any marks. Other candidates wrote $4(x + 3) + 3(2x - 1)$. Others just wrote 7 as the numerator when trying to simplify the left hand side of the equation. A few students did reach the correct quadratic equation and in nearly all these cases the quadratic formula was used to solve the quadratic rather than factorise, and errors then arose. This proved to be a challenging final question with only 5% solving the equation correctly.

2. STATISTICS

2.1. MARK RANGES AND AWARD OF GRADE

Unit/Component	Maximum Mark	Mean Mark	Standard Deviation	% Contribution to Award
1380/1F	100	67.4	16.0	50
1380/2F	100	65.0	18.9	50
1380/3H	100	53.0	20.5	50
1380/4H	100	51.8	22.5	50

GCSE Mathematics Grade Boundaries 1380 – November 2009

	A*	A	B	C	D	E	F	G
1380_1F				78	64	51	38	25
1380_2F				78	64	50	36	22
1380_3H	86	70	52	34	20			
1380_4H	88	71	51	32	19			

	A*	A	B	C	D	E	F	G
1380F				156	128	101	74	47
1380H	174	141	103	66	39	25		

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