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Examiners' Report June 2009

GCSE

GCSE Mathematics (1380)

Higher Calculator Paper (4H)

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1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 4

1.1. GENERAL COMMENTS

1.1.1. Candidates should be reminded not to work in red pen or pencil. Blue or black ink should be used with pencil reserved for graph work and diagrams. This year there were problems with some candidates writing in what appeared to be thick black felt pen which was visible through the paper; please encourage candidates to use biro or ink pen rather than felt pen.

1.1.2. This paper was accessible to the majority of candidates. There was no evidence to suggest that candidates had difficulty completing the paper in the given time.

1.1.3. As expected, some of the weaker candidates made little progress with the more demanding questions, but most candidates were able to gain marks here and there throughout the paper.

1.1.4. The vast majority of candidates did all their calculations and checks within the space provided for each question, but written responses often went beyond the answer region.

1.1.5. Whilst most work was easy to read and follow through, a significant number of candidates produce work that is not well organized.

1.1.6. Candidates should be encouraged to learn the formulae for the circumference and area of a circle. These were not known by a significant number of candidates this summer.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

The majority of students gained full marks on this question. Many however multiplied when they should have divided and vice versa. Candidates need to be encouraged to write out their working as too many merely gave answer only solutions, some of which you suspect, but without any evidence, were copying errors e.g. £564 in(a) or £87 in (b). Some candidates used repeated addition in (a) rather than multiplication.

1.2.2. Question 2

Part (a) was extremely well answered by candidates, with most scoring full marks. The few mistakes included using a scale factor of 3 instead of 2, or doubling the number of steps rather than increasing their length. Most candidates clearly knew what the transformation was in part (b) and gained the first mark for reflection, but many lacked the skill to describe adequately, using words such as flipped and mirrored. However the second mark was not so readily achieved. Although the correct answer was probably the most common, some confused the y-axis with the line y = 0 or merely called it the y line and a few quoted y = x as their mirror line.

1.2.3. Question 3

On the whole this question was well answered, with most candidates stating the answer only. There were a few common wrong responses which included omitting the plus 1 to obtain "1, 4, 9"; using n=0 for the first term to obtain "1, 2, 5"; incorrectly evaluating 3^2 as 6 to obtain "2, 5, 7". Perhaps the most common incorrect response came from those who treated it as an iterative process to gain "2, 5, 26". Some candidates did not evaluate the expression but used "n^2+2, n^2+3" as the next terms.

1.2.4. Question 4

Points were usually plotted correctly although a few candidates clearly missed this part of the question. A number initially misread the table horizontally and so plotted (65,80) but then realised and rectified their mistake when unable to plot (100,110) on the axes provided. In part (b) the majority of candidates chose to describe a dynamic relationship along the lines of "the taller the sheep, the longer it is" rather than just stating positive correlation. Incorrect answers most commonly seen involved "direct proportion" or an expression of the difference between the variables. A number referred to weight of sheep rather than height. In part (c) neither a line of best fit nor vertical line at 76cm was usually seen. Instead candidates judged the value by eye and in most cases gained full marks by being within the acceptable range of answers. Errors that did occur were due to the 2 axes being confused or misreading of the vertical scale.

1.2.5. Question 5

This was generally answered correctly, with most candidates using two steps, first dividing by 19 and then multiplying by 31. Sometimes candidates resorted to an unnecessarily complicated method no doubt taught for situations when calculators are prohibited, e.g. find the cost of one, then 20, then thirty, and then add 1 more. Finding the cost of 1, then 12, then adding on was also quite popular. Unfortunately the more steps that were involved the more mistakes and rounding errors that appeared. However by far the greatest source of mark loss in this question, was in misreads and transcription errors, 13 used instead of 31 being the most common.

1.2.6. Question 6

Substitution of values into the formula was generally correct. Subsequent errors with evaluation usually involved the -8 term where candidates often added 1.8 and -8 rather that multiplying them to give -6.2 and a final answer of 25.8 or ignored the negative sign to evaluate -8 x 1.8 as +14.4 and get 46.4 Often the operations were incorrectly ordered to give 1.8 x (-8 +32) = 43.2 and the decimal point in 1.8 was sometimes omitted. In part (b) as in part (a) correct substitutions were often seen although some candidates missed the mark available for this by going straight to an incorrect attempt to solve. Where errors occurred in subsequent algebraic manipulation, some went on to add 32 to 68 getting 100, which they then divided by 1.8 to get 55.5555…. Others divided 68 by 1.8 before subtracting 32. The decimal point in 1.8 was again sometimes omitted giving 2 as a final answer after 36 = 18C . Another common error was to substitute 68 for C rather than F giving F = 1.8 ×68+32.

1.2.7. Question 7

Weaker candidates could draw the 60° bearing but not 310°. A number used their protractor with the straight edge horizontal, effectively measuring bearings from an East-West line. Some candidates marked points correctly but then joined the two points up, thus losing the third mark. In some cases, the mid-point of this line was identified and labelled R.

1.2.8. Question 8

In part (a) those who did not score full marks either did not simplify fully or had the ratio around the wrong way. The colon on the answer line seemed to be a very good prompt for candidates. In part (b) the majority of candidates scored 2 marks for “45”; this was generally accompanied by workings which showed division by 6 and multiplication by 5 in that order. Some candidates built up the ratio from “1:5” to “2:10” to “3:15” etc summing the parts until the correct one of “9:45” was obtained. One mark was commonly obtained for “9”, sometimes for the ratio “9:45” and rarely for “270”. Zero marks were awarded a number of times for the incorrect response of “10.8”, obtained from “54/5”.

1.2.9. Question 9

While it was pleasing to see that most candidates now have a good grasp of this part of the syllabus and consequently scored well on this question there is still a lack of understanding for the need to calculate a value for x = 2.65 (or between 2.6 and 2.65). Candidates need to be taught that evaluating at 2.6 and 2.7 and finding out which is nearer to 71 is incorrect mathematically. Failure to round their answer to 2.6 was also common, many trying to 'do better' than 1dp.

1.2.10. Question 10

Of the candidates scoring 2 marks, most did this with very neat and precise responses, showing clear construction lines, although a few candidates did use very faint or minimal arcs which were difficult to see. In general it appeared that most candidates knew that bisect meant split the angle in half, although some candidates were seen to construct perpendicular bisectors through the 2 lines and others created a triangle and produced a perpendicular bisector of the new line.

The candidates gaining 1 mark were equally split between those splitting the angle without construction lines and those who drew arcs on the original lines. Many candidates were thrown by the fact that the two arms of the given angle were of different lengths and they drew arcs from the ends of the lines.

1.2.11. Question 11

Many candidates thought that 1 was a prime number. Others had trouble with the word "sum", misinterpreting it as product. Successful candidates usually offered a correct counter example, frequently 2 + 3 = 5, and often backed this up by a written explanation. On occasions, a correct counter-example worthy of full marks was spoiled by further embellishment including incorrect statements or other examples involving non-primes.

1.2.12. Question 12

Most candidates made full use of the extra columns in the table. A significant number of candidates correctly found fx using the appropriate midpoints but then divided the sum by "5" (the number of groups) or "75" the sum of the midpoints (this was particularly disappointing with 80 having been given in the question).

The most common response from those only gaining 1 or 2 marks was to use the end points when calculating fx. Weaker candidates divided the sum of the frequencies or the sum of the midpoints by 5. Most candidates seemed to realise that the extra columns in the table had a purpose and wrong responses included finding the frequency density and producing cumulative frequency.

1.2.13. Question 13

A significant number of candidates were unable to gain any marks in this question, this was frequently due to the formula for the area of a circle being used. Common errors were forgetting to halve the circumference, confusing the radius with the diameter or most commonly forgetting to add on the diameter. Many candidates just found the length of the arc rather than the perimeter of the shape.

1.2.14. Question 14

Parts (a) and (b) were generally well answered. The most common incorrect answer in (a) was 3a. In part (c) Most candidates managed to expand 3y x y correctly and simplify to $3y^2$ but a few did not multiply 3y by 4 and just wrote 12 rather than 12y. Hence $3y^2 + 12$ was the most common error seen. Expansion of both brackets in part (d) did not usually cause problems although a few multiplied the brackets together. Simplification caused more difficulties with the -8 term added leading to 5x + 14 or a common arithmetic slip giving 2x + 3x = 6x Again, in part (e) the expansion of brackets was often successfully tackled but simplification led to more errors, caused usually by difficulties dealing with the negative terms. In the expansion, 4 and -3 were added rather than multiplied to give 1 leading to $x^2 + x + 1$ or just $x^2 + 1$. -3x and 4x were sometimes combined to give –x and a common mistake was to ignore the – sign and add these 2 terms to give $x^2 + 7x - 12$.

1.2.15. Question 15

The majority of candidates gained full marks here. A common error was to type the whole problem into their calculator without the use of brackets, reaching an answer of -1.534023. The most successful solutions were when the candidates worked in stages calculating the numerator and denominator separately, not only does this approach avoid the former error but it also gives the opportunity to gain method marks. Another area of concern was the rounding/truncating of values, either in the answer or at various stages.

1.2.16. Question 16

Candidates were equally successful in part (a) and (b) with the vast majority giving the correct answer in each part. In part (c) the most common error was to cube only one part of the product leading to either 8x or $2x^3$ Some candidates wrote out 2x x 2x x 2x and thus gained a mark but went on to simplify incorrectly. Confusion adding rather multiplying to cube 2 led to $6x^3$ In part (d) many candidates confused the operation of the numbers and indices, leading to answers including $7a^7h^5$ from 3 x 4 = 12 and $12a^{10}h^4$ from 2 x 5 =10 and 4 x 1 = 4. Some candidates included + signs between their terms, for example $12a^7 + h^4$.

1.2.17. Question 17

Many candidates realized the need to use Pythagoras' theorem and then applied it correctly. There were some though that took the required length to be the hypotenuse (finding root 117) and therefore lost marks. This question showed that some of the pupils did not have a clear understanding of what to do if the hypotenuse was given in a question. Some tried to treat it as a trigonometry question with some quite involved work. Many pupils did not round correctly (6.70 or 6.7); candidates should be reminded to give a full figure answer before rounding.

1.2.18. Question 18

Most answered this part (a) correctly. There were some who stated that 30kg was the heaviest bag. The majority of candidates were able to score marks in (b) and (c). However, part (d) was very poorly answered on the whole. Good candidates realised that that those less than 10 represented the lower quartile as seen at the start of the question. They used the diagram given at the start of the question and either said 240/4=60 or said 240/2=120 which gives the median and then said 120/2=60. Errors included 240/5 =48 the 5 being taken from 10-5. Range = (29-5) =24 then 240/24 is 10 and 10 X 5 = 50 the 5 being taken from 10-5 and 240/6 = 40.

1.2.19. Question 19

In part (a) there was the expected mix of results between those calculating compound and simple interest. Most people were able to pick up at least one mark for 180, 4860 or 4680. Many opted for correct methods other than the efficient multiplying by 1.04 or 1.04^2, eg by finding 4% and then adding to find the principal amount for the calculation for the next year. There was a significant number of students who seemed to rely on non-calculator techniques, breaking the problem down to 5% and 1% and then 4%. Many of these attempts ended in numerical errors.

In part (b) the best answers used a "trial & improvement" approach using (1.075)^n showing repeated multiplications of 2400 by 1.075 to find the answer and slightly fewer repeatedly divided 3445.51 by 1.075. There were a surprising number of lengthy methods involving multiplication and addition each year - often correct but for premature rounding. Candidates using this method sometimes miscounted the number of repetitions they had done and gave 4 or 6 as the answer. The two main errors were dividing (3445.51-2400) by £180 or subtracting 7.5% of 3445.51 and working backwards. This question was surprisingly well done even to the extent that a few candidates were able to use logs to solve $1.075^n = 1.4356$.

1.2.20. Question 20

In part (a) many candidates struggled with this question or adopted a long-winded approach involving Pythagoras and the sine rule. Common errors included failing to identify cos as the appropriate ratio or using an incorrect order of operations when finding invcos. The sine rule candidates often failed to rearrange correctly, some of them failed to put sine at all and others calculated the third side using Pythagoras incorrectly.

In part (b) most candidates recognised the need to use the tan ratio but faltered when it became necessary to manipulate the formula to make y the subject. A common error was to write tan40=y/12.5 and then rearrange incorrectly confusing the angle and side length given to calculate 40 x tan12.5. Others attempted tan40 ÷ 12.5 or 12.5 ÷ tan 40. Some candidates identified the third angle as 50 and then successfully used the sine rule.

1.2.21. Question 21

The most common pair of incorrect answers seen were 26 and 135 where candidates did not appreciate that the question involved a sample rather than the whole population shown in the two-way table. Rather than carry out a single calculation, some candidates wrote down decimal or percentage values for fractions such as 26/258. Premature rounding of these values occasionally led to inaccuracies but the necessity to have a whole number final answer usually rescued a potential loss of accuracy marks. A number of candidates assumed that part (b) also referred to the students studying Spanish and calculated 62/258 x 50 rather than use the 135 total of female students.

1.2.22. Question 22

Many candidates struggled with the requirement for an algebraic proof and instead opted to substitute various values for n. Those attempting to simplify the expression often made errors with $(3n)^2$, expressing it as 9n, $6n^2$ or $3n^2$. Sign errors and omission of brackets around the second half of the expansions accounted for many of the other errors with 1 x 1 = 2 causing a severe loss of marks for a few. A difference of two squares method was seen on a small number of occasions. Some candidates correctly simplified to 12n but failed to justify the final mark often stating that 12 rather than 12n was a multiple of 4.

1.2.23. Question 23

Part (a) was correctly answered by about half the candidates, but incorrect responses included (ab)/2, a+b, a-b, and p. It appeared that candidates were confused by part b, and it was noticeable that a lot of those who correctly responded to part (a) did not even attempt part (b). There were some very neat logical arguments but on the whole the responses were messy with lots of crossing out and arrows directing you to the next line of their answer. Of those who gained some credit the most common mistake was using PB instead of BP, (there was little appreciation that the opposite direction results in a negative vector), followed by those who missed out brackets and hence only multiplied part of the vector. Some candidates tried to draw a scale drawing as the proof. A few candidates tried to give a justification in words.

1.2.24. Question 24

This question was reported by many as being a good discriminator. The most efficient way to tackle the question was to realise that the angle of the sector was 60.This enabled the candidates to use the ½ absinC formula for the triangle. However many candidates resorted to the cosine rule to find it or decided because it was a sixth of the circle they needed to use sin 6. A number of candidates were able to calculate one of the areas correctly; more frequently the sector, and then the subtraction carried out The most common error was to use half base x height for the triangle area, using 6 as the height. Some did use Pythagoras to find the height but often made errors. Quite a few found one or other of the two areas and offered this as their answer.

1.2.25. Question 25

A challenging question for all but the most able candiates. Many did not appreciate the need to factorize the numerator and denominator and tried to cancel individual terms. More students gained marks from factorizing the numerator than the denominator, here a non - unitary x^2 coefficient was beyond the reach of all but the best. Pleasingly, the vast majority of those who reached the final answer did not try to cancel again. There were a surprising number of attempts to use the quadratic equation formula here.

1.2.26. Question 26

A large number of candidates drew tree diagrams, which in most cases were helpful: however some candidates drew them so big that their calculations were then squashed around the edges with very little logical flow. Most candidates seemed to have assumed that there was replacement and so limited themselves to 2 out of the four marks. It was common to consider only three scenarios instead of 6, for example red then orange but not orange then red. It was more common to see 6 fractions added rather than 1 – the complement.