Principal Examiner Feedback

Summer 2010

GCSE

GCSE Mathematics (1380)

Higher Non-Calculator Paper (3H)

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1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 3

1.1. GENERAL COMMENTS

1.1.1. This paper was comparable with that of last summer; maybe a little more demanding at the lower levels. Once again poor arithmetic prevents many candidates securing the marks that their mathematical understanding deserves. This was shown in questions 10, 11, 15, 16, 18 and 19. Inability to add and multiply fractions let many candidates, at all levels, down in questions 11, 16 and 26. It is evident that some candidates are being entered at an inappropriate level and are unable to even attempt many of the more demanding questions.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

The most common error, gaining one mark only for the term $8x$, was an answer of $8x - 6y$. Some candidates chose to factorise their correct answer of $8x + 6y$; this was acceptable provided the factorisation was correct. Some candidates still want to combine the $8x$ and $6y$ to give $14xy$. Sometimes candidates factorised but lost the multiplier leading to a final answer 4x + 3y, this may have been an attempt to "simplify".

1.2.2. Question 2

Most candidates gained full marks for a correct diagram; any error here tended to be the omission of one of the repeated values usually 58 or 62. Although a key was usually correct, there were a significant number of errors, often simply describing the notation as "tens" and "units". The majority of candidates did not make use of the extra space provided to complete an unordered diagram first but instead used a possibly more onerous method of searching through the data for ascending values to put it into an ordered diagram straight away.

1.2.3. Question 3

The majority of candidates were able to correctly find the value of y, although many seemed to be confused as to which two angles of the isosceles triangle were equal. Some candidates gave an incorrect angle of 70o, thinking that angle TQP was the required angle. Although many candidates were able to give at least two correct reasons for their answer to (i), many contradicted their reasoning by saying that the lines TP and QP were parallel, clearly not understanding the notation on the diagram. Similarly, candidates who used the isosceles triangle properties contradicted this and referred to it as "equilateral". Calculations were often given in place of reasons; candidates need to be encouraged to communicate their mathematical thinking with reference to the geometric theory used.

1.2.4. Question 4

The great majority of candidates gained full marks in all parts of this question. 10 30, 10 05 were answers sometimes seen in part (a). A range of 13 to 14 enabled most candidates to gain the mark in part (b). In part (c), a significant number of candidates tried to complete the journey above the graph on the given grid and some had difficulty reading the scales.

1.2.5. Question 5

Most candidates were able to rotate the given shape although not always about the given point and sometimes through 90^o, either in a clockwise or anticlockwise direction, instead of 180^o. A few candidates made the mistake of reflecting the given shape, usually in the x – axis. Candidates have access to tracing paper for this question; those who struggle to locate the image correctly would be well advised to take advantage of it.

1.2.6. Question 6

Many candidates scored 1 or 2 marks for describing the given transformation as an enlargement and/or a correct scale factor of 2; however only a few were able to gain full credit by including the centre (1, 0). Attempts at a scale factor such as 'twice as big' or 'double in size' were given no credit. A significant number of candidates made the error of writing the centre as (0, 1) or as a column vector. Others gave coordinates (3,2) or (5,4), the bottom left vertices of the 2 shapes shown. This question asked for a **single** transformation. Those candidates who offered a combination of transformations scored no marks even when part of the description was 'correct'.

1.2.7. Question 7

Most candidates scored highly on this question. Poor arithmetic of the division of 40 by 5 was the most common source of error. Weaker candidates often gave the answer 20:30 incorrectly dividing 40 by 2 to give 20 and then using the 'correct' proportion to give 30. There were a few candidates who failed to add 2 and 3 correctly and came up with 6. A small number attempted increasing ratios like 2:3 then 4:6 up to 16:24. These candidates gained credit. Very few actually reversed the amounts giving Anna £24 and Bill £16 but those who did gained 2 marks.

1.2.8. Question 8

In part (a), the majority of candidates gained the mark for identifying the correct modal class interval, although answers of 5 – 9 and 10 – 14 were not uncommon. In part (b), many candidates failed to use mid interval values for their plotted points choosing the upper and sometimes the lower interval values. Many candidates drew extra lines in an attempt to complete a closed polygon or joined points with curves and consequently failed to gain full credit. Candidates who drew a frequency diagram with bars first and then identified the midpoint of the top of their bars to construct the polygon were usually most successful with their accuracy. A significant number of candidates drew a bar chart only.

1.2.9. Question 9

Although the correct answer of 120 cm^3 was often seen, the most common error was made in candidates failure to correctly find the area of the triangular cross section. The most common error being an answer of 240 cm^3 from a cross sectional area of 12 cm^2. Another common answer was 1200 cm^3 (3 × 4 × 5 × 20). A significant number of candidates found or attempted to find the surface area of the prism. This gained no credit even when perfectly correct.

1.2.10. Question 10

Whilst the correct answer of 162.72 was often seen, many simple arithmetic errors prevented the award of full marks. Candidates choosing to work out 452 × 36 before inserting the decimal point often fared better than those trying to compute a number of decimal calculations. Often 0.02 was taken as 0.2 and since this led to two incorrect calculations, no marks were available.

1.2.11. Question 11

The greater proportion of candidates followed the first method described in the mark scheme and tried to work out one sixth of 300 and three tenths of 300. This method usually led to the correct 50 boys but many made mistakes in their calculation of the number of girls, 30 (one tenth of 300) being the most common error. Candidates were, however, still able to pick up a further mark for the sum of their numbers of boys and girls subtracted from 300. Candidates choosing the addition of fractions route often made mistakes in their method of working out $\frac{1}{6}+\frac{3}{10}$ usually making mistakes in their attempts to convert to fractions with a common denominator of 60. Those candidates who did manage the addition of fractions often gave $\frac{8}{15}$ as their final answer thinking that they are working out the fraction of adults.

1.2.12. Question 12

This question was not answered well. Many candidates were confused between the meaning of exterior and interior angles. Often those understanding exterior as outside mistakenly found the reflex angle. Many candidates did divide 360 by 5 to get an answer of 72 but then subtracted from either 180 or 360 to give answers of 108^o or 288^o respectively. A significant number of candidates used correct methods to find 108^o as an interior angle but then subtracted from 360 giving an incorrect answer of 252^o. Quite often information drawn on the diagram contradicted the candidate's working.

1.2.13. Question 13

This question was very well answered with the majority of candidates describing at least one, and usually two, errors in the given question. The error that 'zero' and '>20' were missing from the response boxes only gained one mark since the mistake was just addressing one aspect that the response boxes were not exhaustive. This question was answered better this year. It seems that candidates are being made aware of the key points to be made.

1.2.14. Question 14

In completing the table of values, most candidates were able to score at least one mark. The most common error was in the substitution of $x = -3$, where values for y of 6 and 9 were often seen. The plotting of points from the table of values was good; however the actual drawing of a smooth quadratic curve was less impressive and often messy. Many candidates joined the points with line segments and many of those attempting curves often drew a line segment between the points (-1, -3) and (0, -3) A substantial number did not take enough care to draw an accurate curve and so missed out one or more points and lost a mark. In part (c), candidates who realised that the solutions were found from the intersections on the x-axis, usually read correct values from their graph. Some candidates made attempts, usually unsuccessfully, to solve the quadratic equation algebraically.

1.2.15. Question 15

The factor tree method was the most popular method employed here. Often this was carried out accurately although an alarming number of simple arithmetic errors prevented many candidates scoring more than one mark. Many began working with 180 = 2 x 60. A great number of candidates demonstrated their lack of understanding of the word 'product' and simply listed the five prime factors of 180 or as a sum 2 + 2 + 3 + 3 + 5. Candidates who included the number '1' in their product failed to gain full marks. Some mistook 9 as prime giving 2 x 2 x 5 x 9.

1.2.16. Question 16

This question was poorly answered with many candidates either making simple arithmetic errors or demonstrating an inability to multiply two fractions together. Many correctly converted the given fractions to improper fractions but then $\frac{13}{4}\times\frac{8}{3}$ often became $\frac{39}{12}\times\frac{32}{12}$ followed by attempts to add the two fractions or multiply only the denominators or 'cross multiply'. Some candidates correctly found $\frac{104}{12}$ then failed to simplify accurately. The ability to "cancel" seems to be lacking. The most common mistake in efforts to find the product of the two given mixed numbers was to multiply the whole numbers and the fractions separately giving an incorrect answer of $6\frac{1}{6}$.

1.2.17. Question 17

In part (a), candidates understanding the concept of factorisation were able to gain the mark for a correct answer. There were some attempts to factorise the given expression into the product of two linear expressions; overcomplicating the demand. Many candidates gained full marks in part (b) for an answer of $\frac{19}{3}$ or better. It should be noted that failed attempts to write $\frac{19}{3}$ as a mixed number were ignored. Many candidates failing to score full marks were often able to gain one mark if they correctly expanded the bracketed expression $4(2x - 3)$. In part (c), many methods were demonstrated, usually leading to the correct answer, although incorrect answers of $y^2 + 20$ and $y^2 + 9y + 9$ were not uncommon. A significant number managed the initial expansion then failed to add the y terms or attempted to simplify a correct answer into an incorrect one. Most candidates were able to score at least one mark in part (d), usually for a correct partial factorisation of the given expression, although a common response of taking $8x$ as a factor leading to $8x(x + 1.5y)$ gained no marks.

1.2.18. Question 18

Many candidates found a correct scale factor (ratio), usually $\frac{6}{4} = 1.5$ and were able to accurately find the unknown lengths in both parts (a) and (b). However, in (b), some candidates multiplied 15 by 1.5 instead of dividing. Many of those who did show $\frac{15}{1.5}$ in their working were unable to evaluate this. Many candidates did not grasp the area of maths being tested and attempted to use Pythagoras to find the unknown sides even though the triangles were not right angled. The most common error was to simply say that the sides in triangle *PQR* were each an additional 2 cm to the lengths of the corresponding sides of triangle *ABC*, giving answers of 14 cm and 13 cm in parts (a) and (b) respectively.

1.2.19. Question 19

A large number of candidates were able to find the correct value of the car after one year by subtracting £400 (10% of £4000) from the initial cost, but then assumed that the depreciation was the same amount each year and offered an answer of £3200. This gained one mark only. A significant number of candidates were clearly unable to find 10% of £4000, often giving an answer of £40. Unless this was a result of an arithmetic error as opposed to a conceptual error no credit was given. Some candidates misinterpreted depreciation as appreciation and answers of £4840 were not uncommon.

1.2.20. Question 20

In part (a), the expression $4abc$ was usually identified as representing a volume. The expressions a^3b and $ab + c^3$ were often chosen in error. Part (b) was poorly answered with an answer of 800 cm^3 being the modal mistake. Some candidates wrote 200 × 200 × 200 and then were unable to complete the calculation.

1.2.21. Question 21

Many candidates showed an understanding of the method of solving a pair of simultaneous equations but only a few were able to carry out the algebraic manipulation without error. The most common errors were in the subtraction of one equation from another, usually adding the right hand sides of the equations, eg 16 and –6 and/or 40 and –4, instead of subtracting. Incorrect values of x or y were then often correctly substituted into one of the equations in an effort to find the second unknown, gaining some credit. A small number of candidates tried methods of substitution, but these usually led to algebraic errors preventing correct solutions. A few candidates were successful employing 'trial and error' methods, but this is not to be encouraged. This question showed up the weakness of algebra skills in many of the candidates. Most realised that the simplest method is to equate coefficients by multiplying first, but after that had no idea whether to add or subtract. This topic seems to be taught by recipe with the students not really understanding what they are doing.

1.2.22. Question 22

In part (a), most candidates correctly quoted the modal class interval; although a significant number offered $30 < n \leq 40$ or $0 < n \leq 20$ or simply 26 as their answer. Accurate completion of the *cf* table was the norm in part (b) but the drawing of the graph was less good in part (c). Many candidates plotted their points at mid interval values, some at beginning of the intervals and a significant number used the middle value of the *cf* intervals. In part (d), the median was often correctly found, but many did not understand 'interquartile range' in the second part, often merely quoting the range from the lq to the uq or just giving the value of the lq. It was a concern that a good number of candidates attempted to find the median and quartiles reading values (30, 15, 45) initially from the Delay axis.

1.2.23. Question 23

This question was poorly answered with only a small number of candidates understanding the concept of $y = mx + c$. Very few successfully used the diagram to find the correct gradient and often algebraic attempts were littered with errors from incorrect arithmetic of negative integers. Answers of $y = \frac{1}{4}x - 2$ and $y = 3x - 2$ were two of the more informed attempts.

1.2.24. Question 24

Part (a) was usually answered correctly, but answers of 0 and 6 were common mistakes. In part (b) 32 was the modal incorrect answer, but many were able to give the correct answer of 8. In part (iii), many candidates evaluated $\frac{27}{8}$ (= 3.375) but without calculators could go no further. The correct answer ($\frac{4}{9}$) was rare. An encouraging number of candidates realised that a negative power implied reciprocal and that the denominator and numerator of a fractional power means root and power respectively, however only a very few were able to carry out all operations successfully to give an answer of $\frac{4}{9}$.

$\frac{9}{4}$ and 1/9/4 and - $\frac{9}{4}$ were common answers.

1.2.25. Question 25

Those candidates who recognised the need to apply Pythagoras's theorem to the given triangle often gained at least 2 marks in part (a). The final mark was often lost as a result of not being able to offer a convincing conclusion to the proof. The success in squaring a bracket was very high this year. It was rare to see $(x+4)^2$ expanded to $x^2 + 16$. Many candidates thought that they were being asked to solve the equation not obtain it. Hence, some answers to (b) were seen in (a). The notion of proof still clearly differentiates at the top level. In part (b), methods to solve the quadratic equation included factorisation, completing the square and using the quadratic formula. Factors of $(x + 6)(x - 2)$ or incorrect substitution into the formula were the general factors preventing the award of full marks. Often spurious methods leading to a single answer of $x = 6$ were seen. These were awarded one mark only. A significant number of candidates relied on trial and improvement methods to obtain a solution. Many of them came up with 6 but failed to find the other solution. A positive answer in (i) usually led to a 'correct' answer in (ii), although a significant number of candidates were happy to use negative values of x.

1.2.26. Question 26

Candidates response to this question was often pleasing. Many drew accurate probability tree diagrams and were able to understand the conditions defining the taking of the second sweet. Many candidates also demonstrated a good knowledge of the 'and' and 'or' rules for combining probabilities. What often prevented many candidates achieving full marks was their poor arithmetic of simple fractions. For example in the calculation of $\frac{3}{10} \times \frac{2}{9}$ it was not uncommon to see answers of $\frac{5}{90}$ or $\frac{6}{19}$, the addition of fractions was also often poor with $\frac{6}{90} + \frac{2}{90} + \frac{20}{90}$ seen equal to $\frac{28}{270}$. Simplifying the three products before addition created an unnecessary extra problem for some candidates. Many candidates assumed that the sweets were replaced (even after eating) and products of $\frac{3}{10} \times \frac{3}{10}$, etc. were common. This approach gained a maximum of 2 marks.

1.2.27. Question 27

Very few candidates appeared to have any knowledge or understanding of the 'alternate segment theorem'. Consequently many solutions attempted to find the size of the angle *PQT* by long-winded methods. Whilst many were able to find that 58^{o} was the size of angle *PQT,* very few gave full explanations for each stage of the working and thus restricted their award to just 3 out of the possible 5 marks. The most common alternative approach was to find the size of angle *POT* and then use the 'angle at the centre theorem' Other methods included the use of congruent triangles *POQ* and *TOQ* but this was rarely proved and so never gained full credit. Weaker candidates mistook PQ and ATB as parallel or ATP and QTB as equal.

2. STATISTICS

2.1. MARK RANGES AND AWARD OF GRADE

Unit/Component	Maximum Mark	Mean Mark	Standard Deviation	% Contribution to Award
1380/1F	100	58.4	18.3	50
1380/2F	100	61.8	18.3	50
1380/3H	100	57.5	21.5	50
1380/4H	100	61.7	19.3	50

GCSE Mathematics Grade Boundaries 1380 – June 2010

	A*	A	B	C	D	E	F	G
1380_1F				75	60	45	31	17
1380_2F				78	63	48	34	20
1380_3H	89	69	49	30	18	12		
1380_4H	90	72	54	36	21	13		

	A*	A	B	C	D	E	F	G
1380F				153	123	94	65	36
1380H	176	141	103	66	39	25		

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