Principal Examiner Feedback

June 2011

GCSE Mathematics (2381)

Higher Non-Calculator Paper (13H)

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1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 13

1.1. GENERAL COMMENTS

1.1.1. The variety of questions in this paper provided a suitable degree of challenge to candidates of all abilities.

1.1.2. A good proportion of candidates were not able to achieve full marks in questions 1, 3, 8, 13 and 14 because of relatively weak computational skills involving fractions, decimals or negative numbers.

1.1.3. It is encouraging to report that most candidates showed their working in the spaces provided and examiners were therefore able to give due credit for partially correct responses.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

This first question proved to be straightforward to the vast majority of candidates and nearly all candidates showed a correct method in their working. Any loss of marks was most often due to a lack of accuracy in the calculation of the amount of sugar needed to make the 15 flapjacks. 44g was the most frequently seen incorrect answer for this ingredient. 85% of candidates scored full marks for their response to this question with only 2% of candidates failing to score any marks.

1.2.2. Question 2

Most candidates found this question well within their capabilities. The correct response to part (a) of the question was given by 94% of candidates while 88% of candidates gave the correct response to part (b).

The most commonly seen incorrect answer to part (b) was "10.8" suggesting that a significant number of candidates would have benefited from checking that they had a better understanding of the scale on the vertical axis of the graph. Candidates could be advised to mark intermediate values on the axes before answering questions based on the graph.

Nearly all candidates (97%) gained some credit for their graphs in part (c) with well over 80% scoring full marks here. Graph drawing was generally accurately done though some candidates missed out the lunch stage on their graph or finished the second stage at 3pm.

1.2.3. Question 3

It was encouraging to see that most candidates showed the substitution of numbers into the formula (eg $2 \times 5 + 3 \times -1$) or showed intermediate working (eg $10 + -3$). This enabled many candidates who did not get the correct answer to obtain one of the two marks available. The most commonly occurring incorrect answer, often following correct working, was 13. A significant number of candidates added the 3 and −1 and gave their answer as 12. Well over 80% of candidates scored two marks with a further 10% earning some credit for a correct method.

1.2.4. Question 4

Examiners are pleased to report that over two thirds of candidates showed some understanding of this question and gained at least partial credit for drawing, inside the square, a correct line or part of a circle of radius 3 cm using P as the centre. Lines and arcs were generally drawn accurately but sometimes it was clear that candidates were not using a ruler and/or pair of compasses. Some candidates drew the correct boundaries but were unable to identify the correct region. A significant proportion of candidates made it difficult for examiners to award any credit because they gave more than one line or more than one arc in their answer.

1.2.5. Question 5

Just under a half of candidates were awarded the single mark available for their response to this question. Any response equivalent to $\frac{1}{8}$ was rewarded. The most common incorrect responses seen included "2" and "4".

1.2.6. Question 6

Most candidates showed that they were able to reflect the shape accurately in a vertical or horizontal line. These candidates were given some credit for their response. About one third of candidates could identify the line $x = -1$, use it correctly and hence obtain full marks. 40% of candidates were awarded one mark. Rotations, translations and attempted reflections in the line $y = x$ were commonly seen.

Part (b) of this question proved to be more challenging with one in every five candidates obtaining full marks. It is encouraging to report that relatively few candidates used the word "transformation" rather than "translation" in their response. Many candidates correctly counted the difference in the number of squares horizontally and vertically between shapes P and Q but were unable to express this either as a correct column vector or clear description in words. Signs in column vectors were often incorrect or its components transposed. Where candidates attempted to give description in terms of the number of squares moved in each direction - "6 to the left and 1 down" being the obvious expression of this - the description was often not sufficiently clear. For example candidates used "across" and "−6 to the left". Such responses could not be given any credit. Candidates could usefully be reminded to consider one point and its image when working out the detail of the translation. The incorrect response $\begin{pmatrix}-3\\-1\end{pmatrix}$ was often seen.

1.2.7. Question 7

There were some very lucid and concise answers to this question from the best candidates. However, a large number of candidates reasoned along the lines that "Callum is correct because 1m = 100cm so $1m^2 = 100cm^2$" clearly missing the point of the question. Unfortunately a similarly large proportion of candidates started from the premise that the "$4m^2$" stated in the question can be represented by the area of a square with side 4m and went on to use $16m^2$ in their explanation. Usually this meant that candidates could not be given even partial credit for answers. Examiners could award only 12% of candidates any credit for their answers but most of these were awarded both marks.

1.2.8. Question 8

Candidates responded well to this question, and showed they were able to interpret a word problem as a test of sharing in a given ratio. Two thirds of the candidates were awarded a mark for identifying the ratio 1:3:6 and most of these candidates went on to produce a fully correct solution to the problem. A significant proportion of correct answers were obtained from a trial and improvement approach rather than the standard method of dividing £54 by 10 then multiplying by 6. This was often coupled with a lack of organization of working in the working space. Some candidates gave Peter's or Tarish's share as their final answer.

1.2.9. Question 9

Questions focussing on percentage increase or decrease usually result in the correct final answer being between 0 and 100. That was not the case for this question, but examiners are pleased to report that most candidates were usually not put off by this. The quarter of candidates that scored 2 out of a possible 3 marks usually gave the number of students at the school in 2008 as a percentage of the number of students in the school in 1958 (i.e. 600%) rather than the percentage increase in the number of students. Candidates used a variety of successful approaches to answer this question. Many of the successful candidates used a "build up" method. Unsuccessful approaches included attempts to work out 250 as a percentage of 1500 and calculations to show that the number of students in 2008 was six times the number of students in 1958. Some of the candidates who adopted the former approach seem to be confused between the meanings of $\frac{250}{1500}$ and. $\frac{1500}{250}$ The latter approach could have been successful but a significant number of candidates followed it by giving 60% as their final answer without any further justification.

1.2.10. Question 10

The best candidates quickly identified the “3, 4, 5 triangle” inherent in this question to obtain full marks. Other candidates usually identified the need to work out the increase in the *x* coordinate and the increase in the y coordinate. Regrettably a large number of these students did not realise that the key to further progress was to use Pythagoras theorem and commonly seen incorrect answers included "7" (4 + 3) and "12" (4 × 3). Some candidates calculated the gradient of the line or worked out the coordinates of the midpoint of *AB*. 24% of candidates obtained full marks in this question. Over 60% of candidates received some credit for their answers.

1.2.11. Question 11

Approximately two thirds of candidates gave a correct response to part (a) of the question. Perhaps surprisingly many of the candidates who could not complete part (a) successfully went on to score all 3 marks for their response to part (b). Over a half of all candidates gave a fully correct answer to part (b) with many others gaining partial credit for some progress in using equivalent fractions to solve the problem. Some candidates successfully subtracted $\frac{2}{5}$ from $\frac{1}{3}$ but then did not know what to do to combine the whole numbers with resulting $-\frac{1}{15}$.

1.2.12. Question 12

Centres are advised to remind candidates of the difference between a request to "work out the value of" and “simplify” in a question involving powers. Here it was expected that any powers would be evaluated. Hence "9" was the required final answer to part (a) of this question. Similarly, in part (b), the fraction “$\frac{1}{8}$” or “0.125” was sought and not “$\frac{1}{2^3}$”.

Confusion with standard index form seemed to lead many candidates to give the answer 0.002 in response to part (b). "−6" and "−8" were also often seen. Only about 20% of candidates scored the mark available in part (a) or in part (b).

Part (c) of the question was answered more successfully with over a half of candidates giving the correct response “t^6”.

The response “t^5” was given by most unsuccessful candidates. Nearly 80% of candidates gained at least one mark in part (d) for a correct use of at least one of the laws of indices. Most candidates preferred to simplify the denominator first to give “$\frac{n^4}{n^5}$”. Unfortunately some then gave their final answer as "*n*".

1.2.13. Question 13

Most candidates showed some understanding of an appropriate method to eliminate one of the variables in a pair of simultaneous equations by using multiples of one or both equations and then either adding or subtracting the equations. However, a significant number of them were unclear as to whether the appropriate operation was subtraction or addition. The number of marks awarded to candidates depended on the their ability to identify the correct operation and to carry out this operation accurately. Many candidates lost marks through their inability to deal accurately with negative integers, particularly subtracting them. A small minority of candidates used a substitution method with varying degrees of success. Over a quarter of all candidates gave completely correct answers with over 20% more gaining 1 or 2 marks for a partially correct solution.

1.2.14. Question 14

This question discriminated well between candidates. Nearly 30% of the candidates scored full marks. Only 13% of candidates failed to score any marks. There were many errors by candidates when working out the missing elements of the table of values and examiners were left asking themselves whether candidates would have been more successful if they had tried to write down some intermediate working, for example, the substitution of − 1 into the equation given. The most frequent error in completing the table was in working out the y value when $x = -1$. Some candidates seemed to have worked out the value of "$x^3 - 2$" rather than "$2 - x^3$". Candidates usually plotted points from their table accurately and attempts at drawing a smooth curve through points were generally good although some candidates joined their points with straight line segments. There was evidence that some candidates firstly drew a straight line or attempted to draw a quadratic curve through the two points given, then used their graph to complete the table in part (a).

1.2.15. Question 15

To their credit, the majority of candidates made an attempt at this question. However, only about 30% of candidates gained any credit for their attempt. Sometimes this was because candidates made several starts to the question and failed to indicate which attempt they wanted to be marked. Often these attempts were placed randomly around the working space. Most of the candidates who were awarded some marks realised that they needed to multiply both sides of the formula by (k − 2) as a first stage and were given credit accordingly. This was sometimes expressed badly as $t \times k -2$ or $tk - 2$. Some candidates started by multiplying k by (k − 2), t by (k + 2) or simply added 2 to the left hand side of the equation. These candidates could, of course, not be given any credit. Only the best candidates could see what to do for the second stage of the algebraic manipulation and although many candidates made a valiant attempt to complete the rearrangement, much of the algebra was incorrect.

1.2.16. Question 16

This question proved to be the most challenging on the paper. Formulae for the surface area of a sphere and for the curved surface area of a cone are given to the candidates on the formulae page of the examination paper. It was therefore surprising to see the high number of candidates who used formulae relating to volumes rather than surface areas. About one fifth of candidates were awarded a mark for adopting a relevant formula and writing it in using the variables given in the question. A small proportion of these candidates were able to write down an equation by putting the surface areas of the two solids equal to each other. Some candidates realised the need to find the slant height of the cone in terms of h and x. However, less than 1% of candidates could put all the necessary parts of the solution together and give a fully correct final answer.

1.2.17. Question 17

Over 40% of candidates, including many who scored modestly elsewhere on the paper, were able to obtain the mark available for expressing ***AB*** in terms of **a** and **b**. The most common incorrect answer seen was 2**a** − 3**b**.

Part (b) was answered less successfully. The best candidates showed a good understanding of vector algebra and could deal competently with the fractions / decimals involved, going on to give a correct, clear and concise conclusion. Some candidates used thirds rather than fifths in this part of the question. A number of candidates did not attempt the question and when it was attempted, it was often difficult for examiners to follow candidates' work. Only 10% of candidates could be awarded any marks in this part of the question.

1.2.18. Question 18

Concise, clear and accurate work leading to a correct solution was seen from a small proportion of the candidates. It is encouraging to report that about one third of candidates made attempts at this challenging question which could be rewarded with at least one mark. This was usually because they realised the need to multiply by either 2 or by $(x + 1)$ or to use a common denominator to combine the two fractions. Relatively few candidates made further progress, but where they did, it was usually by writing the two fractions on the left hand side of the equation as a single fraction, doing this without error, then continuing from there. Many candidates made slips, failing to multiply all the terms of the equation by 2 or $(x + 1)$ or $2(x + 1)$ or making an error when doing so. Some candidates used a trial and improvement method but this was rarely successful.

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