Principal Examiner Feedback

June 2011

GCSE Mathematics (2381)

Higher Calculator Paper (14H)

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June 2011
Publications Code UG028395

1. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 14

1.1. GENERAL COMMENTS

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

1.1.2. It was clear from the candidates' work that many had not read the questions fully. This was evident in question 2 where candidates worked out the number of *red* beads Bob had left rather than the number of *green* beads. Many did not put their final answer in standard form in question 14. In question 15b a large number of candidates worked out the *area* of the smaller rectangle rather than provide the *length* of the smaller rectangle as required.

1.1.3. Inappropriate early rounding led to loss of marks, particularly with the more able students. For example, in question 16 many rounded $\sqrt{55}$ to 7.4 which led to a final answer that was not in the required range.

1.1.4. Poor presentation of work continues to be an issue for some candidates.

1.1.5. Candidates should be advised to ensure their pencil drawings are dark and clear as the questions are marked online. At times some diagrams were difficult to see.

1.2. REPORT ON INDIVIDUAL QUESTIONS

1.2.1. Question 1

Over 85% of the candidates knew what was expected of them in this question. Most managed to draw an acceptable shape for 2 marks. Of the others, some drew a cuboid, whilst others started from an L and tried to make it 3-D by adding lines with varying degrees of success.

Very few candidates left their answer as 2-D, drew a net or made no attempt at all.

1.2.2. Question 2

Nearly 60% of the candidates scored all 3 available marks. The vast majority of candidates were able to work out $\frac{3}{4}$ of 120. However many of the candidates then went on to use 90 and not 30 for the second part of the calculation which meant they only scored 1 mark. A large number of candidates found $\frac{2}{3}$ of 30 correctly and gave 20 as their answer. Candidates are advised to ensure they are answering the question being asked.

Some candidates reached the correct answer from an incorrect method such as $\frac{3}{4}$ of 120 = 90, $\frac{2}{3}$ of 120 = 80, 90 – 80 = 10 In this situation only

1 mark could be scored. Only 12% of the candidates failed to score on this question.

1.2.3. Question 3

The most successful method used was calculating the exterior angle and then dividing 360 by their answer. The errors seen in this method included thinking that the exterior angles totalled 180 or that the sum of the exterior angle and the interior angle was 360. Attempts to use the formula for sum of interior angles were seen, but often with limited success.

Many candidates appeared to think that the three given sides were part of a trapezium, demonstrating that they had not understood, or read the question carefully. (360 – 160 – 160) ÷ 2 = 20 was a common incorrect response. Just over 30% of the candidates scored all 3 marks with 64% failing to score any marks.

1.2.4. Question 4

80% of the candidates were able to demonstrate they had some insight into enlarging the shape. The use of the given centre was inconsistent, with many simply using it as an anchor for their $\frac{1}{2}$ size or $1\frac{1}{2}$ size enlargement. 36% of the candidates successfully enlarged the shape by the correct scale factor, centre *P* and 29% scored 2 marks for a correct enlargement, incorrect centre or a correct enlargement from *P* with incorrect scale factor (generally scale factor $1\frac{1}{2}$) The candidates who gained no marks usually did so because they miscounted the squares on one side of their image and so did not make a consistent enlargement. Weaker candidates added half a square all the way around the shape.

1.2.5. Question 5

There were many good and fully correct solutions (57% of candidates) to this question. Most candidates compared the annual salaries for Michelle and Stephen. Calculating the monthly or weekly figures was also acceptable but tended to be less well done. 90% of the candidates scored at least 1 mark.

Despite this being a calculator paper, very few candidates used the calculation 1.025 × 27120 to find the total after a 2.5% increase. The common error in this approach was to use 1.25 as the multiplier. Most candidates found 2.5% by a build up method, but frequently made errors along the way (10% = 271.20 was often seen). Very few who used this method gained the marks for Stephen’s salary.

Marks were mostly lost in calculating Michelle’s salary. A few candidates thought that her salary increased by £200 each month, and many thought that her final salary was £2100 + (12 × £200) = £4500.

1.2.6. Question 6

This is standard question in the calculator paper and most candidates were clearly prepared for it and knew what was expected. Unfortunately a large number of candidates did not realise the necessity for a trial of x to 2 dp and attempted other methods to discover which of the two possible 1dp values is the correct one. Many found that when $x = 3.7$ the answer is closer to 67 and used this as their working to show $x = 3.7$ This is **not** an acceptable method. Others put 3.65 on the answer line which lost them the final mark. A diagram was sometimes used to identify whether the answer was 3.6 or 3.7 and this proved useful. Candidates need to be reminded to evaluate their trials in order to gain marks.

Overall, 37% scored all 4 marks, 44% scored 3 marks (generally losing a mark for not having a trial between 3.6 and 3.7), and 10% failed to score.

1.2.7. Question 7

0.32 was seen as the answer 86% of the time (the fractional equivalent only very occasionally). A high proportion of both correct and incorrect solutions showed no working, meaning that only 0 or 2 marks could be awarded.

The most frequent errors were – 0.898823529 from 6.144/20.4 – 1.2 (which scored 1 mark if 6.144 had been written down, but 0 if not) and 0.768 from $(2.4 \times 1.6)^2 / 19.2$

Other errors included using 6.114 instead of 6.144 and inappropriate rounding in the working eg using 6.1 or 6.14. Only 8% of the candidates failed to score.

1.2.8. Question 8

It was pleasing to note that nearly $\frac{1}{2}$ the candidates scored all 3 marks. However, a significant number of candidates still do not know the formula for the area of a circle. Those who did often failed to achieve full marks as they used the 1m measurement as a radius or even a diameter in $A = \pi r^2$. Other errors included rounding too early, squaring π, or continuing their method by square rooting or dividing by 6 or 5.

1.2.9. Question 9

In part (a) most students attempted to expand the brackets as their first step. Many were able to do this successfully although $4(2x - 1) = 8x - 1$ or $8x + 4$ or even $6x - 4$ were frequently seen. Many students were able to gain the method mark by successfully rearranging their equation to isolate at least the x term or the constant term. The most common error was due to incorrectly dealing with the negative numbers. eg $-19 + 4$ led to 15, -23 or 23.

Other students successfully arrived at $5x = -15$ only to state that $x = 3$ (or -5 or 5)

The very few who started by dividing both sides by 4 failed to get any marks as they did not separate the RHS into two terms. Overall 55% of the candidates scored all 3 marks with 17% failing to score.

A significant number of students did not attempt part (b). It was pleasing to note that over 70% of the candidate scored both marks but 26% of the candidates did fail to score.

The common errors were: to multiply the numerator by 5 leading to $5y + 20 = 30$, to change the numerator from $4 + y$ to $4y$ and then incorrectly subtract 4 from each side leading to $y/5 = 26$. A surprisingly large number of candidates who correctly wrote $y + 4 = 150$ then failed to calculate the correct value for y, often writing an answer of 154. As in part (a), candidates did themselves a disservice by not checking their final answers by substitution.

1.2.10. Question 10

In part (a) there were many disappointing responses, with poor understanding of open and closed circles, and the required length of any line. Over 42% of the candidates failed to score. Many had lines or arrows starting at -2 or put circles at both ends of their line segment. Others drew an arrow or line segment to the left. 37% of the candidates scored both marks.

In part (b) many ignored the inequality sign completely and lost a mark for writing an answer of $y = -4$. Weaker candidates tried to solve the inequality by trial and improvement, mostly unsuccessfully or added 36 instead of subtracting 36. Overall 45% of the candidates scored both marks with 38% failing to score. To have the best chance of gaining the method mark candidates needed to keep using the inequality throughout their working. Unfortunately most did not.

1.2.11. Question 11

The use of Pythagoras' Theorem was frequently seen despite the triangles not looking right-angled and that they were described as similar.

When a scale factor method was used students frequently rounded to 1.66 or 1.6 or 1.7. In these cases the premature rounding led to answers which were not sufficiently accurate to gain full marks. Candidates who worked with fractions tended to be more successful in achieving the correct answers. There were a number of incorrect answers using addition rather than multiplication indicating that this misconception is still prevalent even amongst students entered at this level. 46% of the candidates failed to score but 37% did provide both answers in the acceptable range.

1.2.12. Question 12

88% of the candidates failed to score on this question. A few scored a mark in (a) for rearranging the equation correctly, writing the correct gradient but with a minus sign or putting *x* with the correct gradient.

In (b), it was even rarer to find a candidate that realised what was required to prove two lines are perpendicular. There were some attempts at solving the two equations simultaneously. A small number could successfully re-arrange the equations, but then did not identify which value was the gradient. There was some evidence of the understanding of reciprocal and inverse, but candidates failed to put this into a coherent statement.

1.2.13. Question 13

Most candidates attempted part (i) with many correct answers seen. Many candidates used the diagram to show their working but unfortunately a significant number then did not select the correct angle for their answer, demonstrating a lack of understanding of three letter notation for angles (finding the angle at the 'centre' was a common error here). Some showed the correct values at angles *ACD* and *CDB* but did not select a value for their answer.

The most common error seen was to calculate the angle as 28° by using the idea of alternate angles in parallel lines! Some even helpfully drew the arrows on the lines *AB* and *DC*.

Very few students who gave the correct answer to (i) were able to give a correct geometrical reason, with many candidates still using a calculation rather than a theorem.

In part (ii) only 12% of the candidates provided an acceptable reason. The theorems which were quoted included many related to parallel lines and even parallel angles! The most successful response was the reference to angles in the same segment (although 'sector' was often seen). Candidates who referred to the same chord or arc frequently failed to give the complete response needed (usually by not referring to the angle on the circumference).

Many candidates refer to the position of the angle by referring to the ‘bow tie’ theorem, the egg timer theorem or the angles at the top of the mountain. These are not acceptable descriptions to use in an examination. A significant minority referred to ‘alternate segment’.

1.2.14. Question 14

60% of the candidates did not realise that they needed to divide the surface area of Jupiter by the surface area of Earth and scored no marks. The main misconception was to find how much larger Jupiter is rather than how many times larger. There were also those who divided but had the values the wrong way around. An answer in the range 121 to 122 was often seen but many either stopped at that point or were unable to correctly convert this to a number in standard form. 19% of the candidates scored all 3 marks with a further 10% scoring 2 marks.

1.2.15. Question 15

Just 4% of candidates achieved full marks for both parts of this question. As this question was testing higher grade skills it is not surprising that overall 66% of candidates failed to score. Many did have a go and this met with a variety of success.

Many candidates did not appear to understand how to go about a proof and solved the equation in part (a) rather than in part (b) as required. The attempts at the proof were often poorly laid out with $2x + 6$ multiplied by x (without brackets) frequently seen, although many did go on to do the correct expansion of $2x^2 + 6x$. Not many candidates made use of the diagram which would have helped enormously.

The most popular method of solving the equation was to use the formula (weaker students were still seen to be using a variety of incorrect methods) and most were able to substitute into it correctly. The errors then included drawing the fraction line too short, evaluating $(–3)^2$ as $– 9$ and subtracting 800 rather than adding it. Having solved the equation, a substantial number of students gave both values rather than selecting the positive root. A significant number of candidates used trial and improvement to calculate the answer, but rarely gained full marks as answers were not accurate enough. Very few candidates used the method of completing the square. About 10% of candidates were able to write a value for x between 6.36 and 6.365 in part (b). Unfortunately many did not read the question fully and went on to find the area of the smaller rectangle.

1.2.16. Question 16

Many candidates used Pythagoras' Theorem to find the length of *BC* and most of these were successful. Unfortunately many just wrote 7.4 (rounding to 2 significant figures) which led to a final answer of 9.66 which was outside the acceptable range. Sine and cosine rules were both tried in this question, with varying degrees of success. Some decided that angle *ACD* was a right angle and applied trigonometry. It was disappointing to find that many of the candidates who successfully calculated *BC* then went on to multiply this by sin50°. Overall, 17% scored all 4 marks and 58% failed to score. 17% scored 2 marks generally for calculating *BC* correctly to at least 3 significant figures.

1.2.17. Question 17

Most candidates attempted this question but with little success with 70% of the candidates failing to score. Many of these candidates just divided 218 by 12.6 reaching 17.3 and then tried to find the lower bound of this answer by writing their final answer as 17.25 demonstrating some knowledge of bounds but not sufficient to score any marks. 16% of the candidates were able to write one of the bounds for the correct calculation many of these candidates then used two lower bounds to work out the lower bound of *l* with 217.5÷12.55 frequently seen. 13% of candidates scored all 3 marks.

1.3 GRADE BOUNDARIES

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