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Principal Examiner Feedback

March 2012

GCSE Mathematics (1380) Higher
Paper 4H (Calculator)

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GCSE Mathematics 1380
Principal Examiner Feedback – Higher Paper 4H

Introduction

Candidates appeared to have plenty of time in which to complete the paper.

The paper gave the opportunity for candidates of all abilities to demonstrate positive achievement.

There were many good attempts to all questions on the paper.

Most candidates seemed to have access to a calculator but there were still many careless arithmetic errors.

A significant proportion of candidates lost marks through premature or incorrect rounding.

Report on individual questions

Question 1

This question was very well answered. Over 85% of candidates gave the correct answer.Of the candidates who did not score full marks a further 9% were able to demonstrate a correct method and so gain 1 mark. These candidates usually either made an arithmetic error in continuing the sequence, or found an expression for the nth term of the sequence but did not use it to find the tenth term. A small number of candidates stopped after finding the next term in the sequence or gave the ninth or eleventh term as their answer.

Question 2

This question was not answered well. Just under 30% of candidates gave the correct answer. A further 12% of candidates gained some credit for their response. These candidates often made some inroads into the problem by working out the total of the scores for either six or seven games but then did not complete the solution. Incorrect responses seen usually consisted of dividing one or both of the mean scores by the number of games, or of finding the difference between the two means (1.5) and stopping there.

Question 3

The first part of this question was very well answered with 90% of candidates scoring both marks available. A significant number of the remaining candidates lost marks through a misread of either the 1.34 given in the question or of the answer given on their calculator display. An answer of 496 was seen quite often. Candidates are reminded to check that they have not miscopied from the question paper or from their calculator display. The most common incorrect method seen was dividing rather than multiplying 350 by 1.34 These candidates clearly did not realise that you get more dollars than pounds for a given amount of money. The majority of the small number of candidates who did not use a calculator made arithmetic errors in evaluating 350 × 1.34

It is pleasing to report that two thirds of candidates scored full marks in part (b) of the question. The most successful approach seen was that of converting the price of the jeans in the USA from dollars to pounds as a first stage. Those candidates who worked in dollars often correctly found the difference of the two prices as $3.35 but did not convert this to pounds. Some candidates worked in mixed units, finding the difference between an amount of money in dollars and an amount given in pounds. For example, '67 – 47.50' was often seen.

Question 4

This question proved to be a good discriminator between the weaker candidates taking this paper. Nearly all candidates gained some credit for their attempts and the majority of candidates scored full marks. Most candidates understood the concept '4 for the price of 3' and only attempted to find the cost of 3 tyres. The most common approaches to answering the question included finding the cost of 3 tyres at £65 each then adding the VAT and finding the VAT for one tyre first before adding it and then multiplying by 3. Candidates adopting the first of these two approaches were generally more successful in scoring full marks.

A significant proportion of candidates who adopted the second method forgot to multiply their VAT (£13) by three and added £13 to £195 giving an answer of £208. These candidates were awarded 3 of the 4 marks available. Some candidates found the cost, including VAT, of one tyre but did not multiply their answer by 3.

A small number of candidates deducted the VAT from the cost of the tyres. It was disappointing not to see more candidates in this higher level paper using the multiplier 1.2 as part of their method. Instead most candidates used more traditional routes to working out percentages. A significant number of candidates used the method of finding 10% of 65 then doubling it to find 20%, a method expected more often on a non-calculator or foundation tier paper.

Question 5

There was a good spread of marks awarded for answers to this question. Nearly a half of all candidates scored full marks with a further 45% of candidates scoring part marks. Candidates are advised to write down intermediate working for questions on the use of a calculator. This can not only help them to focus on the correct order of operations to use but also make it more likely that they will pick up some marks if their final answer is incorrect. For example, in this question partial credit was given for sight of $\sqrt{10}$, 3.162..., 2.2 or 10.

Part (b) of this question was quite well done and the mark was given to candidates who wrote their answer to part (a) correct to 2 decimal places provided it involved some rounding.

Question 6

This was a well answered question and candidates showed their working so that part marks could be awarded accordingly. Over 80% of candidates gained some credit for their answers with nearly 70% obtaining at least 2 of the 4 marks available. Candidates often quickly and accurately evaluated trials with values of x between 3 and 4 and most went on to try at least one of the values 3.1 or 3.2

Fewer candidates evaluated any trials for values of x between 3.1 and 3.2Many candidates based their final answer on how near to 41 their values of $x^3 + 3x$ were. 3.1 was often given as the final answer. Some candidates wrote $3^3 + 3 \times 3$ as their first numerical expression to evaluate but then went on to work out a expressions such as $4^3 + 4 \times 4$ or $3.5^3 + 3.5 \times 3.5$ therefore evaluating $x^3 + x^2$ not $x^3 + 3x$.

Question 7

Most candidates realised that the key to this question was to use Pythagoras’ rule. However, a much smaller proportion of candidates could apply the rule correctly and $16^2 + 8^2$ was seen almost as frequently as the correct $16^2 - 8^2$. Consequently the great majority of candidates scored either full marks or no marks. Some candidates did not write down enough decimal places from their calculator display then gave an incorrectly rounded answer or an answer rounded to less than two decimal places thereby losing at least one mark for their answer.

Question 8

Over 85% of candidates successfully used the laws of indices to get correct answers to both parts (a) and (b) of this question.

A further 8% of candidates scored 1 mark, usually for a correct answer to part (a). Incorrect responses seen included x^{20}, $2x^9$, $2y^5$, y^9, y^{14} and $y^{3.5}$.

The last three parts of the question proved to be good discriminators with almost a third of candidates gaining all 6 marks but less than one tenth of candidates failing to gain any marks.

Candidates were usually successful in part (c) but sign errors prevented some candidates from getting a fully correct answer and $11a - 5$ was seen quite often.

The quadratic expansion in part (d) was also done well. This was perhaps partly due to the fact that there were no negative signs involved. Commonly seen incorrect responses included $y^2 + 35$ and $y^2 + 12y + 12$

It should be noted that part (e) of this question also appeared on the non-calculator paper 3H
There were many good attempts at the factorisation for part (e) and it was only a lack of confidence with signs which prevented a large number of candidates from scoring two marks for a fully correct factorisation.

Question 9

More candidates were successful with this question than any other question on the paper.

Well over 90% of candidates scored both marks for a correct answer in part (a) with some others gaining 1 mark for a fully correct method – that of adding the probabilities given in the table and subtracting the result from 1. Where a mark was lost here, it was usually for an arithmetic error. A few candidates added the four probabilities in the table and gave their answer as 0.76.

About 80% of candidates were successful in part (b). The most commonly seen incorrect answers were 1200, 12 and 0.75, evidence that candidates had often divided 300 by 0.25 instead of multiplying them.

Question 10

The majority of candidates were able to get started on this question, show their working clearly and so usually score some marks for their attempts. Most candidates calculated values for *fx* and most used the correct mid interval values for the height of the plants. It was pleasing to see a decrease in the number of candidates who used the upper or lower boundary of the intervals to represent the heights of the plants. Some candidates could not see where to go from there and stopped. Some opted to start again and used a totally incorrect method to give them an answer. This is regrettable as they could not be awarded any marks. Others divided their $\sum fx$ by the number of classes (5) rather than the total frequency. They did not seem to question the resulting 'average height' of a plant being 176 cm. Some less able candidates confused the situation with one involving cumulative frequencies or frequency densities, whilst others simply divided 30 by 6

Question 11

About one third of candidates scored the mark available in part (a) of this question. Some candidates did not seem very confident in using the symbolism involved and it appeared that they had used the second part of the question to help them answer the first part.

They appear to have used the diagram in part (b) as a template for their answer in part (a), their answers consisting of a line segment with one circle filled in and one empty circle. Other attempts included the use of arrows or line segments which ended without any indication whether the value at the endpoint should be included or not. Many candidates drew lines from −1 to 2, indicating they did not understand that they were dealing with a continuous number line, not just integer values.

In part (b) 38% of candidates scored 2 marks with a further 42% scoring 1 mark. About two in every five candidates formed a fully correct inequality and roughly the same proportion could give a partially correct response. Some candidates gave $-3 \le x. \le 4$ as their answer. Examiners awarded this 1 mark.

In part (c), where candidates were required to solve a linear inequality, a good number of correct answers were seen. However it was unfortunate that many candidates gave their final answer as $t = 3.5$ or 3.5 instead of $t > 3.5$ and so could not be awarded full marks.

Question 12

Most candidates (86 %) scored full marks on this question involving sharing a sum of money in a given ratio. The most common error seen was from candidates who divided 45 by 2, 3 and 4 to give the answers 22.5(0), 15 and 11.25. This, of course, could not be given any credit. There was little evidence of these candidates checking that they had shared out exactly £45.

Question 13

Candidates who knew and used the rule for the area of a trapezium were generally the most successful with this question though some of these candidates substituted incorrect values into the rule whilst others used an incorrect order of operations to evaluate their expression. The most common method seen was to split the shape into a rectangle and a triangle. These candidates usually worked out the area of the rectangle correctly but a large proportion of these candidates did not use 8for the height of the triangle but opted to use the hypoteneuse (10) instead. Candidates need to be aware that there are occasions when not all the information in a question is needed for its solution. It was disappointing to see some candidates entered for a higher tier paper confusing area with perimeter or simply multiplying together all the numbers seen.

Question 14

Where correct responses were seen in the first part of this question, the use of tan *x* was often clearly shown and candidates' solutions easy to follow. A significant number of candidates lost accuracy in their solutions by rounding $\frac{8}{12}$ to 0.6 and then evaluating $\tan^{-1}(0.6)$. Some less able candidates wrote expressions such as tan $(\frac{8}{12})$ or tan (8 × 12). Other candidates based their attempt on using Pythagoras' rule to find the length of side *QP* but were then not able to complete a solution by using it with one of the trigonometric ratios to find the angle. About 30% of candidates produced a fully correct solution to this part of the question.

In part (b) the success rate fell to 22%.It would appear that the orientation of the triangle may have confused some candidates who chose an incorrect trigonometric ratio. Those candidates who did choose sine usually gained the first mark for stating sin 32° = $\frac{5}{YZ}$ but some could not rearrange this to find $YZ = \frac{5}{\sin 32°}$. Instead, $YZ = 5 \times \sin 32°$ was often seen. Some candidates started by working out the size of angle *XYZ* or by attempting to work out the length of *XZ.* Though it would have been possible to calculate the length *YZ* from this first stage, these candidates were usually unable to complete the chain of calculations needed.

Question 15

This question was a good discriminator. About three quarters of candidates recognised the transformation shown in part (a) of this question as an enlargement but fewer were able to use the correct language to express the details (ie scale factor 2, centre (5, 6)) correctly. Expressions such as "doubling", "twice the size" and "× 2" were not accepted by examiners for the award of the second mark. A good proportion of candidates omitted the centre of enlargement or gave it incorrectly. Where an attempt was made to state the centre, candidates often used a column vector form. These candidates lost the third mark. Centres are advised to remind candidates when to use coordinates and when to use column vectors in their work involving transformations. Even though they were asked to describe a single transformation, some candidates gave a combination of two transformations, usually an enlargement and a translation.

In part (b) a half of all candidates gave a completely correct answer with a further 10% of candidates reflecting triangle A in a line parallel to the line $x = 4$ (usually $x = 3.5$, $x = 0$ or $x = 3$). These candidates were awarded one mark. Many other diagrams seen implied that the candidate had reflected the triangle in a line parallel to the x axis, rotated or translated it. Unfortunately, a number of candidates drew more than one triangle. They could not be awarded any credit because they had not made their final answer clear.

Question 16

The cumulative frequency table in part (a) of this question was completed correctly by just under 4 out of every 5 candidates.Correct tables were usually followed by a good attempt to draw a cumulative frequency graph, with only a small proportion of candidates plotting points at the midpoint rather than at the end of the interval. A significant number of candidates did not join their plotted points. Other common errors seen from weaker candidates included attempts to draw a line of best fit, to draw a bar chart to illustrate the cumulative frequencies or to draw horizontal and vertical lines but not define the points plotted, by using crosses for example.

For part (c),many candidates used their graph successfully to find an estimate for the median age. However, a significant proportion of candidates drew lines across from 35 (the midpoint of the scale shown on the cumulative frequency axis) rather than from 30. Some candidates gave 45 as the median, apparently picking out the middle number from the cumulative frequency column of the table.

Part (d) of the question was also well attempted though many candidates used the graph to find the number of teachers younger than 55 years and did not subtract from 60 to find the number of teachers older than 55 years.

Question 17

Abouthalf of the candidates gained some credit for their responses to this question. Those who did score some marks were almost equally split between those gaining 1, 2 or 3 marks. Roughly a third of candidates stated that the single transformation was a rotation by 180°. Fewer candidates scored the mark available for stating the centre of the rotation. Candidates who did not gain any of the marks available for describing the transformation qualified for the award of one mark if they had a correct diagram showing the correct position of triangle Q. Unfortunately, few candidates had drawn Q on the diagram so this mark was not often awarded. Centres may like to remind candidates to use the diagram to show evidence of their working in transformation questions.

Question 18

Thirty per cent of candidates gave a completely correct solution to the simultaneous equations in this question.Most of the candidates who qualified for the award of the first mark for a correct method to eliminate one of the variables went on to score at least one further mark. Once one value was obtained, a process of substitution to find the other value was done well. Those candidates who failed to score any marks were often able to make the coefficient of x or y the same but then used the wrong operation to eliminate the variable. The most common error seen involved the equations $12x + 20y = 76$ and $12x - 6y = -54$ followed by $14y = 22$ Errors with signs were commonplace.A significant proportion of candidates attempted a trial and improvement method but these were mostly unsuccessful. The alternative method involving a rearrangement of one equation followed by substitution into the other was rarely seen.

Question 19

This question was well answered by those students who realised that the quadratic equation formula could be used to solve the equation. Common errors in using the formula included not extending the fraction line far enough and consequently working out the values of $-b \pm \frac{\sqrt{b^2-4ac}}{2a}$

Sign errors also prevented many candidates from gaining full marks. Many candidates did not take the hint given by the instruction to give each solution to 2 decimal places and tried either to factorise the expression $5x^2 + 8x - 6$ or to make x the subject of the equation. Some candidates tried a trial and improvement approach. This was usually unsuccessful. Few candidates used a method involving completing the square.

Question 20

This question was the least well answered question on the paper. Many candidates realised that to find the perimeter of the triangle *ABC*, they first needed to find the length of side *AB*. The best candidates went on to produce a concise, accurate solution to the problem. However, many candidates tried to use Pythagoras' rule to find the length of *AB,* whilst other candidates assumed the triangle could be split into two congruent right angled triangles, each with an angle of 65° then used the trigonometry of right angled triangles to complete the problem.

Question 21

A large majority of the candidates who understood that the areas of the blocks in a histogram should be proportional to the frequencieswere successful.Twenty per cent of candidates drew fully correct diagrams. However, some candidates calculated frequency × class interval and used this instead of frequency density. Other candidates drew a frequency polygon or a bar chart. Candidates usually scored either 0 marks or 3 marks for their response to the question though some candidates who could not be awarded any marks for a diagram did earn some credit for calculating frequency densities correctly.

Question 22

This question proved to be a good discriminator between more able candidates. The best candidates produced concise and clear answers and scored full marks. Attempts by less able candidates were often restricted to working out the value of 163 ÷ 45.3

Many candidates showed some understanding of what was needed and stated the upper and/or lower bounds of *d* and *f.* The upper bounds were not stated correctly as often as the lower bounds. For example 163.4 or 163.49 were often given for the upper bound of *d* instead of the correct value 163.5

Where candidates went on to use their bounds, a significant number of them used upper bound divided by upper bound and lower bound divided by lower bound to generate their maximum and minimum values of *c*. Some candidates based their attempts on a consideration of all 4 combinations, UB ÷ UB, UB ÷ LB, LB ÷ UB, and LB ÷ LB. The fifth mark was rarely awarded with many candidates using the average of their calculations to reach a conclusion.

Question 23

Examiners were unable to award any marks to three quarters of the candidates for their responses to this question. A sizeable number of candidates did not attempt the question. Less than 2%of candidates gave a fully correct answer. Candidates who did make some headway with the question found working out the area of the sector more straightforward than working out the area of the triangle. Some candidates attempted to work out the arc length rather than the area of the sector. The fractions $\frac{35}{360}$and $\frac{360}{35}$ were often seen and were given some credit. Attempts to find the length of AC or the "height" of triangle *OAC* were also seen quite often; however sight of these was not usually followed by a complete method to find the area of the triangle. There were many cases where premature rounding led to errors in the accuracy of the candidate's final answer. An unusual approach seen was that of finding the area of the circle,

$\frac{360}{35}$× area of the triangle, subtracting one from the other then dividing

by $\frac{360}{35}$.

Question 24

This question was not well done. However, it did prove to be a good discriminator of the better candidates. A significant number of candidates seemed to have a clear idea of what they needed to do but were let down by an inability to carry out the necessary steps accurately. Examples of this include candidates who realised the need to multiply $5x - 1$ by $4x + 5$ but who failed to use brackets when they wrote it down on paper and candidates who expanded $5(2x + 1)^2$ as $(10x + 5)^2$.

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