General Certificate of Secondary Education
June 2012

Mathematics 43651H

(Specification 4365)

Paper 1 (Higher): Non-calculator

Report on the Examination

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General

This was the first examination in the new linear specification so there were a greater proportion of functional and problem-solving questions. However, many students appeared to have been prepared for the new style of questions. On the whole, students showed their working and their presentation was good. However, the standard of arithmetic was often poor.

Topics that were well done included:

- simple expansion and factorising
- solving a number puzzle
- area of a circle
- solving a linear equation
- drawing and using a scatter diagram and line of best fit
- mean problem
- histogram problem

Topics which students found difficult included:

- angles in a regular polygon
- simultaneous equations
- relative frequency
- standard form
- equation of a line to obtain a formula
- proportionality
- graph transformations.

Question 1

As a starter question responses were generally poor. Fewer than half the students drew the correct reflection. The expected error of reflecting in line $x = 2$ was seen, but another very common error seen was to reflect in the y-axis.

Question 2

Parts (a) and (b) were usually answered correctly. In part (c), expanding -5×-2 as -10 was the most common error. Many errors with minus signs were seen.

Question 3

As the value of the interior angles was given, it was essential to see that students did not start with this piece of information. Possible solutions included showing the exterior angle to be 60°, leading to 180° – 60° = 120°. An alternative valid solution was to show that the internal angles sum to 720° from $4 \times 180°$, or similar, followed by $720° \div 6 = 120°$. Another acceptable method was to show the equilateral triangles drawn on the diagram, with 60° + 60° shown at one vertex.

Question 4

This number puzzle question was well answered with almost all students progressing to at least 2 rows that totalled 14.

Question 5

The vast majority of students scored on this question with many fully correct solutions seen. Plotting points in part (a) was usually successful, but misreading the scales was the main error. As a functional elements question, students are expected to use the data to make decisions, and so a line of best fit for all this data was not appropriate. In part (b), using a line of best fit was a common approach. This was accepted for the values above 14°C. Another common approach was to take values either side of 25°C and work out an average. Part (c) was also quite well answered with over half of all students realising that ice cream sales were constant below 12°C and making reference to this in their answer. However, using a straight line of best fit to predict values at 9°C was not appropriate for data below 12°C.

Question 6

The majority of students were usually successful when measuring the radius or diameter. Their radius was then used in the area formula in most cases and an answer given. This was sometimes expanded using $\pi = 3.14$. A frequent error was to omit the units. Some students used 6 as the radius while some used an incorrect formula and found the circumference.

Question 7

The majority of students knew to rearrange the equation but almost half made arithmetic or sign errors. Students often gained credit for continuing after their incorrect first step. However, division by 4 or the division of 18 by their coefficient of x was too challenging for many students.

Question 8

This question was very well answered. This was a Quality of Written Communication (QWC) question and despite not stating that students should show full working, the majority responded to the asterisk (*) and gave a detailed solution. The minimum requirement was to see sufficient angles marked on the diagram and a calculation to show where the answer of 56° came from. There were many very well justified solutions seen.

Question 9

The majority of students knew to total the weights of all six team members and divide this by 6 to get the overall mean. The correct answer was then found by quite a few students, but the division of their 354 by 6 proved too difficult for many.

Question 10

Many fully correct answers were seen. A small number used an algebraic approach rather than Trial and Improvement. Their algebra was often let down by a lack of brackets, but there were some very neat solutions seen, many of which used a subtraction method requiring the expansion of two linear brackets. Trial and Improvement was usually successful. Many students calculated a perimeter rather than an area.

Question 11

This question was quite well answered. Of those students who knew what to do, the greatest loss of marks was due to poor arithmetic.

Question 12

Most students knew the algorithm to solve simultaneous equations. Correct attempts to balance a coefficient were often seen, with the occasional arithmetic error. However, the next step proved too difficult for the vast majority of students who could not cope with the negative signs. For those that did reach $22y = -11$, an answer of 2 was common. After the first variable was found, the most common approach was to substitute into one of the original linear equations. Again, some were let down by poor arithmetic especially with fractions. The other approach was to balance the other coefficient. Trial and Improvement was rarely seen.

Question 13

Many students struggled with standard form. In part (a), a fully expanded answer or 18×10^{14} were common answers. Many who did a full expansion of the product then counted only the zeros, giving an answer of 1.8×10^{14}. Correct answers in part (b) were rarely seen. The calculation $3 \div 6$ defeated many, with 2, 3 or 18 common answers for the numerical value. 0.5×10^{-4} was a common incorrect answer.

Question 14

This question was very badly answered. It assesses Assessment Objective 3 (interpret and analyse problems and generate strategies to solve them). If the spatial connection was seen, the mathematics was very straight forward. If not, students used contradictory lengths or Pythagoras' Theorem, which made the solution impossible or complicated. Drawing the square joining the midpoints of the sides served as a visual clue that the 4 outer triangles were the same area as the middle square. This was rarely seen. The majority using this method assumed that the outer triangles had a side length of 0.5m and/or an area of 0.5 m^2. The other common misconception was that the sides of the square were 2m. Many tried using Pythagoras' Theorem to work out half the side length or the whole side length. This was rarely accurate.

Question 15

This was a functional mathematics question which also assessed Quality of Written Communication. A few students realised that it was essentially finding the equation of a line. Others opted for producing tables of values. Finding the relationship between the cost and the number of units of gas was essential to determine the coefficient of n, but this was rarely seen. The QWC mark was for writing a formula in an acceptable form.

Question 16

This standard algorithm continues to be poorly used. Generally students either gave a fully correct or fully incorrect response. A very common misconception in part (a) was $y = x^2 - 1$, leading to 143 in part (b). Other common misconceptions or misreads in part (a) were to take y as directly proportional to x^2 or inversely proportional to x. There were many non-attempts, particularly in part (b).

Question 17

There were many correct answers in part (a) and if the difference of two squares was seen in part (b) this led to a correct answer. Common errors in part (a) were with signs in the bracket. Common errors in part (b), apart from cancelling x^2, were to state $4x^2 - 9 = (2x - 3)^2$, or to cancel x after the correct answer was obtained.

Question 18

Both parts were quite well answered with part (a) more successful than part (b). The usual misconceptions about surds such as $\sqrt{72} = 36\sqrt{2}$, or $\sqrt{6} + \sqrt{12} = \sqrt{18}$, or $\sqrt{6}\sqrt{12} = \sqrt{18}$ were frequently seen. In part (b), the expansion did not always contain 4 terms.

Question 19

Neither part was well answered. In part (b), drawing $y = (x - 1)^2$ or $y = x^2 + 1$ were common errors.

Question 20

Those students who knew that the area of the bars was proportional to the frequency had some success, but often their poor arithmetic prevented fully correct answers. A common error was to draw a bar chart rather than a histogram.

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