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**General Certificate of Secondary Education**
**November 2012**

# Mathematics 43652H

## (Specification 4365)

## Paper 2 (Higher)

# *Report on the Examination*

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## General

This was the second calculator paper for this specification with a greater proportion of functional, problem solving and applications questions. The paper proved challenging to the students entered and there was some evidence that some of the students were unprepared for the more demanding questions with many questions not attempted.

Topics that were well done included:

- angles in a quadrilateral
- solving a simple linear equation
- expectation.

Topics which students found difficult included:

- matching equivalent equations
- percentage problem
- expanding brackets
- ratio problem
- trigonometry
- algebraic expressions
- solving a linear equation involving a fraction
- circle theorems
- combined probability
- area of a sector
- proof
- cubic graphs
- cosine rule problem
- simultaneous equations.

## Question 1

This was one of the most successful questions on the paper, but the proportion of fully correct answers was relatively low. A common error was to add all the given angles together, which gave 255°, and then subtract this total from 360° to give an answer of 105°.

## Question 2

This question was generally well answered with most students following the question and comparing percentages. Those who used formal methods rather than build up methods tended to be more successful. Some students compared the marks by scaling out of a number other than 100, for example 200. It was very common for students to compare the number of lost marks for each test. Other errors included working out 18% of 25 and 30% of 40.

## Question 3

Responses to this question were generally very good with the most successful method being to expand the brackets as the first step. The most common errors were to divide 50 by 3 before subtracting 8 or to multiply all terms on the left by 3 giving $6x + 12 + 24 = 50$ A small proportion of students expanded the bracket as $6x + 4$ or $5x + 12$.

**Question 4**

Part (a) was well answered. In part (b), which was generally poorly answered, many students simply restated the question, for example by stating that a square number cannot be a prime number. Many students appeared to confuse factors with multiples. Good explanations, such as, referring to the square root of a square number being a third factor, were seen.

**Question 5**

This question was generally well answered, although some students did not clearly present their work and others did not show any working at all. Incorrect solutions featured variations of the following:

$(4 \times 6 + 3 - 1) \div (6 - -1) = 26 \div 7 = 3.7$ or $(4 \times 6 + 3 \times -1) \div (6 - 1) = 21 \div 5 = 4.2$

**Question 6**

Most of the students gave one correct and one incorrect answer.

**Question 7**

This question was generally well answered. Common errors included using $\pi \times 8^2$, $\pi \times 8$ or $\pi \times 4$.

**Question 8**

Only a low proportion of students were fully successful on this question. The most common errors were to omit the ½ from the formula or to not round their answer to 1 decimal place. Many students did not show the number they were rounding and simply wrote a 1 decimal place answer.

**Question 9**

Responses to the question at this tier were quite good. Many of the successful students worked out values of $x^3 + 8x$ for $x = 2.2$ and $x = 2.3$ but did not realise this was sufficient to answer the question and continued to work out the solution to greater accuracy. A common error was to mix up the 2.2 and 2.3, working out $2.2^3 + 8 \times 2.3$.

**Question 10**

Part (a) of this question was a good discriminator.

The most common error was to write $\frac{1.5}{7.5} = \frac{3}{15} = \frac{1}{5}$ Part (b) was too challenging for all but the most able students. Those who were successful used a variety of different problem solving techniques with some very elegant solutions seen. Some used trial and error reaching $\frac{4}{16} = 25\%$, so $4 - 2 = 2$ litres more. A few used algebra and usually gave a completely correct solution. The best approach was from those students who realised that 12 litres had to be 75% of the total.

**Question 11**

Part (a) was generally well answered although it was common to see 2.5 ÷ 4 = 0.625. A small proportion of students converted the times to minutes which often led to 150 ÷ 4. Part (b) was a good discriminator. Most successful explanations for week 4 referred to the total weight of 5.7kg. Many students gave week 3 as their answer because this was the longest time spent fishing or because more fish were caught that week. Others gave week 2 as it had the highest mean and a few gave a week that was not in the table, usually week 5 or week 6. Some students struggled to distinguish between mean weight and total weight in their answers.

**Question 12**

The standard of algebra on both parts was often poor. In part (a), $x^2 + 36$ was a common incorrect answer. Part (b) was a very good discriminator, although the number of students with fully correct answers was low. Common errors included sign errors (particularly with the last term), arithmetic errors and conceptual errors such as combining all the letters into a single term for their final answer.

**Question 13**

Part (a) was the most successfully answered question on the paper. In part (b) the question was attempting to assess students' understanding of 'fairness', and many were able to relate this to part (a), making a valid statement. Sometimes the reason given did not support the conclusion, for example 'it lands on 3 a lot more than the other numbers, so it is fair'.

**Question 14**

Very few students made significant progress with this question. The most successful approaches were to recognise the symmetry, or to equate the sum of the angles of a pentagon to $(6x + 3x + 4x + 3x + 4x)$. However this was often equated to 360°, 450° or 900°. Those students who used the line of symmetry to form a quadrilateral, often equated $13x$, instead of $10x$, to 360°.

**Question 15**

This question was generally poorly answered, with many students using incorrect trigonometrical ratios or even mixing up angles and lengths, for example, 31tan16.

**Question 16**

Part (a) was generally well answered although a few students gave 90 as the total. In part (b) some students used 90 as their total even though they gave an answer of 80 in part (a), although many students gave both medians correctly. Many students did not attempt part (c) and only a minority worked out the correct value. In part (d) the most successful students compared the medians. Many students were unable to support their choice of test B with a valid reason.

**Question 17**

This was one of the least attempted questions on the paper with few correct responses seen. The most common error was to substitute a value in for $x$ and work out the numerical mean. Many errors were also seen in attempting to add the three expressions together, for example replacing $x + 3$ with $3x$. Division of $6x + 3$ by 3 sometimes resulted in a final answer of $2x$, or even $6x$ where the 3s had been crossed out.

**Question 18**

A majority of students did not score marks on this question. Common errors included mistakes when multiplying through by 3, for example 30 – $x$, transposition errors when collecting like terms on each side and conceptual errors, for example $\frac{18+6x}{3}$ = 10 and 18 + 5$x$ = 23.
A significant proportion of students used trial and improvement but were often unsuccessful.

**Question 19**

This question was generally poorly answered, although many students made some progress by either attempting to calculate the gradient or by identifying the $y$-intercept. $y = 2x + 4$ was a common incorrect answer.

**Question 20**

Many correct solutions were seen, with work shown on the diagram often clearer than the work of those trying to explain what they were doing on the working lines. Often the angle of 96° was identified at the centre of the circle but many students then, either did not know how to progress, or doubled the 96° to give an answer of 192°. Some students assumed that angle $BOC$ was 90°.

**Question 21**

Many students did not attempt either part of this question with part (b) the least attempted question on the paper. Very few fully correct answers were seen in part (a) although many gave 64° for the angle. Common incorrect reasons were alternate angles, corresponding angles and cyclic quadrilaterals. In part (b), common incorrect answers were 83° and 64°.

**Question 22**

Poor presentation on this question often meant that it was difficult for examiners to decipher what the students were doing, with combinations of decimals appearing almost at random in many cases. Many students were able to imply the different ways that £16 could be deducted, although many of them did not deal with the two ways of being 'on time' and 'over 30 minutes late'. Those students who used a tree diagram often made the most progress.

**Question 23**

Again, a large proportion of students did not attempt this question. Many students worked out $\pi \times 8^2$ but few then knew how to deal with the fraction needed for the sector calculation, with some approximating to ⅓ or even ½. Many did not give their answer to a suitable degree of accuracy, leaving the answer as it appeared on their calculator display.

**Question 24**

Very few students scored marks on this question. Many used right-angled triangle trigonometry, assuming that angle $A$ was 90° and then obtaining $BC$ = 6 cm before going on to make further errors. Often when the sine rule was correctly applied, students were then unable to rearrange the formula correctly. A small number of students drew a perpendicular line from $A$ to $BC$ and used right-angled triangle trigonometry correctly to work out the perpendicular height and then the two angles at $A$.

**Question 25**

Very few students scored marks on this question with many making no attempt. The common error was to use particular values to show that the expression was even. Some did attempt to complete one half of the argument, either for odd only or for even only, but many ignored the +2.

**Question 26**

Only a small minority of students were able to draw a cubic or a reciprocal graph, with many straight lines and parabolas seen. Again there were many non-attempts.

**Question 27**

This was a challenging question for all but the most able students. The most successful students used Pythagoras' theorem to test out the squared values. Those who tried to use the cosine rule often made errors when trying to rearrange the formula.

**Question 28**

Although the method for solving simultaneous equations is a standard procedure, many students made no attempt at this question. Very few correct answers were seen, as even when a quadratic equation was set up, sign errors usually followed when rearranging the equation.

**Grade boundary ranges aqa.org.uk/gradeboundaries**