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General Certificate of Secondary Education
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Mathematics 43602H

(Specification 4360)

Unit 2: Number and Algebra (Higher)

Report on the Examination

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General

This was the fifth series for this unit. Previous indications that students were coming to terms with the mix of straightforward questions and problem solving questions were further supported this time. The paper was comparable to that of last November and represented a fair challenge for all students.

There were some good attempts in the first half of the paper, but some of the later questions in the paper were not well answered. Although almost all students seemed to be able to attempt all the questions in the time allowed, there was also a significant number of non-attempts to the later more challenging questions.

Questions 3 and 12 assessed the quality of written communication. In question 3, it was necessary for working to be shown and a conclusion to be stated. In question 12, all steps had to be clearly shown, with a fully correct method, in order to gain the QWC mark. In all questions, students need to show sufficient steps of their working and try to set out their work clearly.

Many mistakes were made on basic arithmetic with answers that were clearly not sensible or realistic.

Topics that were well done included:

- sequences
- substitution
- money problem
- basic algebra work.

Topics which students found difficult included:

- interpreting a money problem involving fractions
- solving inequalities
- factorising and harder algebra work such as setting up and solving an equation to solve a problem or simultaneous equations where one is non-linear
- simplifying surds
- fractional indices
- straight line problem involving $y = mx + c$.

Question 1

Part (a) was very well answered. In part (b), most students identified that $n = 12$ would give the first negative term. Some verified this and some found it by trying various values for n. Weaker students repeatedly subtracted 4, but this often involved an arithmetical error. A few made an error calculating 45 – 48. Many students, having seen that the first negative term was the twelfth gave an answer of 12 or −3. A small number of students thought that the 'first negative' term meant the term with $n = –1$ and gave an answer of 49.

Question 2

Most students had some success with this question. The most common errors were from incorrect values being substituted into the initial expression, often missing the negative sign from –8. Answers of −6, 14 and −14 were the most common incorrect responses. −20 + 8 was often seen calculated as −28.

Question 3

This question was well answered. A few changed to percentages but most worked with fractions or ratios. Some obtained $\frac{48}{216}$ and $\frac{48}{192}$ or $\frac{192}{864}$ and $\frac{216}{864}$ (or equivalent fractions), or 4 and 4.5, but then made the wrong decision. Poor multiplication and division was seen, for example $27 \div 6 = 4.3$. Some simply subtracted, added or multiplied 27 and 6 or 32 and 8.

Question 4

Many students lacked a clear strategy for attempting this question. The most successful approach involved students starting from the £6, stating that this was equal to one-third and then progressing to £18 being three-quarters of the starting amount. However there were many misinterpretations of this question. Some students used trial and improvement to find the answer but few were successful with this method.

Question 5

There were some fully correct well-presented solutions to this percentage reduction question. However, many students either did not know the correct method or made arithmetical errors. Many approached the task by successive subtraction of 125 from 12500 until they reached 11750 or repeated addition of 125 to 11750 until they reached 12500. The answer was a whole number so using this method was usually successful. Finding the reduction to be 750 then $\frac{750}{125}$ was a common and usually successful method of finding the percentage. Others used a build-up method obtaining 5% and 1% to reach 750. Some students were able to quote the formula for percentage reduction in words, but then did not know how to apply it to the values in the question.

Question 6

Most students knew how to approach the question but errors in arithmetic and poor presentation were real issues for a significant proportion of students. However, there were also many good answers, clearly set out and accurate, sometimes with the exception of the very last step. Common errors in the arithmetic included
$100 \times 0.84 = 8.40$, $60 \times 1.10 = 60.60$, $40 \times 1.60 = 42.40$, and $184 - 150 = 24$.

Question 7

Most students identified the correct formula in part (a) but some gave more than one answer. There were many correct answers to part (b). A few plotted correct points but did not join them. Some drew a parallel line through (0, 30) or a parallel line below the given one. Part (c) was generally well answered. In this part students did not have to state values as "cheaper" was sufficient. Of those who did state values, a large number misread the scale with £90 usually correct but £88 was a common misread. Some chose the wrong company from their graph. A few drew a First Cars graph from the origin to (8, 30). Many did not use their graph but recalculated the values for '7 days'. Those who did not draw the graph sometimes thought Roy's was cheaper because the graph starts at 20 rather than 30.

Question 8

In part (a), most students completed the first step of multiplying both sides of the equation by 3, but there were many cases where $12 - x = 15$ became $x = 15 - 12$. A few started by writing $36 - 3x = 15$ and some tried to take the x term to the other side of the equation before doing anything with the denominator of 3. A small number wrote $4 - x = 5$. Part (b) was reasonably well answered, with many correct answers, particularly in the form $t = \frac{(s-4)}{3}$. Many students were unable to go further than $3t = s - 4$.

Question 9

This question was poorly answered and sometimes not attempted. Many students only gave one value, or missed zero from their list or included –4. –9, –6, –3, 0, 3, 6 was often given as the answer.

Question 10

There were a number of correct answers from using algebra and slightly more from using a trial and improvement method. However, there were also many unsuccessful attempts using trial and improvement usually due to arithmetical errors. The most common errors using algebra were omitting the twins or just using one of the twins. Some correctly found 55, 51, 17 and 10 by trial and improvement but when checking the total just added these four, forgetting the other twin and hence not realising they were correct. There were many algebraic expressions with mixed letters for the family members. The use of $x + 7$ rather than $x - 7$ was a common error.

Question 11

This difference of 2 squares question was one of the least successful questions on the paper and there were a significant number of non-attempts. There were a small number of fully correct answers.

Question 12

Only a small number of students gave a fully correct solution. Many just checked the result using a number put into the formula and the same number put through the flow chart twice. Students need to be aware that when a question says 'show clearly', the algebra needs to be correct, so, for example, omitting brackets, eg $4a - 8 \times 4 - 8$, is not acceptable. A few students successfully worked backwards, taking $16a - 40$ through the flow chart twice, to obtain 'a', but some made errors trying to add 8 to –40. The best answers enclosed $4a - 8$ in brackets and put that through the flow chart. Others treated it as a simultaneous equation question with $b = 4a - 8$ and $c = 4b - 8$; and eliminating b by substituting the first equation into the second.

Question 13

This was generally well answered. The most common incorrect answer was $3x^2y^3$. Very few students included × or + signs which was an improvement on previous series.

Question 14

Part (a) was reasonably successful. Many students knew the method for factorising expressions of this kind but others took a factor of n out of the first two terms. Common mistakes were $(3n + 1)(n + 4)$ and $(3n + 2)(n + 2)$. A few treated the expression as a quadratic equation and went on to give 'solutions' of $-\frac{4}{3}$ and -1. In part (b), very few students used part (a) to help them, failing to spot 374 as being equivalent to 300 + 70 + 4, leading to $n = 10$. Most used a factor tree. The majority showed 2×187, although $374 \div 2$ was incorrectly calculated by some students. A small minority went on to correctly write 187 as 11×17, and give the correct final answer of $2 \times 11 \times 17$. Some students missed out the multiplication signs on the final answer line.

Question 15

In part (a), the most popular answer was to write $\sqrt{80} + \sqrt{180} = \sqrt{260}$. Some students then went on to write $260 \div 5 = 52$ and gave a final answer of $52\sqrt{5}$. The same answer was seen from $\sqrt{80} + \sqrt{180} = 16\sqrt{5} + 36\sqrt{5} = 52\sqrt{5}$.
Many students did not realise that when they were breaking down the given numbers into the product of two or more roots, the emphasis should have been on looking for square numbers, instead writing, for example, $\sqrt{80} = \sqrt{2} \times \sqrt{40}$. Those who went straight in with multiples of $\sqrt{5}$, eg $\sqrt{16} \times \sqrt{5}$ were far more successful than those who did not. Part (b) was not well answered. $\frac{7}{\sqrt{1}}$ was a common error. There was evidence of students who knew the method but could not simplify the expression after reaching $\frac{77\sqrt{11}}{\sqrt{11}\sqrt{11}}$, so errors such as $\frac{\sqrt{847}}{11}$ or $\frac{\sqrt{847}}{\sqrt{11}}$ were common. Some obtained $\frac{77\sqrt{11}}{11}$ but made no further progress. Other errors included, ignoring the square root and, for example, $\frac{77}{\sqrt{11}} = \sqrt{7}$. Writing $\frac{77}{5.5}$ was a common misconception, as was $\frac{77}{3.33}$

Question 16

This question was generally not well answered, with square roots and cubes used in many cases.

Question 17

In part (a), many students correctly showed the expansion of the brackets, with $3x + 3x$ being the key terms required. Writing $2 \times 3x$ was not accepted as clear evidence of a correct method. A correctly completed grid method was accepted. Very few students used part (a) to help them in part (b), and most restarted by expanding $(3x + 1)^2$ again. Hence, many errors were seen in the first step of expanding the brackets, which would have been avoided if part (a) had been used. Poor algebraic skills when rearranging terms and factorising the resulting quadratic equation were common errors. A small minority correctly calculated both solutions. The y values were sometimes omitted from otherwise completely correct responses.

Question 18

This challenging question was generally not well answered. Some attempted to get the y-intercept by rearranging and wrote $3y = -4x - 12$ but then concluded that the y-intercept was -12. Other students wrote $3y = -4x - 12$ with $y = -\underline{4}x - 3$ as their next step. Some students did not realise the gradient of line *B* was positive and gave an answer of $y = -\frac{2}{3}x - 4$. One very common incorrect answer was $6x + 3y + 18 = 0$.

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