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Unit M2: Methods in Mathematics (Geometry and Algebra) - Higher

Report on the Examination

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Unit 2: Higher Tier

General

The overall standard was very high. Students had been well prepared for the examination and there were few questions that were not well answered. Standards of presentation were high and working was almost always shown. Poor arithmetic and poor algebraic manipulation were often the cause of lost marks.

Topics which students found challenging included:

- using algebra in problem solving questions
- combined transformations
- geometric proof
- similar triangles
- algebraic fractions.

The rest of the paper was well done.

Question 1

The majority of students used an appropriate method. The main error was to give an answer of 584.6. Students are reminded that money answers must always be given to 2 decimal places if appropriate. This was the QWC mark.

Question 2

Parts (a) and (b) were usually correct. In part (c) the method mark for the expansion was usually awarded but there were many expansions where $-4 \times -1 = -4$ was seen. This could gain a mark if followed through correctly but $6 - 4 = -2$ was common. Many marks were lost by sign errors and poor arithmetic.

Question 3

The majority used the formula and obtained the correct answer. The bracket was often omitted and the calculation $0.5 \times 14 + 17 \times 8 = 143$, or similar was seen.

Question 4

This question was well done. Diagram 3 for Pair X was the most common error.

Question 5

This question has a Quality of Written Communication mark so the explanation should fully answer the question asked. The answer must include a reason why 24 is the smallest possible area and 56 is the greatest possible area. If marks were lost then these facts were not made clear. Showing the 24 full squares and 56 full and partial squares as an outline on the diagram was sufficient, if followed by a brief explanation.

Question 6

Part (a) was usually correct. Part (b), even with a follow through from an incorrect answer in (a) was not well done. 3.170 was a common wrong answer as was the truncated answer of 3.16.

Question 7

In part (a), the simple fact that the total was odd (or that an even number would give an even total) was all that was required. Many students did give an answer that gained full marks with lengthy explanations. Part (b) was very well done with a majority of students gaining full marks. The main method was trial and improvement. Algebraic methods were rare. Many simply divided by 5 or 115 (73 + 42).

Question 8

Part (a) was very well done and was a lead-in for part (b). Part (b) was also well done although many students may have felt that giving a reason for each that involved lines of symmetry was not allowed, so tried to give reasons that used different geometric properties. For example, all sides the same, no lines of symmetry and no parallel sides. Of the three shapes the parallelogram proved the most difficult to describe uniquely. 'It has parallel sides', was a common wrong answer.

Question 9

Part (a) was well done although $4x = 5$ was often solved as 0.8. Part (b) was not well done. The variable as a denominator proved a difficult concept for the majority of students to cope with. A common error was $4 + 3 = 11y$. Those that managed to get to $\frac{4}{y} = 8$ often gave 32 as the answer. Many that got as far as $4 = 8y$ gave 2 as the answer.

Question 10

This was not well done as the algebra was often wrong. In particular $2x – 3$ was common for the second machine. The main method was trial and improvement and once again the second machine caused problems. For example, starting with $x = –2$, often led to $–2 – 3 \times 2 = – 8$. Students who made a successful start on Trial and Improvement then made further trials that led away from the solution.

Question 11

Part (a) was well done. Part (b) was also quite well done. The majority knew to find the second difference leading to n^2. The main method used was to subtract n^2 and find the *n*th term of the linear sequence.

Question 12

This was not well done. The most common error was not to add the 13 cm diameter to half the circumference. Otherwise, there were many area calculations.

Question 13

Part (a) was very well done. Surprisingly a very common method was to show that when 42 was taken out as a factor, 3 and 10 were left, which have no common factors greater than 1. It was pleasing to see Venn Diagrams used in this question. Part (b) was very badly done.

Question 14

This question was also very badly done. About a third of students ignored the instruction to reflect in an axis and chose a variety of other lines. If correctly reflected and a full rotation was described, this gained 2 marks out of 3. There was a lot of confusion about axes and the lines $y = 0$ and $x = 0$. Coordinates were also written the wrong way round on many occasions.

Question 15

Both parts were quite well done. In part (a) adding the squares was common but the majority who recognised this as a Pythagoras' theorem question often scored full marks. In part (b) using $\tan^{-1}(17 \div 11)$ was the simplest method. A significant number of students calculated the hypotenuse and then used the sine or cosine ratio, or the sine or cosine rule. Students who use 'alternative' methods must do a complete method to score both method marks. Inevitably at some point in these calculations a value is often prematurely rounded so the final answer is outside the acceptable range and the accuracy mark is lost.

Question 16

In part (a) the vast majority gave 75 degrees but fewer gave an acceptable, valid reason. A statement that stated the relationship between the angle at the centre and the circumference was required. In part (b) full marks were rare but most students picked up at least one mark. The angles of 84^o and 42^o were usually found, although reasons were not always given. The first omission of a valid reason was penalised but thereafter, values could be stated or written on the diagram. The alternate segment theorem was often misused with angle *DAC* given as 54^o. Students who managed to find all the correct angles did not always give a valid reason why *BC* and *AD* were parallel. In some cases the lines were assumed parallel.

Question 17

This was the least well done question on the paper. Correct answers for both parts were rare. The simple connection between the ratio of the lengths of the base and the area was not seen. The height was often calculated correctly. In part (b) using the same method with *BC* as a base was not used. Occasionally the height of *E* above *AB* was found as 4 cm using the intercept theorem. Students who used the linear and area scale factors usually found the correct area. In both parts there were lots of cosine, sine or area formulae attempts.

Question 18

Those students who had some idea of how to solve this problem usually made some progress but were often let down by poor arithmetic or careless algebra. Forgetting to multiply the denominator by 'the right hand side' was the first major error. The second was calculating -2×-1 as -2 in the expansion. After the expansion many students did not realise they had to rearrange the terms into a quadratic equation. Those that did used many methods to solve their equation, but students should know that in this type of problem, the quadratic, if found correctly, will always factorise.

Question 19

This was quite well done with many students scoring full marks. The sine rule was used to find *AB* or *AC* or both. Trigonometry was then used to find w, but very often a more complicated route was chosen. For example, the area of *ABC* was found, then $0.5 \times w \times 100$ was used to find w. Another approach was to find the horizontal values using trigonometry and then use Pythagoras' theorem to find w. These are not the most efficient methods and very often one of the intermediate values was prematurely rounded, causing the final answer to be outside the acceptable range. Students should be encouraged to use the calculator display or write intermediate values down to at least 4sf.

Mark Range and Award of Grades

Grade boundaries are available on the Results statistics page of the AQA Website.

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