AQA

Level 2 Certificate
Further Mathematics

83601 Paper 1

Report on the Examination

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General

Most students were well prepared, presented their work in a clear way and were able to make a good attempt at all the questions in the time allowed. There were exceptions to this, some working was difficult to decipher, often untidy, and, although the space allowed for each answer was generous, some candidates needed additional pages to continue or, sometimes, re-start their answers. If work is done on additional pages, students ought to make it clear which solution they intend to be marked. There were instances of two solutions being offered and this can cause problems when deciding whether the work is a genuine re-start or whether we are presented with a choice of solutions, which could lead to a loss of marks. There were also instances of many good responses to questions being let down by some very careless arithmetic, resulting in the loss of marks. The gradual progression of difficulty of the questions meant that a number of students struggled with the more challenging questions towards the end of the paper, but there were still some very good attempts at these questions, with some elegant solutions. It is worth re-iterating that students always need to ensure that they show sufficient working whether or not the question specifically asks them to do so.

Topics that were well done included:

- drawing a straight line when given the gradient and a point on the line
- calculation involving gradient to determine an unknown coordinate
- calculations involving the definition of a function
- finding the nth term of a quadratic sequence
- equation of a circle problem
- algebraic fractions.

Topics which students found difficult included:

- stating the equation of the line of symmetry of a quadratic graph
- setting up an equation using the coefficients of terms from an expansion
- factorising ... when being required to remove a cubic factor
- matrices and transformations
- trigonometry involving knowledge of the sin, cos and tan of 30°, 45° and 60°
- sine rule problem, needing knowledge of sin120°.

Question 1

This question was well answered although there was some carelessness in ensuring the line passed through certain critical points.

Question 2

This question had a very mixed response. Many students did not appreciate the need to differentiate first before trying to apply the gradient condition.

Question 3

Part (a) was quite a good discriminator. Some of the drawing was poor, especially given the fact that most students ought to know that a quadratic curve has a smooth U-shape. It was necessary to factorise first, to find the x-axis crossing points and then ensure that the minimum point was drawn to the left of the y-axis. Part (b) was not well answered. There were instances of completing the square, which was not necessary. Using the symmetry of the graph was all that was needed.

Question 4
Most students used a gradient method, with some success. Using a ratio method or simply looking at differences often led concisely to a correct answer. There was some careless arithmetic such as $7 - -5 = 13$, and omitting the negative sign when using the gradient in a calculation to work out the equation of the line; but overall the question was quite well answered.

Question 5
There is still some confusion and uncertainty when it comes to interpreting the word 'coefficient'. After expanding the brackets many students set up an equation with the x^2 and x terms still included and often made no further progress. Those who tried to use the coefficients sometimes put the '2' on the wrong side of the equation ... $4 - k = 2(-4k - 5)$ was the correct equation.

Question 6
This was the least well answered question on the whole paper. The hint not to expand the brackets was not heeded by many students resulting in lines of algebraic expressions which led nowhere.
A minority of students substituted y for $(x + 6)$ and factorised $y^4 + y^3(3x + 4)$ by removing a common factor of y^3, which usually led to a correct answer.

Question 7
All parts of this question were quite well answered. In (a) most students selected the correct domain. In (b) there was some carelessness in squaring 1.2 (1.04, 1.4, 2.4, 14.4 were some of the variations), but otherwise this was well answered. A first step of $1.2^2 = 2x - 5$ was wise because it indicated the correct method was being used.
In (c) many students got as far as $\sqrt{\frac{2}{8}}$ but failed to complete successfully.

Question 8
This question was well answered. Almost all the successful solutions used the 'differences' method. Common errors included subtracting $(4n)^2$ or n^2 rather than $4n^2$ and there was evidence of some very careless arithmetic.

Question 9
Part (a) was very well answered. Part (b) was less well answered. Many students realised that they had to rearrange the inequality so that it became a quadratic function greater than zero, but many others only got as far as $2x^2 - x > 10$. Of those who successfully factorised the quadratic, only a few realised that one of the two solutions was inadmissible (being negative) and so had to be excluded from their final answer.

Question 10
This question was quite well answered. Students used the given equations to spot the values of the radii, 6 and 8, for *LN* and *NM* and calculated *LM* using Pythagoras' theorem. Perhaps even more crucial to arriving at $h = 13$ was to spot the coordinates of *L* (3, 0), the centre of the smaller circle, but less students saw this. Some interpreted the question as a pair of simultaneous equations and after several lines of fruitless manipulation, finally gave up.

Question 11

Algebraic fractions questions seem to be reasonably well answered. Many students adopt the method of using the product of the denominators for the common denominator, rather than their least common multiple. It leads to a more complicated expression for the numerator, which many students then expand and, as in this case, often ended up with cubic expressions in both numerator and denominator which proved difficult to factorise. Here, the better method was to use the LCM of $(x-3)(x-5)$, giving a numerator of $x^2 - 5x + 6$, which was much easier to handle and usually resulted in a completely correct solution. There were instances of incorrect cancelling where $\frac{x(x-5)+6}{(x-3)(x-5)}$ became $\frac{x+6}{x-3}$

Question 12

None of the parts of this question were well answered. In parts (a) and (c), space was left so that students could draw unit vector diagrams or perform matrix multiplication but very few students took advantage of this. Descriptions of the transformation in (b) were often lacking a piece of information, such as a centre of rotation or a centre of enlargement. There were a significant number of non-attempts at parts (b) and (c).

Question 13

This question proved to be a good discriminator. Students had to unravel the negative index and the fractional power, which could be done in either order. There was some confusion between a fourth root and a fourth power ($x = {}_4\sqrt{5}$ was quite common) and the negative index sometimes just vanished ($x = 0.2^4$ was seen on a number of occasions). There were errors in evaluating 0.2^4, answers such as 0.00016 and 0.08 ruining any chance of a correct final answer. Those students who started with $x^{1/4} = 5$ and then $x = 5^4$ got to 625 most easily.

Question 14

This question was not well answered. The main reason for this was wrong values used for the sin, cos and tan of 30°, 45° and 60°. Spotting $AB = \sqrt{3}$ (since sin 30° = 0.5) and hence $BC = \sqrt{3}$, then using trigonometry or Pythagoras' theorem to work out BD, was usually the most effective solution. Much of the work was very untidy and often quite difficult to follow.

Question 15

This question was quite a good discriminator. The point of inflection was probably the biggest problem for students, although there were many graphs that didn't cross the x-axis three times even though this was clearly stated in the question. The maximum and minimum points were not always labelled and nor were they always in the correct quadrant.

Question 16

This was another trigonometry question that was not well answered. Apart from the fact that many students didn't know the correct value for sin 120°, there were fundamental errors made in using the sine rule, such as writing 120 instead of sin 120° and writing sin $(1/\sqrt{12})$ instead of $1/\sqrt{12}$. There were errors in rearranging the formula to get an expression for y and errors in the surds manipulation. Some students treated the triangle as though it was right-angled, writing $\sin x = 6/y$ or some other equally incorrect expression. As in the previous trigonometry question, some of the work was very untidy and difficult to follow.

Question 17

Part (a) was straightforward factorising and was extremely well answered. Many students used the connection to part (b), usually writing sin θ instead of x in their factors from part (a). Those who persisted with x had, at some stage, to say that $x = \sin\theta$, otherwise the possibility of a solution to the trig equation was lost. The final step, solving $\sin\theta = -1$, proved to be beyond many students. There were a significant number of non-attempts at part (b).

Question 18

There were many good answers to this surds' manipulation question. Some students chose to work with $\sqrt{300}$, whilst others simplified this to $10\sqrt{3}$ as a first step. Multiplying numerator and denominator by $(4\sqrt{3} + 5)$ was the most popular method, although there were a significant number of errors, especially in the numerator ($40\sqrt{3}$ instead of 120 was surprisingly common). A minority of students spotted a very elegant method ... introducing a factor $\sqrt{3}$, or $2\sqrt{3}$, into the numerator and writing it as $\sqrt{3}(8\sqrt{3} - 10)$, or $2\sqrt{3}(4\sqrt{3} - 5)$, which immediately gave the correct final answer of $2\sqrt{3}$.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.