Level 2 Certificate

Further MATHEMATICS

83602 Paper 2 Calculator

Report on the Examination

Specification 8360

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General

The paper covered a variety of topics. Some questions involved standard processes and others required problem solving skills. Geometric and trigonometric proof were also tested. Most students made a good attempt at many of the questions. Some of the later questions had quite high proportions of non-attempts which was more likely due to the difficulty of the questions rather than a lack of time. Many students showed their working clearly but some responses were difficult to follow with work spreading beyond the allocated working space.

Topics that were well done included:

- area of a triangle
- line of symmetry of a quadratic curve
- analysing algebraic statements
- simplifying an algebraic fraction
- *n*th term of a linear sequence
- problem involving circle theorems
- change of subject for a formula.

Topics which students found difficult included:

- factorising a two-term expression involving powers
- working with algebra and volumes
- transformation matrices
- functions and algebraic fractions
- proving a trigonometric identity
- solving a trigonometric equation.

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Question 1

This question was well answered although some students made the problem more difficult by working out lengths of adjacent sides as well as the included angle, before using $\frac{1}{2}ab \sin C$. Some who used this approach made arithmetical errors or rounded prematurely.

Question 2

Part (a) was well answered. There were many fully correct answers to part (b) but a significant number of students did not score. The most common error was to give the x values where the curve intersected the x-axis. Working out a range continued to be a problematic topic for many students. Some of those who used the given curve to answer part (c) and selected the values –3 and 6 did not use appropriate notation. A few attempted a statistical range.

Question 3

Neither part was answered well. The most common wrong answer given in part (a) was $\left(\frac{c}{b}, 0\right)$.

In part (b) the most common wrong answer was $\left(\frac{b}{a}, 0\right)$.

Question 4
Many fully correct answers were seen with all of the alternative methods being used. Some obtained correct equations like $5y = 7$ but then worked out y as $\frac{5}{7}$. Some of those who made y the subject in each equation used decimal coefficients that were rounded and this usually led to incorrect values for x and y. It was not always clear whether the intention of a student was to add or subtract their equations. It is important that the method being used is made clear to examiners

Question 5
Most students were able to select the correct box for at least two statements with many of these getting three or four correct. The most common error was to indicate that the fourth statement was always true.

Question 6
This question was quite well answered and was a good discriminator. Writing $(–2)^4$ without the brackets was a very common error. Some students who substituted correctly and equated to 12 then rearranged by subtracting 3 from 12 instead of adding 3 to 12. Some substituted $x = 2$ into the expression for $\frac{dy}{dx}$.

Question 7
This question was well answered with many students giving fully correct answers and most of the others just making one error. The fraction was not always cubed correctly and others had x^6 instead of x^9. A few students converted to decimals when it would have been more straightforward to work using a fraction. Some responses had answers involving the sum of terms.

Question 8
Most students drew a diagram and used the ratio 3 : 5 to work out appropriate horizontal and vertical distances. Errors with signs were made and some students confused the x and y values. Some used a formula to obtain correct answers but others substituted into the formula incorrectly. Those who used Pythagoras' theorem and/or trigonometry were rarely successful. It was quite common to see $x = –4.5$ in the working with 4.5 on the answer line.

Question 9
Some students did not show sufficient working in this proof question whilst others made errors with brackets. However, nearly all managed to start correctly and many continued to give a convincing response leading to $x = 3y$. Only a very small proportion included fully correct reasons in their answers. Some gave just one reason and others did not use correct terminology.

Question 10
Part (a) was very well answered. The most common error was to factorise the denominator to $(x – 5)(x – 3)$. Many errors were made in part (b), which was not well answered. Some students did use the highest common factor but the other factor was often incorrect. Others had a bracket with only one term or with three terms.

Question 11

This question was a good discriminator. Many attempted a full expansion which quite often included an extra term in x^2, usually from $3x \times x^2$ being $3x^2$. Most students who isolated the terms in x^2, then set up a correct equation were able to solve correctly. Those who did not isolate the terms in x^2 usually wrote a complicated and incorrect expression/equation which frequently involved working going beyond the working lines.

Question 12

Part (a) was well answered. Part (b) was often fully correct, with many using the answer to part (a). Other methods were used, sometimes correctly, but quite often the only correct working was to obtain the correct value for the common second difference.

Question 13

Those who attempted the use linear factors were sometimes successful but many were not able to write two correct factors. The most common correct factor seen was $(x + 1)$. More students attempted to form two simultaneous equations. Errors were made when substituting $x = –1$ and/or $x = \frac{7}{2}$ due to incorrect use of brackets or the absence of brackets. Eliminating a letter, correctly, proved challenging for many. A few attempted differentiation and consideration of the maximum point but this method rarely gained more than one mark.

Question 14

This was a well answered question with the vast majority of students dividing 180 in the ratio 7 : 5 to work out w at the outset.

Question 15

Many correct solutions were seen in part (a). Errors including obtaining $\sqrt{x} = \frac{2}{5}$ or square rooting 2.5 after a correct first step. Most students obtained one correct solution in part (b) which was usually $x = 5$. Only a small proportion collected the terms on one side of the equation and factorised. Most of those who did do this went on to obtain both solutions.

Question 16

Nearly all students started correctly, usually by multiplying both sides by x. Further progress was often made with many fully correct rearrangements seen. It was common for students to correctly collect the terms in x but then not know how to proceed from there. Another common error was to expand $8(w – x)$ to $8w – x$. Although some gave an expression on the answer line, these students had usually already shown $x = ...$ in the working lines.

Question 17

Many students wrote a correct expression for the volume of the cylinder but often this was the only correct working seen. Some used an incorrect formula for the volume of a hemisphere with r^2 commonly used. Also common was to omit brackets when cubing $6y$ as well as only cubing the 6 after correctly writing $(6y)^3$

Question 18
Part (a) was quite well answered. Part (b) was not well answered with only a small number of fully correct answers seen. Many students made no attempt. Some sketched the graph of $y = \sin x$ in the white space and others did not attempt a diagram at all. Many tried to use the identity $\tan x \equiv \dfrac{\sin x}{\cos x}$ and although this could have led to a correct solution, it rarely scored any marks.

Question 19
A variety of graphs were seen and this question was a good discriminator. More students could identify a minimum point than a point of inflection. Labels were quite often left out and some had no understanding of the shape of the graph at the stationary points.

Question 20
It was important to show sufficient working in this question. Multiplying the matrices was often attempted and the product was usually correct if the order of the matrices was correct to begin with**.** Some students showed their subsequent working clearly, either by setting up and solving two equations independently, or by solving one equation and showing by substitution that $a = -3$ satisfied the other one. Conclusions were usually correct.

Question 21
This good discriminator was answered quite well with many able to score some marks even after earlier errors were made. Most students multiplied both sides by $(x - 2)(x - 1)$ although often with expansion errors. Rearranging to a quadratic equation was usually attempted, often with a sign error occurring. Nearly all used the quadratic formula to try to solve their quadratic equation. Very few attempts to solve by trial were seen.

Question 22
Many could not identify the angle that was required with a variety of other angles being attempted. Those who did know which angle was needed usually obtained the correct answer. Finding the angle that *VB* makes with the base was quite often seen.

Question 23
Transformation matrices continued to be a difficult topic for many students and a significant number made no attempt. Those who either knew or could work out the two appropriate matrices often went on to gain full marks. Using the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ as the rotation matrix was a common error. Some students showed the matrix $\begin{pmatrix} -3 & 0 \\ 0 & -3 \end{pmatrix}$ but had not shown, using matrices, how this matrix had been obtained.

Question 24
Quite a few correct expressions were seen for $f(x + 1)$ but many students worked out $f(x) + 1$ or wrote $\dfrac{x+1}{2x+1}$. A correct common denominator was often used when subtracting their fractions although errors in expanding and simplifying the numerators were quite common. A significant number of fully correct solutions were seen.

Question 25
This question was quite well answered with many correct attempts at the equation of the tangent. Some students differentiated twice and others had $\frac{dy}{dx} = 6x^2 - 5$. Some gave an answer of –32 not realising that the length *CD* was positive.

Question 26
Part (a) was fully correct for a significant number of students but was too difficult for many others. When proving a trigonometric identity, the result should **not** be assumed at the outset and all steps should be clearly shown. Most success was obtained by working on the left hand side and showing clearly that it is identical to the right hand side. In part (b) most students used the identity from part (a) but errors in rearranging meant that sin x was not always the correct value. The negative value of sin x was often not considered at all and those who used trial and improvement rarely gained more than one mark. There were many non-attempts.

Mark Ranges and Award of Grades

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