AQA

AS
MATHEMATICS

Unit Pure Core 1
Report on the Examination

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General

All students were able to demonstrate their understanding of basic topics such as coordinate geometry, differentiation, integration, factorising polynomials and surds, although some of the more complex topics provided more challenge.

Algebraic manipulation continues to be a weakness; this was very evident when solving simultaneous equations, multiplying out brackets and factorising quadratic expressions. Students resorted to using the formula for quadratic equations when testing a couple of possible factors would enable them to factorise a quadratic.

Question 1

(a) This was an easy starter with almost every student being awarded full marks.

(b) Rationalising the denominator is well practised with just more than half the students scoring full marks. Most of the wrong answers came from errors with signs or arithmetic usually when simplifying $\frac{6\sqrt{2}-18}{-14}$ to its simplest form.

Question 2

(a)(i) Almost every student was able to find the correct gradient of the line QR. A few omitted the minus sign and others wrote their gradient as $-\frac{7}{5}x$ which was penalised here but recovery was allowed in part **(ii)**.

(ii) This was handled much better than in recent years with about nine out of ten students obtaining a correct equation of the line AB in the requested form.

(b) In contrast this part of the question defeated the vast majority of students who may be used to doing all their arithmetic on a calculator. Those who divided both sides of the equation $46x = -69$ by 23 quickly obtained the coordinates of S in their simplest form; those who had fractions with huge denominators rarely found the coordinates to be $\left(-\frac{3}{2}, \frac{5}{2}\right)$.

(c) Just less than half of the students scored full marks in this part. Often sign errors when subtracting coordinates prevented students from obtaining a correct quadratic equation. Those who did were usually able to factorise correctly and obtain the correct values of k .

Question 3

(a)(i) The vast majority of students used the Factor Theorem to evaluate $\mathrm{p}(x)$ when $x = -2$. Most showed their simplification of the powers of -2 correctly and obtained full marks when they wrote $-8-28+10+26=0$ followed by a statement such as “therefore $x+2$ is a factor”.

(ii) Many used inspection to obtain the quadratic factor $x^2 - 9x + 13$ whereas others used long division or its equivalent in tabular form. This topic was well practised and by far the majority of students scored full marks for expressing $\mathrm{p}(x)$ in the given form.

(b)(i) Arithmetic errors were made by about one fifth of the students when evaluating their discriminant. Those with the correct value then needed to say that $29 > 0$ and so the quadratic equation had two real roots and hence the curve crossed the x-axis three times.

(ii) As usual with a direct request such as "find $\frac{\mathrm{d}y}{\mathrm{d}x}$" almost every student found the correct first and second derivatives but the application was not done quite so well in part **(iii)**.

(iii) About half of the students only considered the second derivative when attempting to show that the curve had a maximum point. It was necessary to show that $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$ at the given point and then to find the correct value of $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ when $x = -\frac{1}{3}$ together with a reason, such as "$-16 < 0$" in order to show that the curve had a maximum point when $x = -\frac{1}{3}$. This question was an example of even good students lacking thoroughness in proving a particular result; strings of numbers were never linked to either $\frac{\mathrm{d}y}{\mathrm{d}x}$ or $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$; brackets were often missing with students giving answers like "$3 \times -\frac{1}{3}^2 - 14 \times -\frac{1}{3} - 5 = 0$" and this type of work was unable to gain full marks.

Question 4

A little more than half of the students scored full marks on this question. The condition for equal roots needed to be explicitly stated or the discriminant needed to be clearly equated to zero. Students were unable to get full credit in this question for the omission or incorrect use of brackets and so the algebra had to be fully correct to earn full marks. Many students launched into the quadratic equation when it was very easy to factorise the quadratic.

Question 5

(a) Only about two thirds of the students found the correct gradient of the normal to the circle. Errors were made by a considerable number of students when subtracting -8 from -2 in the numerator.

(b) Less than two thirds of students obtained the correct equation of the circle, with the most common error being writing $\sqrt{61}$ instead of 61 on the right hand side of the equation.

(c) About half of the students scored no marks at all on this part of the question. Many who attempted this part substituted $x = 0$ instead of $x = 7$ thus displaying a lack of understanding of what was being requested. Those who had $(y+8)^2 = 61$ often failed to complete; those with more insight immediately wrote down the y-coordinate of Q as $-8+\sqrt{61}$ without any working simply by considering the y-coordinate of C and the radius of the circle.

(c) Only about half of the students scored full marks in this part. Pythagoras' theorem needed to be used with the hypotenuse being the value of their radius; the final mark for $3\sqrt{5}$ was only awarded if correct notation was used and so sloppy working such as $61-16=\sqrt{45}=3\sqrt{5}$ was penalised.

Question 6

(a)(i) Finding an equation of the tangent was very high scoring this year with only one in ten failing to achieve full marks. This was helped by the question allowing this equation to be given in any form and so once a correct answer was seen subsequent working was ignored.

(ii) About ten percent of those who had a correct tangent equation failed to obtain the correct coordinates of B, the point where the tangent crossed the x-axis.

(b)(i) The integration was handled well with more than half of the students earning full marks. Most dealt well with the negative limits, with the minus sign and with removing the brackets. Many scored the first few marks but their work in combining fractions sometimes let them down. When tackling definite integrals students are encouraged to consider an expression of the form $\mathrm{F}(b)-\mathrm{F}(a)$ holistically rather than working with separate entities, as it is not always clear when they combine later that subtraction has taken place. Students are also advised to show the correct substitution of limits before attempting any simplification as a small arithmetic mistake could render their method incorrect.

(ii) There were quite a few fully correct solutions here, with most students scoring at least one mark for considering the difference between their answer from part **(b)(i)** and the area of a triangle. A small number of students tried to find the area of the region that was below the line using integration but very few of them were successful. It was easier to simply evaluate $\frac{1}{2}\times14\times7$, which the majority tried to do.

Question 7

(a)(i) Less than half the students were able to express $2x^2-5x+4$ in the completed square form $2(x-p)^2+q$. It was pleasing to see that the majority of students did at least have the correct value of p but most could not find the correct value of q.

(ii) The line of symmetry had equation $x=\frac{5}{4}$ and because of allowing follow through on their value of p more than two thirds of the students scored this mark. Some students had y instead of x and others thought the equation was $x=\text{"}their\text{"}\,q$.

(iii) Some felt the need to differentiate when they saw the word "tangent" but most realised that the line was of the form $y=\text{"}their\text{"}\,q$ and the mark was given if this followed through from part **(a)(i)**. Quite a few simply wrote down the coordinates of the vertex and this was given no credit.

(b) There was a good spread of marks on this part with most students realising what to do. Those who used the completed square form could rarely cope with the fractions when multiplying out even though they had a correct expression such as $y = 2\left(x - \frac{17}{4}\right)^2 - \frac{57}{8}$; those working with $y = 2(x-3)^2 - 5(x-3) - 4$ usually fared better, but even then only about one fifth of all the students obtained the correct simplified coefficients.

Question 8

(a) This was the usual quadratic inequality which for some reason caused many students to launch into the quadratic equation formula in order to find the critical values. It would have been better to list the pairs of factors of 63 in order to obtain the correct factorisation $(5x+21)(x-3)$. Instead many were left with the expression $\frac{-6 \pm \sqrt{1296}}{10}$ which unsurprisingly very few could simplify. In the end just over half the students solved the inequality correctly.

(b)(i) More than three quarters of the students were able to obtain the given inequality by considering the area of the trapezium.

(ii) Those who realised that AD had length $5x$ could usually find the perimeter and over half of the students had the correct expression for the perimeter.

(iii) The term “at least” was not widely understood with most of those who had the correct perimeter usually writing $14x + 6 > 30$ and so could not gain the method mark. It was then necessary to combine the result of the inequality for the perimeter restraint with that for the area restraint solved in part **(a)**. As a result just over one tenth of students obtained the correct final values of x. Rather than being unable to gain all three marks, a special case of 1 mark was awarded to those who had a final answer of $\frac{12}{7} < x < 3$.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator www.aqa.org.uk/umsconversion