AQA

A-level

Mathematics

MPC1 – Pure Core1
Report on the Examination

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General

Once again the question paper seemed to provide a suitable challenge for able students whilst at the same time allowing weaker students to demonstrate their understanding of key topics such as differentiation, integration, coordinate geometry, rationalising the denominator of surds and polynomials.

Basic items such as the general equation of a circle and the solution of quadratic equations by factorisation need more attention by the weaker students. Algebraic manipulation continues to be a weakness, particularly the use of brackets and dealing with negative signs. The number of arithmetic errors appeared to have increased this year as a number of students could not even carry out a simple subtraction such as $135 - 105$. The handling of fractions was beyond the ability of many who clearly depend on the use of calculators for this process.

When a question asks for a particular result to be proved or verified then a concluding statement is expected. Also if a specific form of answer, such as $x + py = q$, is requested then the final answer should be in this exact form.

Some students might benefit from the following advice.

- The straight line equation $y - y_1 = m(x - x_1)$ could sometimes be used with greater success than always trying to use $y = mx+c$.
- The quadratic equation formula needs to be learnt accurately and values need to be substituted correctly or no marks will be earned.
- When solving a quadratic inequality, a sketch or a sign diagram showing when the quadratic function is positive or negative could be of great benefit.
- When asked to show that a point is a maximum it is necessary to show that $\frac{dy}{dx} = 0$ as well as $\frac{d^2y}{dx^2} < 0$ at the given point.

Question 1

(a)(i) Most students found the gradient correctly although some found difficulty in dealing with negative coordinates. A few used the incorrect formula $\frac{x_1 - x_2}{y_1 - y_2}$ and those who tried to use an expression such as "rise/ run" rarely scored any marks since they failed to consider the negative gradient.

(ii) The majority of students found the correct equation of the line AB but most failed to answer the question fully as the specific form, $px + qy = r$, was requested. Some of those who tried to rearrange their equation made sign errors.

(b)(i) Apart from a few who used an incorrect formula for the midpoint, most answered this correctly.
(ii) The negative reciprocal of the gradient was attempted correctly by most students. Those who used $y–y_1 = m(x–x_1)$ were more likely to earn full marks as the first correct form of the equation was rewarded. Those using $y = mx+c$ often experienced problems in combining the fractions.

(c) Those who used the distance formula here often proceeded quite well. Errors came in the difference of the y coordinates where $2–2k+3$ was a common error. There were also several poor attempts at squaring, such as $(2k+1)^2 = 4k^2+1$. Many were unable to factorise the quadratic and so used the formula but could not complete as $\sqrt{256}$ defeated them.

Question 2

The majority of students rationalised the denominator by multiplying the numerator and denominator by $9 - 5\sqrt{3}$. A very common arithmetic error was $135 – 105 = 20$. The given form of the answer, stating that *m* and *n* were integers, should have alerted them to an error in their working.
A few weak students began by dividing the length by the area so could make no progress.

Question 3

(a)(i) and **(ii)** Almost all students found the first and second derivatives correctly. A very small number added $+c$.

(b) (i) Students were unsure as to whether to use the first or second derivative. Those who correctly used the former did not always explain why y was decreasing i.e. because $\frac{\mathrm{d}y}{\mathrm{d}x} < 0$.

Reasons such as "because it is negative" were unacceptable.

(ii) This was generally well answered and most students used their gradient found in part **(b)(i)** and not its negative reciprocal. A few made arithmetic slips in finding the y coordinate of P, largely because the x coordinate was negative.

(c) Almost all students only earned half the marks here. Most thought it was only necessary to show that the second derivative was negative to complete the verification. Very few began, as they should, by verifying that Q was a stationary point.

Question 4

(a) (i) The negative coefficient of x^2 led to many problems. Those who reversed the signs of the expression, completed the square and then reversed the signs once more, were the most successful. Common incorrect answers were $7 - (x+3)^2$ and $25 - (x-3)^2$.

(ii) Those whose answer to part **(a) (i)** was of the form $p - (x + q)^2$ earned this mark if they stated that the maximum value was p. However many who gave an answer such as $(-3, 25)$ revealed that they did not understand the demand of the question.

(b)(i) Factorisation was very poor largely due, once more, to the negative coefficient of x^2.
A common incorrect answer was $(x - 2)(x + 8)$.
Many confused roots with factors. Some students used the quadratic equation formula to solve the corresponding equation but failed to write the correct factors afterwards.

(ii) Most graphs were of the correct shape despite factors of $(x-2)(x+8)$ in part **(b)(i).** However, very few showed their maximum point in the second quadrant. Despite the difference between the values -8 and 2 , many assumed that the maximum point was on the y– axis.
A few cubic curves were seen too.

Question 5

(a) Almost all students attempted to find $p(-3)$. However the majority failed to include "$= 0$" until the very last line and were penalised since the proof was incomplete.

(b) A minority of students found $p(-2)$ and so made no progress. A large number of students who found $p(2)$ neglected to equate their expression to 65, not taking the remainder into account. Some of those who wrote the correct equation in an unsimplified form made arithmetic errors in combining the terms and so were unable to obtain a correct solution in part **(c).**

(c) Those who used the correct two equations were usually successful here since the simultaneous equations were very simple. Many weaker students matched the coefficients of *c* or *d* but did not carry out the appropriate addition or subtraction required.

Question 6

(a)(i) Most students carried out this proof correctly. However, a few students neglected to include "$=0$" on the last line.
Some tried a different approach. They began by solving the given equation to find $x = -2$ and 3. However, they rarely carried out a full verification by showing that $(-2,5)$ and $(3,10)$ lay on both the cubic curve and the straight line.

(ii) Most students attempted to factorise the quadratic and found the correct values of x , although quite a few made no attempt to find the *y*-coordinates of the points. The errors that did occur usually arose in finding the y value when $x = -2$.

6(b) Almost all students integrated correctly.

(c) Correct use of limits was not always clear here. Many students, having shown the correct limits, gave an answer of $-\frac{52}{3}$ and not $0-\left(-\frac{52}{3}\right)$. Errors in the evaluation of the powers and in the combination of fractions abounded. Some students stopped after finding the area under the curve. Those who attempted to find the area of the trapezium often demonstrated poor arithmetic with $2\frac{(5+7)}{2}$ often being evaluated as 14.

Question 7

(a) Most students began by attempting to complete the square for both the x and the y terms but not all were successful. The expression $(x-5)^2+(y-6)^2$ on the left hand side of the equation was quite common. Sometimes $\sqrt{20}$ instead of 20 was seen on the right hand side of the equation and indicated a lack of understanding of the equation of the circle.

(b)(i) This was almost always answered correctly or at least was a correct follow through from the answer from part **(a).**

(ii) Not all students first wrote that $r=\sqrt{20}$ but most obtained the value $2\sqrt{5}$, including those who had answered part **(a)** incorrectly, as they often used a different method to find the radius.

(c) Most students appreciated the need to find the gradient of AC and then to use its negative reciprocal in order to find the equation of the tangent. However, very few gave the answer in the form required by the question. Answers such as $y+2=\frac{1}{2}(x-3)$ and $2y-x=-7$ were common.
Some made sign errors at the start as they could not deal with negative coordinates while others used the gradient of AC and not the gradient of the tangent.
There were some very poor attempts using implicit differentiation but there was rarely any progress made.

(d) Not all attempted this part of the question. However, those who did, and in particular those who drew a diagram, used Pythagoras theorem correctly and gave the correct answer.
Some used poor notation such as $AB^2=16=\sqrt{16}=4$ which was penalised.

Question 8

(a) Errors abounded here. The most common errors stemmed from the removal of the brackets and it was common to see $-15x + 2$ or $-15x + 10$ when simplifying $-5(3x+2)$ were common.

Also most students did not reverse the inequality sign so an answer of $x > -\frac{1}{3}$ was common.

Some left the final answer as $x < -\frac{7}{21}$ but simplification of the fraction was expected to earn full marks.

(b) There were several completely correct solutions. Those who chose to factorise the equation, in order to find the critical values, were usually more successful than those using the quadratic equation formula, as often $\sqrt{1-4\times 6\times(-12)}$ defeated many without the use of a calculator. Students are advised to draw a sketch or sign diagram in order to solve a quadratic inequality.

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