AS

MATHEMATICS

MPC1 Pure Core 1
Report on the Examination

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General

It was encouraging this year to see that the question paper provided a suitable challenge for the more able students. At the same time weaker students were able to demonstrate their understanding of coordinate geometry, differentiation, integration, factorising polynomials and rationalising the denominator of surds.

When an answer is requested in a particular form, such as the equation of a straight line, students will not score full marks if their final answer is not in that specific form. Where a printed answer appears in a question, students must reproduce this exactly with terms in the correct order on their final line.

Algebraic manipulation continues to be a weakness; this was very evident when solving simultaneous equations, multiplying out brackets and factorising quadratic expressions. The correct use of brackets is often necessary to gain full marks in a question.

Some of the writing and presentation this year was very poor and this makes students' work particularly difficult to read. In particular it is very difficult to mark graphs when several attempts have been made on the same set of axes.

Question 1

(a) This was a high scoring part with two thirds of the students scoring full marks. Rationalising the denominator continues to be a skill that is well practised. Most of the wrong answers came from carelessness with signs or arithmetic.

Some students made errors in evaluating the middle terms of the denominator, writing things like $-5\sqrt{7}+5\sqrt{7}$ and were penalised; others found difficulty simplifying $25-28$. There were also a few errors seen this year when going from the penultimate line with the correct numerator and denominator to the final line due to incorrect division by -3.

(b) Once again, about two thirds of the students scored full marks on this part. The expected method was that students would express each term in terms of $\sqrt{5}$ but some chose more complicated methods such as trying to rationalise the denominator after writing $x=\dfrac{\sqrt{80}}{9\sqrt{5}-2\sqrt{45}}$ and very few were successful using this approach.

Question 2

(a) Although the majority of students differentiated the expression in x correctly, many students seemed reluctant to write $\dfrac{\mathrm{d}y}{\mathrm{d}x}=...$ or to equate their derivative to zero. The condition for a stationary point was widely known but some omitted to actually write "=0" and a number of incorrect expressions such as $20-2x-6x^2=3x^2+x-10$ were seen and penalised. It was encouraging to see many students factorising their quadratic in order to find the other stationary point rather than simply relying on using the quadratic equation formula.

(b) Some found the value of $\frac{d^2y}{dx^2}$ when $x = \frac{5}{3}$ but most students substituted $x = -2$, obtaining $-2 - 12(-2)$, with only the weakest students evaluating this incorrectly. Students were expected to provide a reason, such as "$22 > 0$", as well as stating that M was a minimum point.

(c) Half of the students scored no marks for their graph. The others made a reasonable attempt at a cubic graph passing through the origin with one maximum and one minimum point. To earn full marks, the graph needed to be correct in all four quadrants.

Question 3

(a) The vast majority of students used the Factor Theorem to evaluate $p(x)$ when $x = -2$. Most showed their simplification of $p(-2) = 0$ correctly and obtained full marks as they reduced their equation to the required form; however quite a few omitted the "= 0", only introducing this after they compared their final line with the printed answer.

(b) Some equated their expression for $p(3)$ to 0 or 30 rather than –30 and scored no marks. Some with a correct equation made errors when subtracting terms from the other side or dividing throughout by 3 and spoiled their solution.

(c) The majority of students made an attempt at solving the simultaneous equations and usually obtained the correct solution if they had a correct equation from part (b). However, poor arithmetic sometimes led to errors in the elimination of b or c and hence the loss of marks. Students who solved the equations by elimination rather than substitution were usually more successful.

Question 4

(a) This was handled much better than in recent years, with the majority of the students obtaining the correct equation of the line AB in the requested form. There were fewer errors in subtracting coordinates to find the gradient this year and consequently a higher success rate in finding the equation of the line. It was good to see that students had heeded the reports of previous years.

(b) In contrast this part of the question defeated the vast majority of students. There were essentially two main methods: one was to use the gradients of the lines AC and BC equating the product to –1; the other was to use Pythagoras using the squares of the lengths of the three sides. Most students lacked the perseverance to deal with the resulting quadratics in k from either of these methods and were often unsuccessful as they tried to cope with the resulting algebra. Clever alternatives were seen using the scalar product or equating the radius of the circle with AB as the diameter to the distance from the point C to the midpoint of AB.

Question 5

(a) Quite a few students wrongly thought that the line AB was the normal to the curve at A. Most differentiated correctly to obtain the gradient of the tangent and found the negative reciprocal which gave the gradient of the normal. Some arithmetic errors occurred when trying to produce an equation of the required form.

(b)(i) The integration was handled well, with the 4 in the integrand causing most errors: sometimes omitted, sometimes left as 4. Most dealt well with the negative limit, 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.

(b)(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 trapezium. A small number of students tried to find the area of the region below the line using integration but very few of them were successful.

Question 6

(a) The vast majority of students found the correct circle equation. Sign errors were very uncommon this year and the radius being 10 seemed to reassure many.

(b) The best solutions had both an algebraic result and a statement about the geometrical configuration. Students were expected to make reference to the significance of the repeated root $y=7$ when $x=0$ as indicating that the circle touched the y-axis; the two real values of x when $y=0$ implied that the circle crossed the x-axis in two distinct points.

(c)(i) There is usually one part of the examination for this unit that tests the steps of an algebraic proof and the final line must be presented in exactly the same form as that printed in the question. Once again, only about half the students scored full marks. A common error in the proof was squaring kx when multiplying out the brackets but writing the term as kx^2.

(c)(ii) Less than a third of the students scored full marks in this part. Students needed to obtain the correct discriminant and equate this to zero. It may have surprised students that this reduced to a simple linear equation in k but those who persevered were able to solve the equation correctly.

Question 7

(a)(i) Less than half the students were able to express y in terms of x correctly. A common error was writing $4y+4x=15$ when considering the length of fencing, forgetting that AF and FE were sides of the building.

(a)(ii) There was a variety of ways of expressing the area of the shaded region but some students made heavy weather of the task. Having obtained a correct expression for S such as x^2+2xy it was a fairly simple matter to substitute for y in terms of x and hence obtain the printed answer. However, less than a third of the students scored full marks on this part with a large number fudging their incorrect expression so it transformed into the correct printed answer.

(b)(i) It was encouraging to see more than half of the students being able to complete the square correctly, even though there was no constant term and the coefficient of x^2 was negative. This topic had been well rehearsed.

(b)(ii) This last part proved to be the most challenging part of the paper. Finding the maximum value of S entailed multiplying the value of p from the previous part of the question by three. A common mistake was to simply quote their value of p as the maximum value of S.

Question 8

(a) The majority of students scored the first two marks here for differentiation, although $\frac{\mathrm{d}h}{\mathrm{d}t}$ was rarely seen. It was surprising how many faltered at the basic arithmetic, after substituting $t = 3$ and multiplying by large numbers, then being unable to evaluate $108 - 177 + 72$ correctly.

(b) The quadratic inequality was disguised in this part of the question involving the period of time for which the height of the water was decreasing. Students attempting to use the quadratic equation formula found the numbers quite daunting without a calculator. Those with insight realised that the two critical values were likely to lie between 0 and 4 and factorised accordingly. Those who used a sign diagram or a sketch graph usually were more successful when solving the inequality.

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.

Converting Marks into UMS marks

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