Version : 1.0 0607

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MPC1 Pure Core 1

Report on the Examination

2007 examination - June series

Further copies of this Report are available to download from the AQA Website: www.aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

General

The presentation was sometimes disappointing and centres should discourage candidates from dividing the pages of the answer booklets in to two vertical columns to write their solutions in order to fit more writing on a page; this makes it very difficult to mark the script. The question paper seemed to provide a challenge for the very able candidates whilst at the same time allowing other candidates to demonstrate basic skills such as differentiation, integration, rationalising the denominator of surds and completing the square.

Algebraic manipulation proved to be difficult for many candidates and there seemed to be far more arithmetic errors than in previous years, perhaps indicating that candidates have become too dependent on a calculator for simple arithmetic. Some candidates might benefit from the following advice.

- The straight line equation $y - y_1 = m(x - x_1)$ can sometimes be used with greater success than always trying to use $y = mx + c$
- The vertex of $y = (x + p)^2 + q$ has coordinates $(-p, q)$ and the line of symmetry has equation $x = -p$
- The only geometrical transformation tested on MPC1 is a **translation** and this word must be used rather than shift or move etc.
- The normal at a point N to a circle with centre C is the straight line which passes through C and N
- When asked to use the Factor Theorem, no marks can be earned for using long division
- When $\text{p}(x) = (x-1)(x^2 + ax + b)$, we say that $(x - 1)$ is a **factor** of $\text{p}(x)$ but that $x = 1$ is a **root** of $\text{p}(x) = 0$
- When y is a function of t, the required condition for y to be decreasing at a given point is that $\frac{\text{d}y}{\text{d}t} < 0$
- A quadratic equation has real roots when the discriminant is greater than or equal to zero ($b^2 - 4ac \geqslant 0$)
- Proofs require a final statement such as "Hence $x - 1$ is a factor" or "Therefore there is a stationary point when $x = 2$"; far too many candidates are simply writing "yes", "QED", ticking their numerical answer or even just drawing a smiley face instead of writing a simple conclusion.

Question 1

Part (a)(i) Most candidates were able to show that the gradient was $-\frac{3}{2}$. However, examiners had to be vigilant since fractions such as $\frac{6}{4}$ and $\frac{-4}{6}$ were sometimes equated to $-\frac{3}{2}$.

Part (a)(ii) Many candidates did not heed the request for integer coefficients and left their answer as $y = -\frac{3}{2}x + 8$. Many who attempted to express the equation in the required form were unable to double the 8 and wrote their final equation as $3x + 2y = 8$.

Part (b)(i) Most candidates realised that the product of the gradients should be –1. However, not all were able to calculate the negative reciprocal. Others used the incorrect point and therefore found an equation of the wrong line.
Part (b)(ii) Many candidates made no attempt at this part of the question. The most successful method was to substitute $y = 7$ into the answer to part (b)(i) or to equate the gradient to $\frac{2}{3}$.
There were also some good answers using a diagrammatic approach. Those using Pythagoras usually made algebraic errors and so rarely reached a solution.

Question 2

Part (a) Some candidates found this part more difficult than part (b) and revealed a lack of understanding of surds. Some managed to express the first term as $\sqrt{7}$ but were unable to deal with the second term. Those who attempted to find a common denominator often multiplied the terms in the numerator and/or added those in the denominator. Very few obtained the correct answer of $3\sqrt{7}$.

Part (b) Most candidates recognised the first crucial step of multiplying the numerator and denominator by $\sqrt{7}+2$ and many obtained $\frac{9+3\sqrt{7}}{3}$, but poor cancellation led to a very common incorrect answer of $3\sqrt{7}+3$.

Question 3

Part (a)(i) The completion of the square was done successfully by most candidates, although occasionally $+ 44$ was seen instead of $– 6$ for q.

Part (a)(ii) Most candidates were able to write down the correct minimum point, although some wrote $(5, –6)$ as the vertex. A few chose to use differentiation but often made arithmetic slips in finding the coordinates of the stationary point.

Part (a)(iii) Although there were correct answers for the equation, the term " line of symmetry" was not well understood by many; typical wrong answers were $y = – 6$, the y-axis and even $y = –x^2 +10x+19$ or other quadratic curves.

Part (a)(iv) The more able candidates earned full marks here. The term **translation** was required but generally the wrong word was used or it was accompanied by another transformation such as a stretch. The most common (but incorrect) vector stated was $\begin{bmatrix} 10 \\ 19 \end{bmatrix}$.

Part (b) There were a number of complete correct solutions here. The errors that did occur usually stemmed from sign slips in rearranging the equations. Some candidates found the x-coordinates and made no attempt at the y-coordinates. A few candidates wrote down the coordinates of at least one point without any working.

Question 4

Part (a) Almost all candidates were able to find the first and second derivatives correctly, although there was an occasional arithmetic slip; some could not cope with the fraction term, others doubled 26 incorrectly.

Part (b) Those who substituted $t = 2$ into $\frac{dy}{dt}$ did not always explain that $\frac{dy}{dt} = 0$ is the condition for a stationary point. Many used the second derivative test and concluded that the point was a maximum. Some **assumed** that a stationary point occurred when $t = 2$ and went straight to the test for maximum or minimum and only scored half of the marks. A few tested $\frac{dy}{dt}$ on either side of $t = 2$ correctly, but those who only considered the gradient on one side of the stationary value scored no marks for the test.

(c) The concept of "rate of change" was not understood by many. Approximately equal numbers of candidates substituted into $t = 1$ into the expression for y, $\frac{dy}{dt}$ or $\frac{d^2y}{dt^2}$ and so only about one third of the candidates were able to score any marks on this part. Those who used $\frac{dy}{dt}$ often made careless arithmetic errors when adding three numbers.

Part (d) As in part (c), candidates did not realise which expression to use and perhaps the majority wrongly selected the second derivative. It is a general weakness that candidates do not realise that the sign of the **first** derivative indicates whether a function is increasing or decreasing at a particular point.

Question 5

Part (a) Most candidates found the correct coordinates of the centre, although some wrote these as $(3, -2)$ instead of $(-3, 2)$. Those who multiplied out the brackets were often unsuccessful in writing down the correct radius of the circle.

Part (b)(i) Most candidates were able to verify that the point N was on the circle, although some, who had perhaps worked a previous examination question, were keen to show that the distance from C to N was less than the radius and that N lay inside the circle.

Part (b)(ii) Most sketches were correct, though some were very untidy with several attempts at the circle so that the diagram resembled a chaotic orbit of a planet. Some candidates omitted the axes and scored no marks.

Part (b)(iii) The majority of candidates found the gradient of CN and then assumed they had to find the negative reciprocal of this since the question asked for the normal at N. Reference to their diagram might have avoided this incorrect assumption.

Part (c)(i) Most wrote $PC^2 = 5^2 + 4^2$, provided they had the correct coordinates of C. However, the length of PC was often calculated incorrectly with answers such as $\sqrt{31}$ and $\sqrt{36 = 6}$ seen quite often.

Part (c)(ii) Although there were many correct solutions seen, Pythagoras` Theorem was often used incorrectly. A large number of candidates wrote the answer as a difference of two lengths such as $\sqrt{41} - 5$. Candidates need to realise that obtaining the correct answer from incorrect working is not rewarded; quite a few wrote $\sqrt{41} - \sqrt{25} = \sqrt{16} = 4$ and scored no marks. Many who drew a good diagram realised that a tangent from $(2,6)$ touched the circle at $(2,2)$ and so the vertical line segment was of length 4 units.

Question 6

Part (a)(i) Most candidates realised the need to find the value of $f(x)$ when $x = 1$. However, it was also necessary, after showing that $f(1) = 0$, to write a statement that the zero value implied that $x - 1$ was a factor.

Part (a)(ii) Those who used inspection were the most successful here. Methods involving long division or equating coefficients usually contained algebraic errors.

Part (a)(iii) This section seemed unclear to some candidates. Many tried to find the discriminant but used the coefficients of the cubic equation. Many who used the quadratic thought that in order to have one real root the discriminant had to be zero, no doubt thinking the question was asking about equal roots. Some correctly stated that 1 was the only real root but many were obviously confused by the terms "factor" and "root" and stated that "$x-1$ was a root".

Part (b)(i) Most candidates were well versed in integration and earned full marks here.

Part (b)(ii) The correct limits were usually used, although many sign/arithmetic slips occurred after substitution of the numbers 1 and 2. Very few candidates realised the need to find the area of a triangle as well and so failed to subtract the value of the integral from the area of the triangle in order to find the area of the shaded region.

Question 7

Part (a) Only the more able candidates were able to complete this proof correctly. Many began by stating that the discriminant was less than or equal to zero, no doubt being influenced by the printed answer.

Part (b)(i) The factorisation was usually correct.

Part (b)(ii) Most candidates found the critical values, but many then either stopped or wrote down a solution to the inequality without any working. Many candidates wrongly thought the solution was $k \leqslant \frac{1}{2}, \quad k \leqslant 2$. Candidates are advised to draw an appropriate sketch or sign diagram so they can deduce the correct interval for the solution.

Mark Ranges and Award of Grades

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