

Version 1.0: 0706



# General Certificate of Education

## Mathematics 6360

*MPC1 Pure Core 1*

# Mark Scheme

*2006 examination – June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

## Key To Mark Scheme And Abbreviations Used In Marking

|              |  |     |                            |
|--------------|--|-----|----------------------------|
| M            | mark is for method   |     |                            |
| m or dM      | mark is dependent on one or more M marks and is for method         |     |                            |
| A            | mark is dependent on M or m marks and is for accuracy              |     |                            |
| B            | mark is independent of M or m marks and is for method and accuracy |     |                            |
| E            | mark is for explanation  |     |                            |
| ✓ or ft or F | follow through from previous incorrect result                      | MC  | mis-copy                   |
| CAO          | correct answer only  | MR  | mis-read                   |
| CSO          | correct solution only  | RA  | required accuracy          |
| AWFW         | anything which falls within  | FW  | further work               |
| AWRT         | anything which rounds to   | ISW | ignore subsequent work     |
| ACF          | any correct form   | FIW | from incorrect work        |
| AG           | answer given   | BOD | given benefit of doubt     |
| SC           | special case   | WR  | work replaced by candidate |
| OE           | or equivalent  | FB  | formulae book              |
| A2,1         | 2 or 1 (or 0) accuracy marks                                       | NOS | not on scheme              |
| -x EE        | deduct x marks for each error                                      | G   | graph                      |
| NMS          | no method shown  | c   | candidate                  |
| PI           | possibly implied   | sf  | significant figure(s)      |
| SCA          | substantially correct approach                                     | dp  | decimal place(s)           |

### No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

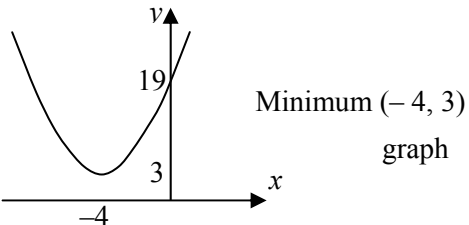
Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

**Otherwise we require evidence of a correct method for any marks to be awarded.**

**MPC1**

| Q              | Solution   | Marks  | Total          | Comments   |  |
|----------------|--|--|----------------|--|--|
| <b>1(a)(i)</b> | Gradient $AB = \frac{1-7}{5-1}$  | M1   | 2              | Must be $y$ on top and subtr'n of cords<br>Any correct equivalent  |  |
|                | $= -\frac{6}{4} = -\frac{3}{2} = -1.5$   | A1   |                |  |  |
|                | <b>(ii)</b>  | $y-7 = m(x-1)$ or $y-1 = m(x-5)$   | M1             | 2  | Verifying 2 points or $y = -\frac{3}{2}x + c$<br>AG (or grad & 1 point verified) |
|                |  | leading to $3x + 2y = 17$  | A1             |  |  |
|                | <b>(b)</b>   | Attempt to eliminate $x$ or $y$ : $7x = 42$ etc<br>$x = 6$<br>$y = -\frac{1}{2}$ | M1<br>A1<br>A1 | 3  | Solving $x - 4y = 8$ ; $3x + 2y = 17$<br>$C$ is point $(6, -\frac{1}{2})$        |
| <b>(c)</b>     | Grad of perp = $-1 / \text{their gradient } AB$  | M1   | 3              | Or $m_1 m_2 = -1$ used or stated<br>ft their gradient $AB$<br>CSO Any correct form of equation   |  |
|                | $= \frac{2}{3}$<br>$y-7 = \frac{2}{3}(x-1)$ or $3y - 2x = 19$                            | A1 $\checkmark$<br>A1  |                |  |  |
| <b>Total</b>   |  |  | <b>10</b>      |  |  |
| <b>2(a)</b>    | $(x+4)^2 + 3$  | B1   | 2              | $p = 4$<br>$q = 3$   |  |
|                |  | B1   |                |  |  |
|                | <b>(b)</b>   | $(x+4)^2 = -3$ or "their" $(x+p)^2 = -q$   | M1             | 2  | Or discriminant = $64 - 76$<br>Disc $< 0$ so no real roots (all correct figs)    |
|                |  | No real square root of $-3$  | A1             |  |  |
| <b>(c)</b>     |       | B1 $\checkmark$  | 3              | ft their $-p$ and $q$ (or correct)<br>Parabola (vertex roughly as shown)<br>Crossing at $y = 19$ marked or $(0, 19)$ stated  |  |
|                |  | B1   |                |  |  |
|                |  | B1   |                |  |  |
| <b>(d)</b>     | Translation (and no additional transf'n) through $\begin{bmatrix} -4 \\ 3 \end{bmatrix}$ | E1<br>M1<br>A1   | 3              | Not shift, move, transformation, etc<br>One component correct eg 3 units up<br>All correct – if not vector – must say 4 units in negative $x$ - direction, to left etc |  |
| <b>Total</b>   |  |  | <b>10</b>      |  |  |
| <b>3(a)</b>    | $\frac{dy}{dx} = -10x^4$   | M1   | 2              | $kx^4$ condone extra term<br>Correct derivative unsimplified   |  |
|                |  | A1   |                |  |  |
| <b>(b)</b>     | When $x = 1$ , gradient = $-10$  | B1 $\checkmark$  | 3              | FT their gradient when $x = 1$<br>Attempt at $y$ & tangent ( <b>not</b> normal)<br>CSO Any correct form  |  |
|                | Tangent is $y-5 = -10(x-1)$ or $y + 10x = 15$ etc  | M1<br>A1   |                |  |  |
| <b>(c)</b>     | When $x = -2$ $\frac{dy}{dx} = -160$ ( or $< 0$ )  | B1 $\checkmark$  |                |  | 2  |
|                | ( $\frac{dy}{dx} < 0$ hence) $y$ is <b>decreasing</b>                                    | E1 $\checkmark$  |                |  |  |
| <b>Total</b>   |  |  | <b>7</b>       |  |  |

**MPC1 (cont)**

| Q              | Solution   | Marks | Total     | Comments  |
|----------------|--|-------|-----------|---|
| <b>4(a)</b>    | $4(\sqrt{5})^2 + 12\sqrt{5} - \sqrt{5} - 3$  | M1    | 3         | Multiplied out<br>At least 3 terms with $\sqrt{5}$ term   |
|                | $4(\sqrt{5})^2 = 4 \times 5 \quad (= 20)$  | B1    |           |   |
|                | Answer = $17 + 11\sqrt{5}$   | A1    |           |   |
| <b>(b)</b>     | Either $\sqrt{75} = \sqrt{25}\sqrt{3}$ or $\sqrt{27} = \sqrt{9}\sqrt{3}$   | M1    | 3         | Or multiplying top and bottom by $\sqrt{3}$<br>or $\frac{\sqrt{225} - \sqrt{81}}{3}$ or $\sqrt{25} - \sqrt{9}$ or $5 - 3$<br>CSO  |
|                | Expression = $\frac{5\sqrt{3} - 3\sqrt{3}}{\sqrt{3}}$  | A1    |           |   |
|                | = 2  | A1    |           |   |
| <b>Total</b>   |  |       | <b>6</b>  |   |
| <b>5(a)(i)</b> | $\frac{dy}{dx} = 3x^2 - 20x + 28$  | M1    | 3         | One term correct<br>Another term correct<br>All correct (no + c etc)  |
|                |  | A1    |           |   |
|                |  | A1    |           |   |
| <b>(ii)</b>    | Their $\frac{dy}{dx} = 0$ for stationary point<br>$(x - 2)(3x - 14) = 0$<br>$\Rightarrow x = 2$<br>or $x = \frac{14}{3}$ | M1    | 4         | Or realising condition for stationary pt<br>Attempt to solve using formula/ factorise<br>Award M1, A1 for verification that<br>$x = 2 \Rightarrow \frac{dy}{dx} = 0$ then may earn m1 later |
|                |  | m1    |           |   |
|                |  | A1    |           |   |
|                |  | A1    |           |   |
| <b>(b)(i)</b>  | $\frac{x^4}{4} - \frac{10x^3}{3} + 14x^2 \quad (+c)$   | M1    | 3         | One term correct unsimplified<br>Another term correct unsimplified<br>All correct unsimplified<br>(condone missing + c)   |
|                |  | A1    |           |   |
|                |  | A1    |           |   |
| <b>(ii)</b>    | $\left[ \frac{81}{4} - 90 + 126 \right] \quad (-0)$<br>= $56\frac{1}{4}$   | M1    | 2         | Attempt to sub limit 3 into their (b)(i)<br>AG Integration, limit sub'n all correct   |
|                |  | A1    |           |   |
| <b>(iii)</b>   | Area of triangle = $31\frac{1}{2}$<br>Shaded Area = $56\frac{1}{4} - \text{triangle area}$<br>= $24\frac{3}{4}$          | B1    | 3         | Correct unsimplified $\frac{1}{2} \times 21 \times 3$<br>Or equivalent such as $\frac{99}{4}$   |
|                |  | M1    |           |   |
|                |  | A1    |           |   |
| <b>Total</b>   |  |       | <b>15</b> |   |

**MPC1 (cont)**

| Q              | Solution  | Marks                | Total     | Comments   |
|----------------|---|----------------------|-----------|--|
| <b>6(a)</b>    | $p(3) = 27 - 36 + 9$<br>$p(3) = 0 \Rightarrow x - 3$ is a factor  | M1<br>A1             | 2         | Finding $p(3)$ and <b>not</b> long division<br>Shown = 0 <b>plus a statement</b>   |
| <b>(b)</b>     | $x(x^2 - 4x + 3)$ or $(x - 3)(x^2 - x)$ attempt<br>$p(x) = x(x - 1)(x - 3)$   | M1<br>A1             | 2         | Or $p(1) = 0 \Rightarrow x - 1$ is a factor attempt<br>Condone $x + 0$ or $x - 0$ as factor  |
| <b>(c)(i)</b>  | $p(2) = 8 - 16 + 6$<br>(Remainder is) $-2$  | M1<br>A1             | 2         | Must use $p(2)$ and <b>not</b> long division   |
| <b>(ii)</b>    | Attempt to multiply out and compare coefficients<br>$a = -2$<br>$b = -1$<br>$r = -2$<br>SC B1 for $r = -2$ if M0 scored   | M1<br>A1<br>A1<br>A1 | 4         | Or long division (2 terms of quotient)<br>$x^2 - 2x...$<br>$-1$<br>Withhold final A1 for long division unless written as $(x - 2)(x^2 - 2x - 1) - 2$                                       |
| <b>Total</b>   |   |                      | <b>10</b> |  |
| <b>7(a)(i)</b> | $(x - 2)^2$<br>centre has $x$ -coordinate = 2<br>and $y$ -coordinate = 0  | M1<br>A1<br>B1       | 3         | Attempt to complete square for $x$<br>M1 implied if value correct or $-2$<br>Centre (2,0)  |
| <b>(ii)</b>    | RHS = 18<br>Radius = $\sqrt{18}$<br>Radius = $3\sqrt{2}$  | B1<br>M1<br>A1       | 3         | Withhold if circle equation RHS incorrect<br>Square root of RHS of equation (if $> 0$ )  |
| <b>(b)</b>     | Perpendicular bisects chord so need to use Length of 4<br>$d^2 = (\text{radius})^2 - 4^2$<br>$d^2 = 18 - 16$<br>so perpendicular distance = $\sqrt{2}$  | B1<br>M1<br>A1       | 3         |  |
| <b>(c)(i)</b>  | $x^2 + (2k - x)^2 - 4x - 14 = 0$<br>$(2k - x)^2 = 4k^2 - 4kx + x^2$<br>$\Rightarrow 2x^2 + 4k^2 - 4kx - 4x - 14 = 0$<br>( $\Rightarrow x^2 + 2k^2 - 2kx - 2x - 7 = 0$ )<br>$\Rightarrow x^2 - 2(k + 1)x + 2k^2 - 7 = 0$ | M1<br>B1<br>A1       | 3         | AG (be convinced about algebra and = 0)  |
| <b>(ii)</b>    | $4(k + 1)^2 - 4(2k^2 - 7)$<br>$4k^2 - 8k - 32 = 0$ or $k^2 - 2k - 8 = 0$<br>$(k - 4)(k + 2) = 0$<br>$k = -2, k = 4$   | M1<br>A1<br>m1<br>A1 | 4         | " $b^2 - 4ac$ " in terms of $k$ (either term correct)<br>$b^2 - 4ac = 0$ correct quadratic equation in $k$<br>Attempt to factorise, solve equation<br>SC B1, B1 for $-2, 4$ (if M0 scored) |
| <b>(iii)</b>   | Line is a tangent to the circle   | E1                   | 1         | Line touches circle at one point etc   |
| <b>Total</b>   |   |                      | <b>17</b> |  |
| <b>TOTAL</b>   |   |                      | <b>75</b> |  |