C1 Paper D – Marking Guide

1. $x = \frac{4 \pm \sqrt{16+32}}{2}$ M1

$= \frac{4 \pm 4\sqrt{3}}{2} = 2 \pm 2\sqrt{3}$ M1 A1 **(3)**

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2. quadratic, coeff of $x^2 = 1$, minimum is $(-2, 5)$

$\therefore\ y = (x + 2)^2 + 5$ M1 A1

$= x^2 + 4x + 9, \qquad a = 4, b = 9$ M1 A1 **(4)**

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3. *(i)* $x^2 - 6x + 7 = 2x - 9$

$x^2 - 8x + 16 = 0$ M1

$(x - 4)^2 = 0$ M1

$x = 4, y = -1$ A2

(ii) the line is a tangent to the curve at the point $(4, -1)$ B1 **(5)**

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4. *(i)* $= (6 + \sqrt[4]{16})^{\frac{1}{3}}$ B1 M1

$= (6 + 2)^{\frac{1}{3}} = \sqrt[3]{8} = 2$ A1

(ii) $\frac{3}{\sqrt{x}} = 4$ M1

$\sqrt{x} = \frac{3}{4}$ M1

$x = \frac{9}{16}$ A1 **(6)**

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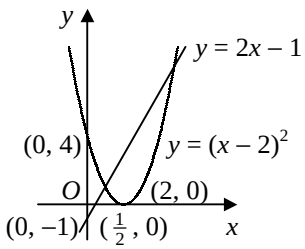
5. *(i)*



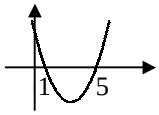
B2

B2

(ii) $x^2 - 4x + 4 > 2x - 1$

$x^2 - 6x + 5 > 0$

$(x - 1)(x - 5) > 0$ M1



M1

$x < 1$ or $x > 5$ A1 **(7)**

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6. *(i)* $2y + \frac{3}{y} = 7$ M1

$2y^2 + 3 = 7y$ M1

$2y^2 - 7y + 3 = 0$ A1

(ii) $(2y - 1)(y - 3) = 0$ M1

$y = \frac{1}{2}, 3$ A1

$x^{\frac{1}{3}} = \frac{1}{2}, 3$

$x = (\frac{1}{2})^3, 3^3 = \frac{1}{8}, 27$ M1 A1 **(7)**

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7. *(i)* $\frac{dy}{dx} = \frac{1}{2}x^{-\frac{1}{2}} + 2x^{-\frac{3}{2}}$ M1 A2

(ii) $\frac{d^2y}{dx^2} = -\frac{1}{4}x^{-\frac{3}{2}} - 3x^{-\frac{5}{2}}$ M1 A1

(iii) LHS $= 4x^2(-\frac{1}{4}x^{-\frac{3}{2}} - 3x^{-\frac{5}{2}}) + 4x(\frac{1}{2}x^{-\frac{1}{2}} + 2x^{-\frac{3}{2}}) - (x^{\frac{1}{2}} - 4x^{-\frac{1}{2}})$

$= -x^{\frac{1}{2}} - 12x^{-\frac{1}{2}} + 2x^{\frac{1}{2}} + 8x^{-\frac{1}{2}} - x^{\frac{1}{2}} + 4x^{-\frac{1}{2}}$ M1 A1

$= 0$ A1 **(8)**

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8. *(i)* $f'(x) = 12x - 3x^2$ M1 A1

for SP, $12x - 3x^2 = 0$

$3x(4 - x) = 0$ M1

$x = 0, 4$

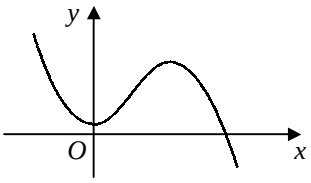
$\therefore$ (0, 2), (4, 34) A1

(ii) $f''(x) = 12 - 6x$ M1

$f''(0) = 12$, $f''(x) > 0$ $\therefore$ (0, 2) minimum A1

$f''(4) = -12$, $f''(x) < 0$ $\therefore$ (4, 34) maximum A1

(iii)



B2

(iv) $2 < k < 34$ B1 **(10)**

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9. *(i)* grad $= \frac{7-4}{9-7} = \frac{3}{2}$ M1 A1

$\therefore$ $y - 4 = \frac{3}{2}(x - 7)$ M1

$2y - 8 = 3x - 21$

$3x - 2y - 13 = 0$ A1

(ii) $y = 8x$ B1

(iii) at R, $3x - 2(8x) - 13 = 0$

$x = -1$ M1

$\therefore$ R (−1, −8) A1

$OP = \sqrt{7^2 + 4^2} = \sqrt{49+16} = \sqrt{65}$ M1 A1

$OR = \sqrt{(-1)^2 + (-8)^2} = \sqrt{1+64} = \sqrt{65}$

$\therefore$ $OP = OR$ A1 **(10)**

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10. *(i)* $= \frac{-8-4}{8-2} = -2$ M1 A1

(ii) $= (\frac{2+8}{2}, \frac{4-8}{2}) = (5, -2)$ M1 A1

(iii) perp. grad $= \frac{-1}{-2} = \frac{1}{2}$ M1

perp. bisector: $y + 2 = \frac{1}{2}(x - 5)$ M1 A1

centre where $y = 0$ $\therefore$ $x = 9$ $\Rightarrow$ (9, 0) M1 A1

(iv) radius = dist. (2, 4) to (9, 0) $= \sqrt{49+16} = \sqrt{65}$ B1

$\therefore$ $(x - 9)^2 + (y - 0)^2 = (\sqrt{65})^2$ M1

$x^2 - 18x + 81 + y^2 = 65$

$x^2 + y^2 - 18x + 16 = 0$ A1 **(12)**

Total **(72)**