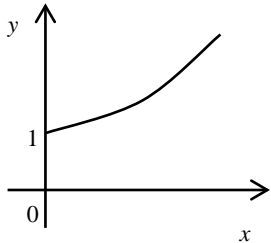


Question number	Scheme	Marks
<p>1. (a)</p> <p>(b)</p>	$p + 6 + 12 + q = -\frac{1}{8}p + \frac{6}{4} - 6 + q$ $\therefore \frac{9}{8}p = -22\frac{1}{2}$ $p = -20$ <p>Remainder = $p + q + 18 = p + 21 (=1)$</p>	<p>M1 , M1</p> <p>M1</p> <p>A1 (4)</p> <p>B1√ ft on p (1)</p> <p>(5 marks)</p>
<p>2. (a)</p> <p>(b)</p>	$4x + 9, +12\sqrt{x}$ $\int (4x + 12x^{\frac{1}{2}} + 9) dx = 2x^2 + 8x^{\frac{3}{2}} + 9x \quad (\text{dep. on 3 terms})$ $[\dots]_1^2 = (8 + (8 \times 2^{\frac{3}{2}}) + 18) - (2 + 8 + 9)$ $= 7 + 16\sqrt{2}$	<p>B1, B1 (2)</p> <p>M1</p> <p>M1 A1</p> <p>M1 A1 (5)</p> <p>(7 marks)</p>
<p>3. (a)</p> <p>(b)</p> <p>(c)</p>	 <p>Shape</p> <p>domain, intercept</p>	<p>B1</p> <p>B1 (2)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>M1 A1 (3)</p> <p>(7 marks)</p>

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<p>4. (a)</p> <p>(b)</p> <p>(c)</p>	<p>$\frac{1}{2}r^2\theta = \frac{1}{2} \times 6.5^2 \times 0.8 = 16.9$ (a.w.r.t. if changed to degrees)</p> <p>$\sin 0.4 = \frac{x}{6.5}$, $x = 6.5 \sin 0.4$, (where x is half of AB)</p> <p>(n.b. $0.8 \text{ rad} = 45.8^\circ$)</p> <p>$AB = 2x = 5.06$ (a.w.r.t.) (*)</p> <p>$r\theta + 5.06 = (6.5 \times 0.8) + 5.06 = 10.26$ (a.w.r.t) (or 10.3)</p>	<p>M1 A1 (2)</p> <p>M1, A1</p> <p>A1 (3)</p> <p>M1 A1 (2)</p> <p>(7 marks)</p>
<p>5.</p>	<p>$1 + nax, + \frac{n(n-1)}{2}(ax)^2 + \frac{n(n-1)(n-2)}{6}(ax)^3 + \dots$ accept 2!, 3!</p> <p>$na = 8, \frac{n(n-1)}{2}a^2 = 30$</p> <p>$\frac{n(n-1)}{2} \cdot \frac{64}{n^2} = 30, \frac{\frac{s}{a}(s-1)a^2}{2} = 30$</p> <p>$n = 16, a = \frac{1}{2}$</p> <p>$\frac{16 \cdot 15 \cdot 14}{6} \cdot \left(\frac{1}{2}\right)^3 = 70$</p>	<p>B1, B1 (2)</p> <p>M1</p> <p>M1</p> <p>A1, A1 (4)</p> <p>M1 A1 (2)</p> <p>(8 marks)</p>
<p>6. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>$V = \pi r^2 h = 500, A = 2\pi r h + \pi r^2$</p> <p>$A = 2\pi r \left(\frac{500}{\pi r^2}\right) + \pi r^2 = \pi r^2 + \frac{1000}{r}$</p> <p>$\frac{dA}{dr} = 2\pi r - 1000r^{-2}$</p> <p>$2\pi r - 1000r^{-2} = 0 \quad r = \sqrt[3]{\frac{500}{\pi}} \quad (\approx 5.42)$</p> <p>$\frac{d^2A}{dr^2} = 2\pi + 2000r^{-3}, > 0$ therefore minimum</p> <p>$A = \pi r^2 + \frac{1000}{r} = 277$ (nearest integer)</p>	<p>B1, M1</p> <p>M1 A1 (4)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p>M1 A1 ft (2)</p> <p>M1 A1 (2)</p> <p>(12 marks)</p>

Question number	Scheme	Marks
<p>7. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	$x(x^2 - 6x + 5)$ $= x(x - 1)(x - 5)$ <p>1 and 5</p> $\frac{dy}{dx} = 3x^2 - 12x + 5$ <p>At $x = 1$. $\frac{dy}{dx} = 3 - 12 + 5 = -4$</p> $\int (x^3 - 6x^2 + 5x) dx = \frac{x^4}{4} - \frac{6x^3}{3} + \frac{5x^2}{2}$ $[\dots]_0^1 = \frac{1}{4} - 2 + \frac{5}{2} \quad \left(= \frac{3}{4} \right) \quad R$ <p>Evaluating at 5: $\frac{625}{4} - 250 + \frac{125}{2} \quad \left(= -31\frac{1}{4} \right)$</p> <p>To find S: $-31\frac{1}{4} - \frac{3}{4} = -32$</p> <p>Total Area = $32 + \frac{3}{4} = 32\frac{3}{4}$</p>	<p>M1</p> <p>M1 A1 (3)</p> <p>B1 ft (1)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>M1 A1 ft</p> <p>A1</p> <p>M1</p> <p>A1 (7)</p> <p>(14 marks)</p>
<p>8. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	$\frac{dy}{dx} = 3x^2 - 14x + 15$ $3x^2 - 14x + 15 = 0$ <p>$(3x - 5)(x - 3) = 0 \quad x = \dots, 3$ (A1 requires <u>correct</u> quadratic factors).</p> <p>$y = 12$ (Following from $x = 3$)</p> <p>P: $x = 1 \quad y = 12$</p> <p>Same y-coord. as Q (or “zero gradient”), so PQ is parallel to the x-axis</p> $\int (x^3 - 7x^2 + 15x + 3) dx = \frac{x^4}{4} - \frac{7x^3}{3} + \frac{15x^2}{2} + 3x$ <p>(First A1: 3 terms correct, Second A1: all correct)</p> $\left[\frac{x^4}{4} - \frac{7x^3}{3} + \frac{15x^2}{2} + 3x \right]_1^3 = \left(\frac{81}{4} - 63 + \frac{135}{2} + 9 \right) - \left(\frac{1}{4} - \frac{7}{3} + \frac{15}{2} + 3 \right)$ $\left(33\frac{3}{4} - 8\frac{5}{12} \right) - 24 = 25\frac{1}{3} - (2 \times 12) = 1\frac{1}{3} \quad \text{(or equiv. or 3 s.f or better)}$	<p>M1 A1 (2)</p> <p>M1</p> <p>M1, A1</p> <p>A1 (4)</p> <p>B1</p> <p>B1 (2)</p> <p>M1 A1 A1</p> <p>M1</p> <p>M1 A1 (6)</p> <p>(14 marks)</p>