

Question number	Scheme	Marks
<p>1. (a) (b)</p>	<p>Centre is (5, -3) Radius is 7</p>	<p>M1 A1 (2) M1 A1 (2) (4 marks)</p>
<p>2. (a) (b)</p>	<p>Uses $f(1) = 9, \Rightarrow a + b = 2$ (o.e) Uses $f(-2) = 0, \Rightarrow -8a + 4b = -28$ (o.e) $\therefore a = 3, b = -1$ (solves to find both values M1)</p>	<p>M1, A1 (2) M1, A1 M1 A1 cao (4) (6 marks)</p>
<p>3. (a) (b)</p>	<p>$\theta = -15^\circ, \theta = 345^\circ$ One of these... $\theta + 75 = 360 - "60"$ $\theta = 225, 345$ $(2\theta) = 44.4$ $(2\theta) = 135.6$ $(2\theta) = 404.4, 495.6$ $\theta = 22.2, 67.8, 202.2, 247.8$</p>	<p>B1 M1 A1 (3) B1 one more soln. B1 ft other 2 in range B1 ft $\div 2$ M1 A1 (5) (8 marks)</p>
<p>4. (a) (b)</p>	<p>$5 + 2x - x^2 = 2$ or $x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = -1, x = 3$ $\int (5 + 2x - x^2) dx = [5x + x^2 - \frac{1}{3}x^3]$ Using limits: $(15 + 9 - 9) - (-5 + 1 + \frac{1}{3})$ $(= 18\frac{2}{3})$ Shaded area = $18\frac{2}{3} - 8 = 10\frac{2}{3}$</p>	<p>M1 M1 A1 (3) M1 A1 M1 A1 M1 A1 (6) (9 marks)</p>
<p>5. (a) (b) (c) (d)</p>	<p>$r = 5.12 \div 6.4 = 0.8$ $a = 6.4 \div 0.64 = 10$ Sum to $\infty = a \div (1 - r) = 10 \div (1 - 0.8) = 50$ $S_{25} = 10(1 - 0.8^{25}) \div (1 - 0.8)$ $(= 49.8111)$ $50 - 49.8111 = 0.189$</p>	<p>M1 A1 (2) M1 A1 ft (2) M1 A1 (2) M1 A1 ft M1 A1 (4) (10 marks)</p>

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<p>6. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>$100 = 81 + 25 - (2 \times 9 \times 5 \cos BAC)$</p> <p>$\cos BAC = \frac{81+25-100}{90} (= \frac{1}{15}), BAC = 1.504 \text{ radians.}$ *</p> <p>$\frac{1}{2} r^2 \theta = \frac{1}{2} \times 9 \times 1.504 = 6.768 \text{ cm}^2 (6.77)$</p> <p>Area of triangle = $\frac{1}{2} \times 45 \times \sin 1.504$ (= 22.450 cm²)</p> <p>Shaded area = $22.450 - 6.768 = 15.682 \text{ cm}^2$ (15.68, 15.7)</p> <p>Arc length = $r\theta = 3 \times 1.504 (= 4.512 \text{ cm})$</p> <p>Perimeter = $10 + 6 + 2 + 4.512 = 22.512 \text{ cm} (22.51, 22.5)$</p>	<p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1 (2)</p> <p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>M1 A1 ft (4)</p> <p>(12 marks)</p>
<p>7. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<p>Area of $X = 2d^2 + \frac{1}{2} \pi d^2$, Area of $Y = \frac{1}{2} (4 d^2) \theta$</p> <p>Equate and divide by d^2: $2 + \frac{1}{2} \pi = 2\theta, \theta = 1 + \frac{1}{4} \pi.$ *</p> <p>$12 + 3\pi$</p> <p>$4d + r\theta, = 12 + 6 (1 + \frac{1}{4} \pi), = 18 + \frac{3}{2} \pi$</p> <p>$X: 12 + 3\pi = 21.425 \text{ cm}, \quad Y: 18 + \frac{3}{2} \pi = 22.712 \text{ cm}$</p> <p>Difference = 13 mm (or 12.9 mm) or 12.88 mm</p>	<p>B1, M1 A1</p> <p>M1 A1 (5)</p> <p>B1 B1 (2)</p> <p>M1, A1, A1, (3)</p> <p>M1 A1 (2)</p> <p>(12 marks)</p>

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8. (a)	$2x^2h = 1030,$ $h = \frac{515}{x^2}$	M1, A1 (2)
(b)	$A = 4x^2 + 6xh$ (or unsimplified version)	B1
	$A = 4x^2 + \frac{3090}{x}.$ *	M1 A1 (3)
(c)	$\frac{dA}{dx} = 8x - 3090x^{-2}$	M1 A1
	$8x - 3090x^{-2} = 0$	M1
	$x^3 = (386.25)$	M1
	$x = 7.283$ (7.28, 7.3)	A1 (5)
(d)	$A = 4 \times 7.28^2 + \frac{3090}{7.28}$	M1
	$= 636.4 \text{ cm}^2$	A1 (2)
(e)	Second derivative = $8 + 6180x^{-3}$	M1
	Correct deriv, $> 0,$ \therefore Min	A1 (2)
		(14 marks)