Question number	Scheme	Marks
1. (*a*)	*Complete* attempt at remainder theorem, or long division	
	Either $f(3) = 27 + 9a + 3b - 10 = 14$,	M1
	Or complete attempt at long division by (*x*-3) leading to equation.	
	Either $f(-1) = -1 + a - b - 10 = -18$ or long division by (*x*+1) leading to equation.	
	Equation equivalent to $9a + 3b = -3$ $(3a + b = -1)$	A1
	Equation equivalent to $a - b = -7$	A1
	Solve two equations to get $a = -2,\ b = 5$	M1, A1 (5)
(b)	Either $f(2) = 8 - 8 + 10 - 10 = 0$, Or complete division with no remainder.	M1,
	$\therefore (x-2)$ is a factor.	A1 cso
	Or $f(x) = (x-2)(x^2+5)$	(M1 A1) (2)
		(7 marks)
2. (a)	$1 + nax, + \frac{n(n-1)}{2}(ax)^2 + \frac{n(n-1)(n-2)}{6}(ax)^3 + \ldots$	
	accept 2!, 3!	B1, B1 (2)
(b)	$na = 8,\quad \frac{n(n-1)}{2}a^2 = 30$ both	M1
	$\frac{n(n-1)}{2}\cdot\frac{64}{n^2} = 30,\quad \frac{\frac{8}{a}\left(\frac{8}{a}-1\right)a^2}{2} = 30$	M1
	either	
	$n = 16,\quad a = \frac{1}{2}$	A1 A1 (4)
(c)	$\frac{16.15.14}{6}\cdot\left(\frac{1}{2}\right)^3 = 70$	M1 A1 (2)
		(8 marks)

Question number	Scheme	Marks
3. (*a*)	Attempting to get to a^6 = from 800 = $\dfrac{20000a^6}{4+a^6}$	M1
	$a^6 = \dfrac{3200}{1200}$	A1
	$a = \left(\dfrac{3200}{1200}\right)^{\frac{1}{6}} \rightarrow 1.1776$ (4 dp)	M1 A1 cao (4)
(b)	Substituting P = 1800 into formula with a^t as unknown	M1
	$a^t = 36 \rightarrow$, t = 22	A1, M1
	Number of years needed for p from 800 to 1800 = 16 years	A1 ft (4)
(c)	$P = \dfrac{2000}{1+4a^{-t}}$, $4a^{-t} \rightarrow 0$ as $t \rightarrow \infty$	
	So $P \rightarrow 2000$ but does not exceed it	B1 (1)
		(9 marks)
4. (a)	$2x^{\frac{3}{2}} - 3x^{-\frac{3}{2}} = 0$	M1
	$x^3 = \frac{3}{2}$	
	$x = \sqrt[3]{\frac{3}{2}}$ $x = \sqrt[3]{\alpha}$	M1
	= 1.1447… = 1.14 (3 sf)	A1 cao (3)
(*b*)	$f(x) = 4x^3 + 9x^{-3} - 12 + 5$ $A = 4$	B1
	$= 4x^3 + \dfrac{9}{x^3} - 7$ $B = 9$, $C = -7$	B1, B1 (3)
(*c*)	$\int_1^2 f(x)\ dx = \left[x^4 - \frac{9}{2}x^{-2} - 7x\right]_1^2$ $x^n \rightarrow x^{n+1}$	M1
		A2 ft (candidate's *A*,. *B*, *C*) (–1 eeoo)
	$= (2^4 - \frac{9}{2} \times 2^{-2} - 14) - (1 - \frac{9}{2} - 7)$ [2] – [1]	M1 (use of limits)
	$= 11\frac{3}{8}$ or 11.375	A1 (5)
		(11 marks)

Question number	Scheme	Marks
5. (a)	$BM = \sqrt{(7^2 + 24^2)} = 25$ (*)	B1 (1)
(b)	$\tan\alpha = \frac{7}{24}$ or equiv. and $\angle BMC = 2\alpha$, or cosine rule	M1 A1
	$\angle BMC = 0.568$ radians (*)	A1 (3)
(c)	ΔABM: $\frac{1}{2}(14 \times 24)$ (= 168 mm^2) (or other appropriate Δ)	B1
	Sector: $\frac{1}{2}(25^2 \times 0.568)$	M1 A1
	Total: "168 + 168 + 177.5" = 513 mm^2 (or 514, or 510)	M1 A1 (5)
(d)	Volume = "513" × 85 mm^3 (M requires unit conversion)	M1
	= 44 cm^3	A1 (2)
		(11 marks)
6. (a)	$5 + 2x - x^2 = 2$ or $x^2 - 2x - 3 = 0$	M1
	$(x-3)(x+1) = 0$ $x = -1$, $x = 3$	M1 A1 (3)
(b)	$\int (5 + 2x - x^2)\,dx = [5x + x^2 - \frac{1}{3}x^3]$	M1 A1
	Using limits: $(15 + 9 - 9) - (-5 + 1 + \frac{1}{3})$ $(18\frac{2}{3})$	M1 A1
	Shaded area = $18\frac{2}{3} - 8 = 10\frac{2}{3}$	M1 A1 (6)
		(9 marks)

Question number	Scheme	Marks
7. (a)	$\theta - 10 = 15$ $\theta = 25$ (cos($\theta - 10$) = $\cos\theta - \cos 10$, etc, is B0)	B1
	$\theta - 10 = 345$ $\theta = 355$ M: Using 360 – "15" (can be implied)	M1 A1 (3)
	Stating θ = 345 scores M1 A0	
	(Other methods: M1 for <u>complete</u> method, A1 for 25 and A1 for 355)	
(b)	$2\theta = 21.8\ldots$ (α) (At least 1 d.p.) (Could be implied by a correct θ).	B1
	$2\theta = \alpha + 180$ or $2\theta = \alpha + 360$ or $2\theta = \alpha + 540$ (One more solution)	M1
	$\theta = 10.9,\ 100.9,\ 190.9,\ 280.9$ (M1: divide by 2)	M1 A1ft A1 (5)
	(A1ft: 2 correct, ft their α) (A1: all 4 correct cao, at least 1 d .p.)	
(c)	$2\sin\theta\left(\dfrac{\sin\theta}{\cos\theta}\right) = 3$, $2\sin^2\theta = 3\cos\theta$	M1, A1
	$2(1-\cos^2\theta) = 3\cos\theta$	M1
	$2\cos^2\theta + 3\cos\theta - 2 = 0$	
	$(2\cos\theta - 1)(\cos\theta + 2) = 0$ $\cos\theta = \dfrac{1}{2}$	M1 A1
	(M: solve 3 term quadratic up to cos θ = … or x = …)	
	$\theta = 60$, $\theta = 300$	A1 (6)
		(14 marks)