Question number	Scheme	Marks
1.	Try to use remainder theorem i.e evaluate f($-\frac{1}{2}$) or f($+\frac{1}{2}$) Uses correct substitution to give $4(-\frac{1}{2})^3 + 3(-\frac{1}{2})^2 - (-\frac{1}{2}) - 6 = 4\frac{3}{4}$	M1 M1 A1 (3) **(3 marks)**
2.	**Either** Obtains centre (0, 6.5) f.t on $\frac{1}{a}$ Finds radius or diameter by Pythagoras Theorem, to obtain r = 2.5 or $r^2 = 6.25$ $x^2 + (y-6.5)^2 = 2.5^2$ or $x^2 + y^2 - 13y + 36 = 0$	B1 M1 A1 B1 (4)
	Or $\frac{y-8}{x+2} \times \frac{y-5}{x-2} = -1$ Gradients multiplied and put = to –1 $x^2 + y^2 - 13y + 36 = 0$	B1 M1 A1 B1 (4)
	Or Obtains centre (0, 6.5) $x^2 + (y-6.5)^2 = r^2$ or $x^2 + y^2 - 13y + c = 0$ substitutes either (2 , 5) or (-2 , 8) $x^2 + (y-6.5)^2 = 2.5^2$ or $x^2 + y^2 - 13y + 36 = 0$	B1 B1 M1 A1 (4) **(4 marks)**
3. (a)	f (–2) = $(-2)^3 - (19 \times -2) - 30$ M: Evaluate f (–2) or f (2) f (–2) = 0, so (x + 2) is a factor Alternative: $(x^3 - 19x - 30) \div (x+2) = (x^2 + ax + b)$, $a \neq 0, b \neq 0$ [M1] $= (x^2 - 2x - 15)$, so (x + 2) is a factor [A1]	M1 A1 (2)
(b)	$(x^3 - 19x - 30) = (x+2)(x^2 - 2x - 15)$ $= (x + 2)(x + 3)(x - 5)$	M1 A1 M1 A1 (4) **(6 marks)**

Question number	Scheme	Marks
4.	$\frac{3}{x(x+2)} + \frac{x-4}{(x+2)(x-2)}$	B1 B1
	$= \frac{3(x-2)+x(x-4)}{x(x+2)(x-2)}$	M1 A1
	$= \frac{(x-3)(x+2)}{x(x+2)(x-2)}$	M1 A1 A1 (7)
		(7 marks)
5.	$2\cos^2\theta - \cos\theta - 1 = 1 - \cos^2\theta$	M1
	$3\cos^2\theta - \cos\theta - 2 = 0$	A1
	$(3\cos\theta + 2)(\cos\theta - 1) = 0 \quad \cos\theta = -\frac{2}{3}$ or 1	M1 A1
	$\theta = 0 \qquad \theta = 131.8°$	B1 A1
	θ = (360 – "131.8")° = 228.2°	M1 A1 ft
		(8 marks)
6. (a)	$S = a + ar + ar^2 + \ldots + ar^{n-1}$	B1
	$rS = ar + ar^2 + \ldots + ar^n$	M1
	Subtract: $S(1-r) = a(1-r^n)$ $\qquad S = \frac{a(1-r^n)}{1-r}$	M1 A1 (4)
(b)	$ar = 3 \qquad ar^3 = 1.08$	B1 B1
	Divide: $r^2 = 0.36 \qquad r = 0.6$	M1 A1
	$a = 6 \div 1.2 = 5$	A1 (5)
(c)	$S = \frac{5}{1-0.6}$	M1 A1 ft
	$= 12.5$	A1 (3)
		(12 marks)

Question number		Scheme	Marks
7.	(a)	$l = (50 - 2x)$ $w = (40 - 2x)$	B1
		$V = x(50 - 2x)(40 - 2x)$ $V = xlw$	M1
		$V = x(2000 - 80x - 100x + 4x^2)$ = $4x(x^2 - 45x + 500)$ (*)	A1 cso (3)
	(b)	$0 < x < 20$ (accept ≤)	B1 (1)
	(c)	$\frac{dV}{dx} = 12x^2 - 360x + 2000$ (accept ÷ 4)	M1, A1
		$\frac{dV}{dx} = 0 \Rightarrow 3x^2 - 90x + 500 = 0 \Rightarrow x = \frac{90 \pm \sqrt{8100 - 6000}}{6}$	M1 (dV/dx = 0 & attempt to solve)
		$x = (22.6)$, required $x = 7.36$ or 7.4 or 7.362	A1 (4)
	(d)	$V_{max} = 4 \times 7.36(7.36^2\ldots)$, = 6564 or 6560 or 6600	M1, A1 (2)
	(e)	e.g. $V'' = 24x - 360 \big\vert_{x=7.36}$ (= −183…) < 0, ∴ maximum	M1 full method A1 full accuracy (2)
			(12 marks)
8.	(a)	$\frac{1}{2}r^2\theta = \frac{1}{2} \times 6.5^2 \times 0.8 = 16.9$ (a.w.r.t. if changed to degrees)	M1 A1 (2)
	(b)	$\sin 0.4 = \frac{x}{6.5}$, $x = 6.5 \sin 0.4$, (where x is half of AB) (n.b. 0.8 rad = 45.8°)	M1, A1
		$AB = 2x = 5.06$ (a.w.r.t.) (*)	A1 (3)
		Alternative: $AB^2 = 6.5^2 + 6.5^2 - 2 \times 6.5 \times 6.5 \cos 0.8$ [M1]	
		$AB = \sqrt{6.5^2 + 6.5^2 - 2 \times 6.5 \times 6.5 \cos 0.8}$ [A1]	
		AB = 5.06 [A1]	
	(c)	$r\theta + 5.06 = (6.5 \times 0.8) + 5.06 = 10.26$ (a.w.r.t) (or 10.3)	M1 A1 (2)
			(7 marks)

Question number	Scheme	Marks
7. (a)	$x + 1 = 6x - x^2 - 3$	M1
	$x^2 - 5x + 4 = 0$ $(x - 1)(x - 4)$ (or use of formula) $x =$	M1
	$x = 1$ $x = 4$	A1
	$y = 2$ $y = 5$	M1 A1 (5)
(b)	$\int (6x - x^2 - 3)\mathrm{d}x = 3x^2 - \frac{x^3}{3} - 3x$	M1 A1
	Limits x_A and x_B: $(48 - \frac{64}{3} - 12) - (3 - \frac{1}{3} - 3)$ (= 15)	M1 A1
	Trapezium: $\frac{1}{2}(2 + 5) \times 3 = 10.5$	B1 ft
	Area of R $15 - 10.5 = 4.5$	M1 A1 (7)
	Alternative for (b)	
	$(6x - x^2 - 3) - (x + 1) = 5x - x^2 - 4)$	M1 A1
	$\int (5x - x^2 - 4)\,\mathrm{d}x = \frac{5x^2}{2} - \frac{x^3}{2} - 4x$	M1 A1 ft
	Limits x_A and x_B: $(40 - \frac{64}{3} - 16) - (\frac{5}{2} - \frac{1}{3} - 4)$, $= 4.5$	M1 A1, A1 (7)
		(12 marks)