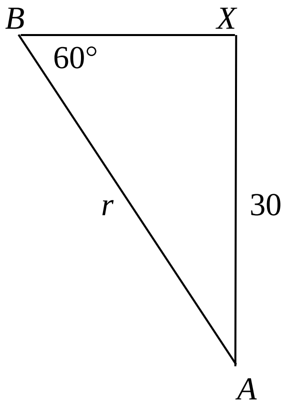
Question number	Scheme	Marks
1.	Try to use remainder theorem ie evaluate $f(-\frac{1}{2})$ or $f(+\frac{1}{2})$	M1
	Uses correct substitution to give	
	$4(-\frac{1}{2})^3 + 3(-\frac{1}{2})^2 - 2(-\frac{1}{2}) - 6 = -4\frac{3}{4}$	M1 A1
		(3 marks)
2. (a)	$\sin 2\theta \div \cos 2\theta = \tan 2\theta$, $\tan 2\theta = 0.5$ *	M1 (1)
(b)	$\tan 2\theta = 0.5$ $2\theta = 26.6°$	B1
	$2\theta = 206.6$, One more soln.	B1ft
	386.6, 566.6 other 2 solus in range	B1 ft
	$\theta = 13.3.\ 103.3.\ 193.3.\ 283.3$	M1 A1 (5)
		(6 marks)
3. (*a*)	$4^x = (2^x)^2 = u^2$ or $2^{(x+1)} = 2.2^x = 2u$, $\rightarrow u^2 - 2u - 15 (= 0)$	M1, A1 c.s.o (2)
(*b*)	$u^2 - 2u - 15 = (u-5)(u+3)$	M1, A1
	$u = 5 \Rightarrow 2^x = 5 \Rightarrow x = \frac{\log 5}{\log 2}$, = 2.32	M1, A1 (4)
	[Ignore any other solution]	**(6 marks)**
4. (*a*)	 $\sin 60° = \frac{3}{r}$ or $r = 2x$, $4x^2 = x^2 + 3^2$, $x = \sqrt{3}$	M1
	$r = \frac{6}{\sqrt{3}}$ or $r = 2\sqrt{3}$	A1 (2)
(*b*)	Area = $\frac{1}{2}r^2\theta^c$ or $\frac{\theta°}{360°} \times \pi r^2$ = , $\frac{1}{6} \times \pi \times 12 = 2\pi$ (cm^2)	M1, A1 (2)
	Arc = $r^2\theta^c$ or $\frac{\theta°}{360°} \times 2\pi r$ = , $\frac{1}{6} \times 2\pi \times 2\sqrt{3}$	M1
(c)	Perimeter = Arc + $2r$ = , $\frac{2\sqrt{3}}{3}\pi + 2 \times 2\sqrt{3} = \mathbf{\frac{2\sqrt{3}}{3}}(\pi + 6)$ (cm) (*)	M1, A1 cso (3)
		(7 marks)

Question number		Scheme	Marks
5.	(a)	$(x-3)^2 + (y-4)^2 = 18$	M1 A1 (2)
	(b)	Use $y = x + 3$ to obtain $(x-3)^2 + (x-1)^2 = 18$	M1
		And thus $2x^2 - 8x = 8$	A1
		Solve quadratic, to obtain $x = 2 \pm \sqrt{8}$, $y = 5 \pm \sqrt{8}$	M1, A1ft, A1ft (5)
	(c)	Distance = $\sqrt{((2\sqrt{8})^2 + (2\sqrt{8})^2}$ = 8	M1 A1 cso (2)
			(9 marks)
6.	(a)	$u_2 = 2p + 5$	B1
		$u_3 = p(2p + 5) + 5$	M1
		$8 = 2p^2 + 5\text{p} + 5$ or $2p^2 + 5p - 3 = 0$	
		$(2p - 1)(p + 3) = 0$	M1
		$P = -3$, or $\frac{1}{2}$	A1, B1 cso (5)
	(b)	$\log_2\left(\frac{1}{2}\right) = \log_2 2^{-1} = -1$	B1 (1)
	(c)	$\log_2\left(\frac{p^3}{\sqrt{q}}\right) = \log_2 p^3 - \log_2 \sqrt{q}$ Use of log a – log b	M1
		$= 3\log_2 p - \frac{1}{2}\log_2 q$ Use of log a^n	M1
		$= -3 - \frac{1}{2}t$ accept $3\log_2 p - \frac{1}{2}t$	A1 ft (3)
			(9 marks)

Question number		Scheme	Marks
7.	(a)	$x + 1 = 6x - x^2 - 3$	M1
		$x^2 - 5x + 4 = 0$ $\quad (x-1)(x-4)$	M1
		$x = 1 \quad x = 4$	A1
		$y = 2 \quad y = 5$	M1 A1 (5)
	(b)	$\int (6x - x^2 - 3)\,dx = 3x^2 - \frac{x^3}{3} - 3x$	M1 A1
		Limits x_A and x_B: $(48 - \frac{64}{3} - 12) - (3 - \frac{1}{3} - 3)$ $\quad (= 15)$	M1 A1
		Trapezium: $\frac{1}{2}(2 + 5) \times 3 = 10.5$	B1ft
		Area of $R = 15 - 10.5 = 4.5$	M1 A1 (7)
			(12 marks)
8.	(*a*)	$f(x) = \ldots + \binom{n}{2}\frac{x^2}{k^2} + \binom{n}{3}\frac{x^3}{k^3} \ldots$	M1
		$2 \times \frac{n(n-1)}{2k^2} = \frac{n(n-1)(n-2)}{6k^3}$	M1
		$\Rightarrow 6k = n - 2$ $\quad$ or $n = 6k + 2$ $\quad$ *	A1 c.s.o (3)
	(*b*)	$\frac{n(n-1)(n-2)(n-3)}{4!\quad k^4} = \frac{n(n-1)(n-2)(n-3)(n-4)}{5!\quad k^5}$, $\Rightarrow 5k = n - 4)$ (oe)	M1, A1
		Solving: $\quad 5k = 6k + 2 - 4, \Rightarrow k = 2$ and $n = 14$ $\quad$ *	M1, A1 cso (4)
	(*c*)	$(1 + \frac{x}{2})^{14} = 1 + 7x + \binom{14}{2}\frac{x^2}{4} + \binom{14}{3}\frac{x^3}{8} + \binom{14}{4}\frac{x^4}{16} + \binom{14}{5}\frac{x^5}{32} \ldots$	M1 (≥ correct)
		$= 1 + 7x, + \frac{91}{4}x^2 + \frac{91}{2}x^3, + \frac{1001}{16}x^4 + \frac{1001}{16}x^5 \ldots$	B1, A1, A1 (4)
			(11 marks)

Question number	Scheme	Marks
9. (*a*)	$l = (50 - 2x) \quad w = (40 - 2x)$	B1
	$V = x(50 - 2x)(40 - 2x)$ $\qquad V = xlw$	M1
	$V = x(2000 - 80x - 100x + 4x^2) \quad = \quad 4x(x^2 - 45x + 500)$ (*)	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. $V'' = 24x - 360 \big\|_{x = 7.36}$ $(= -183\ldots) < 0$, $\therefore$ maximum	M1 full method A1 full accuracy (2)
		(12 marks)