Question	Answer	Marks	Partial Marks
6(b)	Sum of three correct areas $4\pi + 12 + 3\sqrt{3}$ cao	**3**	**M2 FT** *their* $\frac{2\pi}{3}$ and *their* $2\sqrt{3}$ for sector *AOE*: $\frac{1}{2} \times (\textit{their}\ 2\sqrt{3})^2 \times \textit{their}\ \frac{2\pi}{3}$ oe or 4π **and** $\frac{1}{2} \times 6 \times 4$ or $2 \times \frac{1}{2} \times 3 \times \sqrt{3}$ oe or **M1 FT** *their* $\frac{2\pi}{3}$ and *their* $2\sqrt{3}$ for sector *AOE*: $\frac{1}{2} \times (\textit{their}\ 2\sqrt{3})^2 \times \textit{their}\ \frac{2\pi}{3}$ oe or 4π
7	Attempts product rule	**M1**	
	$\frac{dy}{dx} = 2\cos x - 2x\sin x$ oe	**A1**	
	When $x = \pi$, $\frac{dy}{dx} = -2$	**DM1**	**FT** *their* $\left.\frac{dy}{dx}\right\|_{x=\pi}$
	Gradient of normal: $\frac{1}{2}$	**M1**	**FT** $\frac{-1}{\textit{their}\left.\frac{dy}{dx}\right\|_{x=\pi}}$
	$y + 2\pi = \frac{1}{2}(x - \pi)$ oe	**A1**	**FT** *their* normal gradient
	$(5\pi, 0)$ or $(0, -\frac{5}{2}\pi)$ oe, soi	**A1**	
	Area of triangle *POQ*: $\frac{25}{4}\pi^2$ nfww	**A1**	
8(a)	$3t^2 + 2t - 1$	**B1**	
	$(3t - 1)(t + 1)$	**M1**	**FT** *their* 3-term quadratic in $t = 0$ soi
	$t = \frac{1}{3}$ and no other solutions	**A1**	
8(b)	At $t = 0$, $x = 8$ and $v = -1$	**B2**	**B1** for $t = 0$, $x = 8$ or $t = 0$, $v = -1$
	Conclusion: Since x is positive and v is negative [the particle is moving towards *O*.]	**B1**	

© Cambridge University Press & Assessment 2024

Question	Answer	Marks	Partial Marks
8(c)	$t = \frac{1}{3}$ $x = \frac{211}{27}$ or 7.814[814…] rot to 4 or more sf	**B1**	
	Distance $t = 0$ to $t = \frac{1}{3}$: $8 - \frac{211}{27}$ or $\frac{5}{27}$ or 0.1851[85…] rot to 4 or more sf **and** Distance $t = \frac{1}{3}$ to $t = 2$: $18 - \frac{211}{27}$ or $\frac{275}{27}$ or 10.18[51…] rot to 4 or more sf	**M2**	**M1** for distance $t = 0$ to $t = \frac{1}{3}$: $8 - \frac{211}{27}$ or $\frac{5}{27}$ or 0.1851[85…] rot to 4 or more sf or $t = \frac{1}{3}$ to $t = 2$: $18 - \frac{211}{27}$ or $\frac{275}{27}$ or 10.18[51…] rot to 4 or more sf
	Total: 10.4 or 10.37[037…] rot to 4 or more sf	**A1**	
9(a)(i)	$c = 12$	**B1**	
9(a)(ii)	$\frac{dy}{dx} = 2x - 8 = 0$ or $x^2 - 8x + c = (x - 4)^2 - 16 + c$	**M1**	
	$3 = -16 + c$ or $3 = 4^2 - 8\times4 + c$	**DM1**	
	$c = 19$	**A1**	
9(b)	$c > 16$	**B2**	**B1** for c * 16 where * is = or an incorrect inequality sign
10(a)	${}^7C_3 \times {}^8C_3 + {}^7C_4 \times {}^8C_2$	**M2**	**M1** for ${}^7C_3 \times {}^8C_3$ or ${}^7C_4 \times {}^8C_2$
	2940	**A1**	
10(b)	${}^6P_4 \times 3 \times 5$ oe	**M2**	**M1** for ${}^6P_4[\times 1]$ or ${}^6P_4 \times 3$ or ${}^6P_4 \times 5$ oe
	5400	**A1**	
11(a)(i)	Valid explanation e.g. The line $x = k$, where $-10 \leqslant k \leqslant 10$ cuts the curve in one point only	**B1**	
11(a)(ii)	$\frac{\frac{x}{x-1}}{\frac{x}{x-1} - 1}$	**M1**	
	Correct simplification to x	**A1**	