

2) $x = \frac{1}{t} \quad y = \sqrt{t}e^{-t}$

$$\frac{dx}{dt} = \frac{-1}{t^2} \quad \frac{dy}{dt} = \left[\frac{1}{2\sqrt{t}} \right] (e^{-t}) + (\sqrt{t})[-e^{-t}] = \frac{e^{-t}}{2\sqrt{t}} - \sqrt{t}e^{-t} = \frac{e^{-t} - 2te^{-t}}{2\sqrt{t}}$$

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{\left(\frac{e^{-t} - 2te^{-t}}{2\sqrt{t}} \right)}{\left(\frac{-1}{t^2} \right)} = \left(\frac{e^{-t} - 2te^{-t}}{2\sqrt{t}} \right) \left(\frac{-t^2}{1} \right) = \frac{2t^2\sqrt{t}e^{-t} - t\sqrt{t}e^{-t}}{2}$$

6) $x = \sin^3 \theta \quad y = \cos^3 \theta \quad \theta = \frac{\pi}{6}$

$$\frac{dx}{d\theta} = 3\sin^2 \theta \cos \theta \quad \frac{dy}{d\theta} = 3\cos^2 \theta (-\sin \theta) = -3\sin \theta \cos^2 \theta \quad \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{-3\sin \theta \cos^2 \theta}{3\sin^2 \theta \cos \theta} = \frac{-\cos \theta}{\sin \theta}$$

$$m = \frac{-\cos\left(\frac{\pi}{6}\right)}{\sin\left(\frac{\pi}{6}\right)} = \frac{-\left(\frac{\sqrt{3}}{2}\right)}{\left(\frac{1}{2}\right)} = -\sqrt{3} \quad x = \sin^3\left(\frac{\pi}{6}\right) = \left(\frac{1}{2}\right)^3 = \frac{1}{8} \quad y = \cos^3\left(\frac{\pi}{6}\right) = \left(\frac{\sqrt{3}}{2}\right)^3 = \frac{3\sqrt{3}}{8}$$

$$y - \frac{3\sqrt{3}}{8} = -\sqrt{3}\left(x - \frac{1}{8}\right) \Rightarrow y = -\sqrt{3}x + \frac{\sqrt{3}}{2}$$

10) $x = t^3 + 1 \quad y = t^2 - t$

$$\frac{dx}{dt} = 3t^2 \quad \frac{dy}{dt} = 2t - 1 \quad \frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2t - 1}{3t^2}$$

$$\frac{d}{dt}\left(\frac{dy}{dx}\right) = \frac{d}{dt}\left(\frac{2t - 1}{3t^2}\right) = \frac{[2](3t^2) - (2t - 1)[6t]}{(3t^2)^2} \Rightarrow \frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}} = \frac{\left(\frac{6t - 6t^2}{(3t^2)^2}\right)}{(3t^2)} = \frac{6t - 6t^2}{(3t^2)^3}$$

14) $x = t^3 - 3t \quad y = t^3 - 3t^2$

$$\frac{dx}{dt} = 3t^2 - 3 \quad \frac{dy}{dt} = 3t^2 - 6t$$

	$0 = 3t^2 - 6t$	$0 = 3t^2 - 3$
	$0 = 3t(t - 2)$	$0 = 3(t^2 - 1)$
Horizontal: $\frac{dy}{dt} = 0$	$3t = 0 \quad t - 2 = 0$	$0 = 3(t + 1)(t - 1)$
	$t = 0 \quad t = 2$	$t + 1 = 0 \quad t - 1 = 0$
		$t = -1 \quad t = 1$

Vertical: $\frac{dx}{dt} = 0$

