(5) $0 \le \rho \le 1, \quad 0 \le \theta \le 2\pi, \quad 0 \le \phi \le \pi/4$

(6) a). $\gamma'(t) = \langle 3\cos 3t, \; -3\sin 3t, \; 3t^{1/2} \rangle$.

Parametric equations for the tangent line at $t = \pi$:

$$\left(\begin{array}{l} \gamma(\pi) = \langle 0, -1, 2\pi^{3/2} \rangle \\ \gamma'(\pi) = \langle -3, 0, 3\pi^{1/2} \rangle \end{array} \right) \qquad \begin{array}{l} x = -3t \\ y = -1 \\ z = 2\pi^{3/2} + t \; 3\pi^{1/2} \end{array}$$

(8) $\gamma(t) = \left\langle \dfrac{2}{1+t^2} - 1, \; \dfrac{2t}{1+t^2} \right\rangle = \left\langle \dfrac{1-t^2}{1+t^2}, \dfrac{2t}{1+t^2} \right\rangle$

Arc length parametrization: $\quad$ * $(1,0)$ corresponds to $t=0$

$$S = s(t) = \int_0^t \|\gamma'(u)\| \, du = \int_0^t \frac{2}{1+u^2} \, du = 2\tan^{-1} t$$

$(= 2\arctan t)$

$$s = 2\tan^{-1} t \Rightarrow \tan\left(\frac{s}{2}\right) = t = t(s)$$

$$\therefore \gamma(t(s)) = \left\langle \frac{2}{1+\tan^2\left(\frac{s}{2}\right)} - 1, \; \frac{2\tan(s/2)}{1+\tan^2\left(\frac{s}{2}\right)} \right\rangle$$

$$= \left\langle \frac{2}{\sec^2\left(\frac{s}{2}\right)} - 1, \; \frac{2\tan(s/2)}{\sec^2(s/2)} \right\rangle = \langle \cos s, \sin s \rangle$$

the unit circle !