D.N.

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$$\vec{p}(t) = (e^t \cos t,\ e^t \sin t,\ e^t) \qquad 0 \le t \le \infty$$

$$s(t) = \int_0^t \|\dot{\vec{p}}(\tau)\|\, d\tau = \int_0^t \sqrt{3} e^{\tau}\, d\tau = \sqrt{3}\, e^{\tau}\Big|_0^t = \sqrt{3}\,(e^t - 1)$$

$$\dot{\vec{p}}(t) = (e^t \cos t - e^t \sin t,\ e^t \sin t + e^t \cos t,\ e^t)$$

$$\| \quad = e^t (\cos t - \sin t,\ \sin t + \cos t,\ 1)$$

$$\Rightarrow \|\dot{\vec{p}}(t)\| = e^t \sqrt{(\cos t - \sin t)^2 + (\sin t + \cos t)^2 + 1}$$

$$= e^t \sqrt{\cos^2 t - \cancel{2\sin t \cos t} + \sin^2 t + \sin^2 t + \cancel{2 \sin t \cos t} + \cos^2 t + 1}$$

$$= e^t \sqrt{3}$$

$$s(t) = \sqrt{3}(e^t - 1)$$

$$\frac{s}{\sqrt{3}} = e^t - 1$$

$$e^t = \frac{s}{\sqrt{3}} + 1$$

$$t = \ln\left(1 + \frac{s}{\sqrt{3}}\right)$$

$$\vec{p}(s) = \left(\left(\frac{s}{\sqrt{3}} + 1\right) \cos\left(\ln\left(1 + \frac{s}{\sqrt{3}}\right)\right),\ \left(\frac{s}{\sqrt{3}} + 1\right) \sin\left(\ln\left(1 + \frac{s}{\sqrt{3}}\right)\right),\ \frac{s}{\sqrt{3}} + 1\right)$$

$$= \boxed{\left(\frac{s}{\sqrt{3}} + 1\right)\left(\cos\left(\ln\left(1 + \frac{s}{\sqrt{3}}\right)\right),\ \sin\left(\ln\left(1 + \frac{s}{\sqrt{3}}\right)\right),\ 1\right)}$$