1. Consider the parametric curve given by:

$$\vec{x}(t) = \begin{pmatrix} e^t \cos t \\ e^t \sin t \\ e^t \end{pmatrix}$$

   (a) Find the unit tangent, normal, and binormal vectors.

   (b) Find the curvature κ and the curvature vector.

   (c) Find the arc length from $t = 0$ to $t = \pi$.

   (d) Parametrize the line that is tangent to $\vec{x}(t)$ at the point t_0.

   (e) Find the point where the above tangent line intersects the xy plane. Let $\vec{y}(t_0)$ be the position vector for this point. As t_0 varies, sketch the curve that $\vec{y}(t_0)$ traces.

   (f) Find the equation of the osculating plane for $\vec{x}(t)$ at t_0.