(1) Let $\gamma : (-1, 1) \to \mathbb{R}^3$ be defined by
\[
\gamma(t) = \left( \frac{(1 + t)^{3/2}}{3}, \frac{(1 - t)^{3/2}}{3}, t \sqrt{2} \right)
\]
Show that $\gamma$ is unit speed. Compute the tangent vector $T(t)$, principal normal vector $N(t)$, and binormal vector $B(t)$. Also compute their derivatives with respect to $t$.

(2) Show that for unit speed curve $\gamma : I \to \mathbb{R}^3$, the torsion is given by
\[
\tau = \frac{(\dot{\gamma} \times \ddot{\gamma}) \cdot \dddot{\gamma}}{\kappa^2}
\]
where $\kappa(t)$ is the curvature.

(3) Let $\gamma : I \to \mathbb{R}^2$ be a plane curve (any parametrization), with $\kappa_s(t) \neq 0$ for all $t \in I$. Define the evolute of $\gamma$ to be the curve
\[
\beta(t) = \gamma(t) + \frac{1}{\kappa_s(t)} N(t)
\]
(a) Show that the tangent to the evolute is normal to $\gamma$.
(b) Show the point of intersection to the normal lines to $\gamma$ at $t_0$ and $t$, $t \neq t_0$, converge at $t \to t_0$ to a point on the evolute.