Calc 3: Assignment # 10

(1) Show that $\frac{d}{dt}\left(\vec{r}(t) \times \vec{r}'(t)\right) = \vec{r}(t) \times \vec{r}''(t)$

(2) Find the unit tangent, the normal, and the curvature:

a) $\vec{r}(t) = \langle t^2, \sin(t) - t\cos(t), \cos(t) + t\sin(t) \rangle$, $t > 0$

b) $\vec{r}(t) = \langle t, \frac{1}{2}t^2, t^3 \rangle$

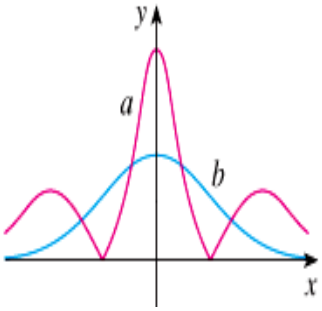
(3) Find the curvature:

a) $\vec{r}(t) = (t, t, 1+t^2)$

b) $\vec{r}(t) = \langle e^t\cos(t), e^t\sin(t), t \rangle$

(4) Find a formula for the curvature of a function $y = f(x)$. Hint: write the function in parametric form, then embed in $\mathbb{R}^3$. Then compute the curvature using cross products.

(5) Which of the following curves is the original function $f(x)$, which is its curvature as a function:



(6) Find the vectors T, N, and B for:

a) $\vec{r}(t) = \langle t^2, \frac{2}{3}t^3, t \rangle$ at $(1, \frac{2}{3}, 1)$

b) $\vec{r}(t) = \langle \cos(t), \sin(t), \ln(\cos(t)) \rangle$ at $(1, 0, 0)$