Calculus III (Math 241)

W1. Prove the product rule for differentiating cross products,

$$\frac{d}{dt}\big(\mathbf{u}(t)\times\mathbf{v}(t)\big)=\mathbf{u}'(t)\times\mathbf{v}(t)+\mathbf{u}(t)\times\mathbf{v}'(t),$$

by working directly with the corresponding coordinate functions and using results from Calculus I.

W2. Find parametric equations for the tangent line to the curve with the given parametric equations at the specified point.

$$x=\ln(t+1),\quad y=t\cos(2t),\quad z=2^t;\quad (0,0,1)$$

W3. Suppose you start at the point $(0,0,3)$ and move 5 units along the curve $x=3\sin t$, $y=4t$, $z=3\cos t$ in the positive direction. Where are you now?

W4. Find equations of the osculating circles of the ellipse $9x^2+4y^2=36$ at the points $(2,0)$ and $(0,3)$. Use a graphing calculator or computer to graph the ellipse and both osculating circles on the same screen.

W5. Show that the osculating plane at every point on the curve

$$\mathbf{r}(t)=\langle t+2,1-t,\tfrac{1}{2}t^2\rangle$$

is the same plane. What can you conclude about the curve?