

Calculus III  
Math 241-002  
Fall 2025  
Quiz 3

Name Solution

Find the parametric equations of a line tangent to the curve

$$\mathbf{r}(t) = 2\sqrt{3t} \mathbf{i} + e^{t^2-9} \mathbf{j} + \sin(t-3) \mathbf{k}$$

at the point (6, 1, 0) and find the unit tangent vector  $\mathbf{T}(t)$  at the given point.

$$\vec{r}'(t) = \frac{3}{\sqrt{3t}} \hat{i} + 2te^{t^2-9} \hat{j} + \cos(t-3) \hat{k}$$

$$\vec{r}(t) = 6\hat{i} + \hat{j} \Rightarrow 2\sqrt{3t} = 6 \Rightarrow t = 3$$

$$\vec{r}'(3) = \hat{i} + 6\hat{j} + \hat{k}$$

$$x = 6 + t$$

$$y = 1 + 6t$$

$$z = t$$

$$\hat{T}(3) = \frac{\vec{r}'(3)}{|\vec{r}'(3)|} = \frac{\langle 1, 6, 1 \rangle}{\sqrt{1+36+1}} = \left\langle \frac{1}{\sqrt{38}}, \frac{6}{\sqrt{38}}, \frac{1}{\sqrt{38}} \right\rangle$$