Name:

1. Find an equation for the tangent line of the curve $\mathbf{r}(t) = \sin(2t)\mathbf{i} + e^{-t}\mathbf{j}$ at $t = 0$.

2. Sketch the domain of $f(x, y) = \ln(9 - x^2 - y^2)$.

3. Consider the function
$$f(x, y) = \frac{xy}{3x^2 + y^2}.$$

- Is $(0, 0)$ in the domain of this function? Why or why not?

- What is the value of this function along the line $y = x$?

- What is the value of this function along the line $y = 0$?

- Either compute $\lim\limits_{(x,y) \to (0,0)} f(x, y)$ or explain clearly why this limit doesn't exist.