

1. **(5 points)** Evaluate the limit $\lim_{(x,y) \rightarrow (0,0)} \frac{2x^2y}{x^2+y^2}$ or demonstrate that it does not exist.

2. **(5 points)** Given the trajectory $\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j} + 3t\mathbf{k}$, identify the tangential and normal components of the acceleration vector when $t = 2$.

3. **(5 points)** Let $u = xy \cos(yz) - xz^3$. Calculate $\frac{\partial u}{\partial x}$, $\frac{\partial u}{\partial y}$, and $\frac{\partial u}{\partial z}$.

4. **(5 points)** Find the equation of the tangent plane to the curve $z = 2x^2 - 3xy$ at $(2, -1, 14)$.

5. **(2 point bonus)** For functions $f(x, y)$ and $g(x, y)$ and a point (a, b) such that $f(a, b) = g(a, b) = 0$ but $g_x(a, b) \neq 0$ and $g_y(a, b) \neq 0$, prove that $\lim_{(x,y) \rightarrow (a,b)} \frac{f(x,y)}{g(x,y)}$ exists only if $f_x(a, b)g_y(a, b) = f_y(a, b)g_x(a, b)$.