

Calculus III Review Three

1. Prove that the limit $\lim_{(x,y) \rightarrow (0,0)} \frac{y^2 - \sin(x)}{x + y^2}$ does not exist.
2. Suppose $P = \sqrt{u^2 + v^2 + w^2}$, $u = xe^y$, $v = ye^x$, and $w = e^{xy}$. Find $\frac{\partial P}{\partial y}$ when $x = 0$ and $y = 2$.
3. Find $D_{\mathbf{u}}f(1, 2)$, where $f(x, y) = y^2/x$, and $\mathbf{u} = \langle \frac{3}{5}, \frac{4}{5} \rangle$.
4. Find the tangent plane to the surface $xy + yz + zx = 5$ at $(1, 2, 1)$.
5. Find all local extrema and saddle points of $f(x, y) = xy - 2x - 2y - x^2 - y^2$.
6. Find the maximum and minimum values of $f(x, y) = 3x + y$, subject to the constraint $x^2 + y^2 = 10$.