

3. If $z = e^y \sin(x)$, where $x = st$ and $y = se^t$. Using the chain rule, find $\frac{\partial z}{\partial s}$ when $s = 0$ and $t = 1$.

4. Consider the function $f(x, y) = e^{2xy} + y \cos(x)$.

(a) Find the tangent plane to $f(x, y)$ at the point $(0, 1, 1)$.

5. Find $\frac{\partial z}{\partial x}$ for $z^2 - xyz = 0$. You can use any method.

6. Let $f(x, y) = x^2y^2 + xy - 1$.

(a) Find the gradient of f .

(b) Find the rate of change of f in the direction of $\vec{v} = \langle 3, 4 \rangle$ at the point $P(1, 0, -1)$.

(c) What is the max rate of change at $P(1, 0, -1)$? And in what direction?

7. Find the local maximum, local minimum, and saddle points of the function $f(x, y) = x^3 - y^2 - xy$.