

Section 14.6: Additional Problems

1. If $f(x, y) = x^4 + 4x^3y - y^3$, find the gradient of f and evaluate the gradient at the point $P(1, 2)$
2. Given $g(x, y, z) = x^2 + 4yz^3 + 2x^4z + z^2$.
 - (a) Find the gradient vector at $(3, 2, 1)$.
 - (b) Find the directional derivative at $(3, 2, 1)$, in the direction of $\langle 4, 4, 2 \rangle$.
 - (c) Find the maximum value of the directional derivative at $(3, 2, 1)$.
 - (d) Find the direction of greatest decrease at $(3, 2, 1)$.
3. Consider the surface given by $x^2 + 2y^2 + z^3 = 10$. Find an equation for the tangent plane and the equation for the normal line to the surface at the point $(1, 1, 2)$.
4. Find all points at which the direction of fastest change of the function $f(x, y)$ is $\mathbf{i} + \mathbf{j}$.

$$f(x, y) = x^2 + y^2 - 2x - 6y$$