Assignment 5

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1. Find the Directional derivative of the function $f(x, y) = x^3y - 2x^2y^2$ in the direction of the vector $\vec{v} = \hat{\imath} + 2\hat{\jmath}$ at the point $P(1, 1)$.

2. Find $\frac{\partial z}{\partial z}$ and $\frac{\partial z}{\partial y}$ for $x^2 - y^2 + z^2 - 2z = 4$

   Solution

   $$\frac{\partial}{\partial x}(x^2 - y^2 + z^2 - 2z) = \frac{\partial}{\partial x}(4) \qquad \frac{\partial}{\partial y}(x^2 - y^2 + z^2 - 2z) = \frac{\partial}{\partial y}(4)$$
   $$2x - 0 + 2z\frac{\partial z}{\partial x} - 2\frac{\partial z}{\partial x} = 0 \qquad 0 - 2y + 2z\frac{\partial z}{\partial y} - 2\frac{\partial z}{\partial y} = 0$$
   $$\frac{\partial z}{\partial x}(2z - 2) = -2x \qquad \frac{\partial z}{\partial y}(2z - 2) = 2y$$
   $$\frac{\partial z}{\partial x} = -\frac{x}{z - 1} \qquad \frac{\partial z}{\partial y} = \frac{y}{z - 1}$$

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