

## Q5.4

Find partial derivative of the function:

$$\begin{aligned} a) \quad f(x, y) &= x^2 + 4y^2 - 2xy + 2x - 6y + 5 \\ \frac{\partial f}{\partial x} &= 2x - 2y + 2 \\ \frac{\partial f}{\partial y} &= 8y - 2x - 6 \end{aligned}$$

---

$$\begin{aligned} b) \quad f(x, y) &= \frac{1}{x^2 + y^2 + 1} \\ \text{Set } u &= x^2 + y^2 + 1 \Rightarrow f(x, y) = \frac{1}{u} \\ \frac{\partial f}{\partial x} &= \frac{\partial f}{\partial u} \frac{\partial u}{\partial x} = \frac{-1}{u^2} * 2x = \frac{-2x}{(x^2 + y^2 + 1)^2} \\ \frac{\partial f}{\partial y} &= \frac{\partial f}{\partial u} \frac{\partial u}{\partial y} = \frac{-1}{u^2} * 2y = \frac{-2y}{(x^2 + y^2 + 1)^2} \end{aligned}$$

---

$$\begin{aligned} c) \quad f(x) &= x_1^2 + x_1x_2x_3 - 3x_2x_1 + x_3^2, x \in R^3 \\ \frac{\partial f}{\partial x_1} &= 2x_1 + x_2x_3 - 3x_2 \\ \frac{\partial f}{\partial x_2} &= x_1x_3 - 3x_1 \\ \frac{\partial f}{\partial x_3} &= x_1x_2 + 2x_3 \end{aligned}$$