

$$df(x, y, z) = \frac{\partial}{\partial x} f(x, y, z) dx + \frac{\partial}{\partial y} f(x, y, z) dy + \frac{\partial}{\partial z} f(x, y, z) dz$$

$$\frac{\partial}{\partial x} f(x, y, z) = y^2 - 6zx, \quad \frac{\partial}{\partial y} f(x, y, z) = 2xy + z^2, \quad \frac{\partial}{\partial z} f(x, y, z) = -3x^2 + 2yz$$

$$df(x, y, z) = (y^2 - 6zx) dx + (2xy + z^2) dy + (-3x^2 + 2yz) dz$$