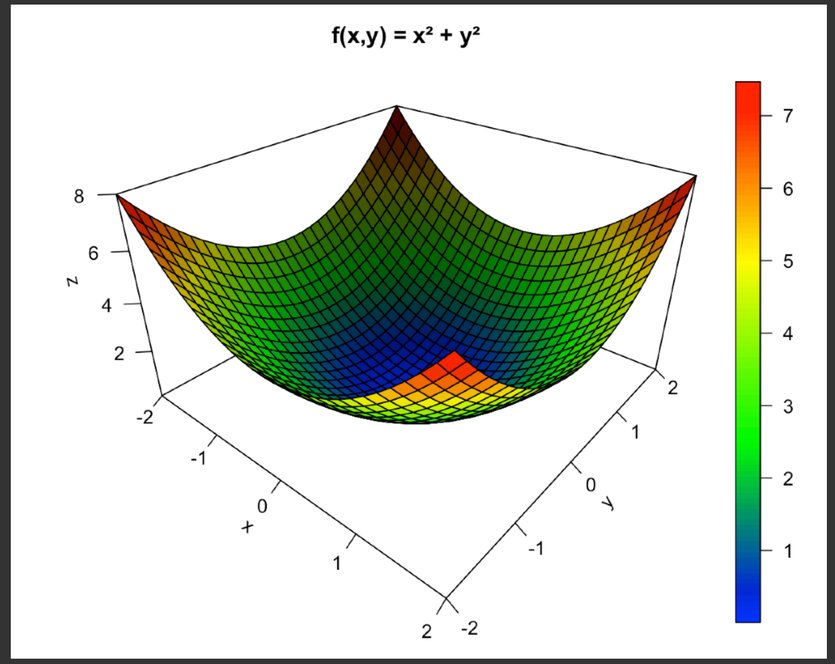
gradient

The gradient captures all the partial derivative information of a multivariable function.

example

For $f(x, y) = x^2 + y^2$, the gradient is:

$$\nabla f = \left(\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} \right) = (2x, 2y)$$



gradient

$$f(x, y) = x^2 + y^2 \implies \nabla f = \begin{bmatrix} \frac{\partial f}{\partial x} \\ \frac{\partial f}{\partial y} \end{bmatrix} = \begin{bmatrix} 2x \\ 2y \end{bmatrix}$$

directional derivatives

$$\nabla_{\vec{v}} f(\vec{a}) = \lim_{h \to \infty} \frac{f(\vec{a} + h \cdot \vec{v}) - f(\vec{a})}{h}$$