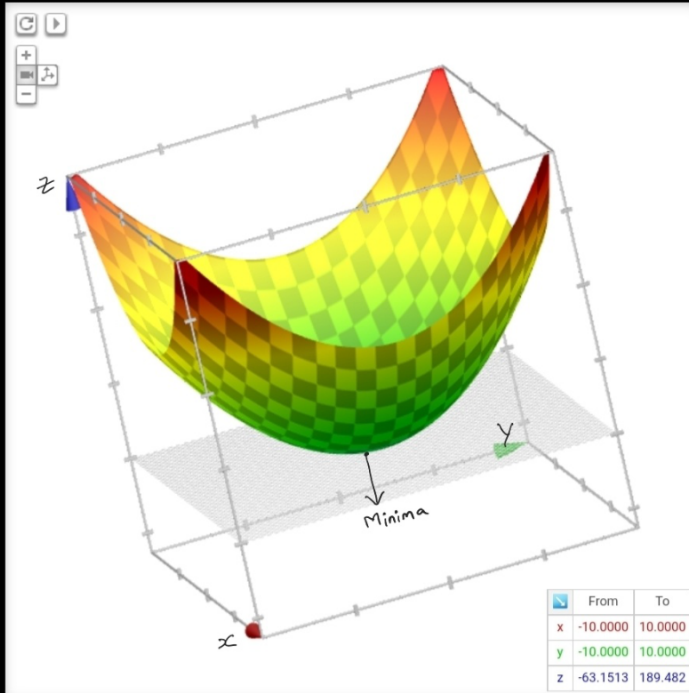


# Partial derivatives & Del

In ML it is very common to see multi-variant functions as shown below

$$\Rightarrow z = f(x, y) = x^2 + y^2$$

Graph of  $f(x, y)$  looks as follows



Now in order to find minima of  $f(x, y)$  first we need to find  $f'(x, y)$

→ In order to solve this we should be aware of multi-variant calculus

$$z = f(x, y) = (x^2 + y^2)$$

$$f'(x, y) = ?$$

$$\Rightarrow \nabla z = \begin{bmatrix} \frac{\partial z}{\partial x} \\ \frac{\partial z}{\partial y} \end{bmatrix}$$

DEL (pointing to  $\nabla$ )

Partial derivative (pointing to the derivatives in the vector)

How to compute this? (pointing down)

$$\Rightarrow \nabla z = \begin{bmatrix} 2x + 0 \\ 0 + 2y \end{bmatrix} = \begin{bmatrix} 2x \\ 2y \end{bmatrix}$$

Rate of change  
w.r.t  $y$

Rate of change  
w.r.t  $x$

$$\frac{\partial z}{\partial x} : \frac{dz}{dx} \text{ with } y \text{ as const.}$$

$$\frac{\partial z}{\partial y} : \frac{dz}{dy} \text{ with } x \text{ as const.}$$