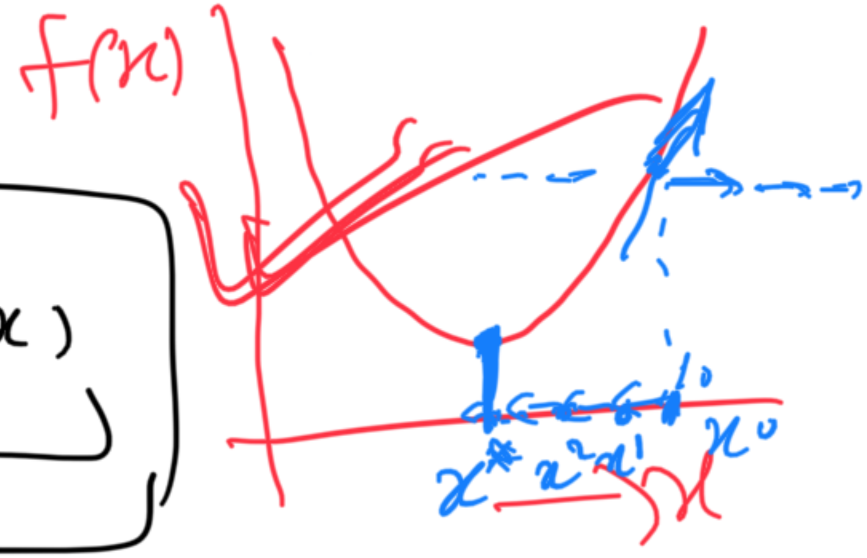
Optimization

$$\boxed{\underset{x}{\text{minimize}} \quad \underbrace{f(x)}}$$

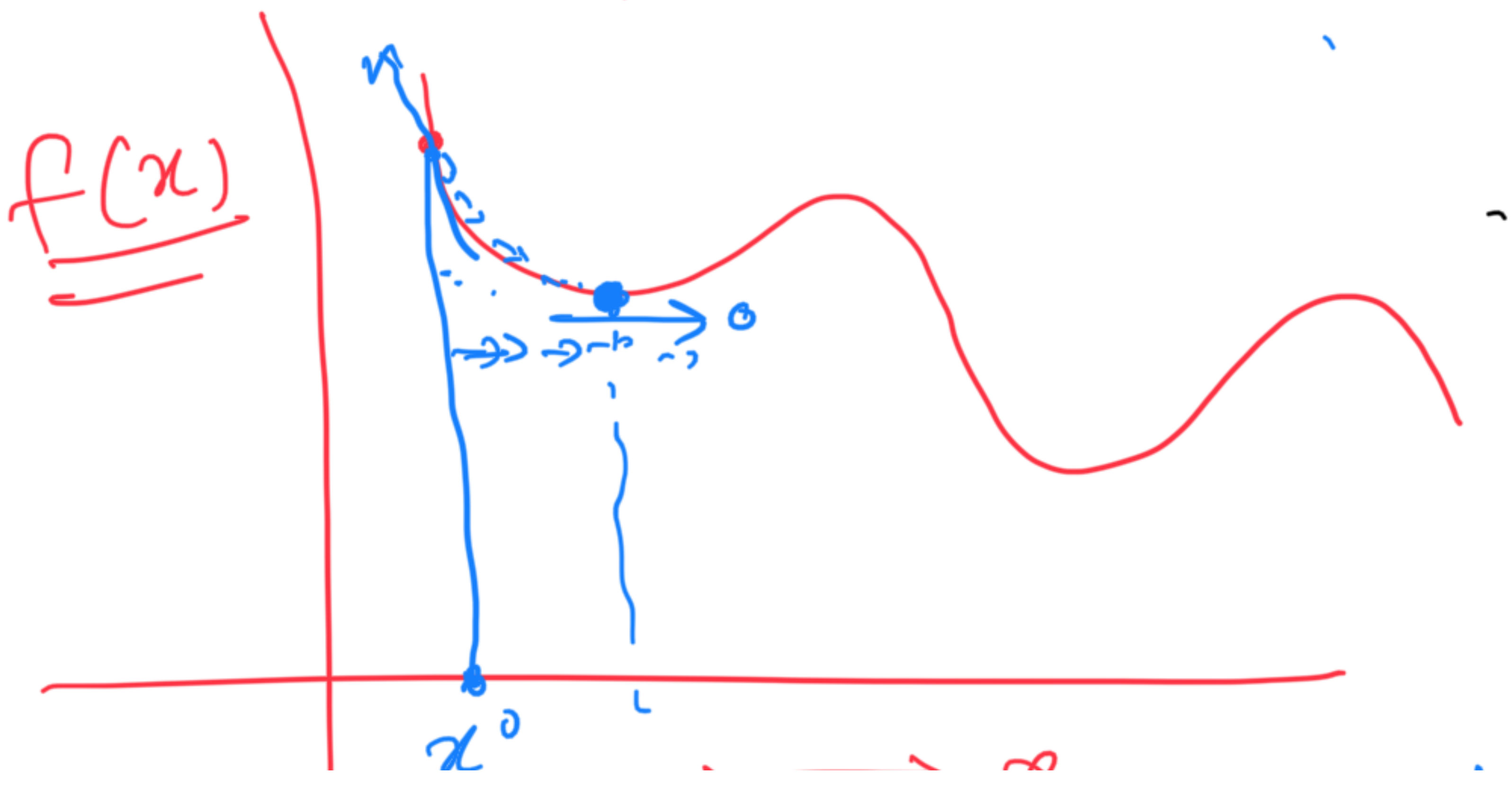


$$x^t = x^{t-1} - \eta \frac{\partial f}{\partial x^{t-1}}$$

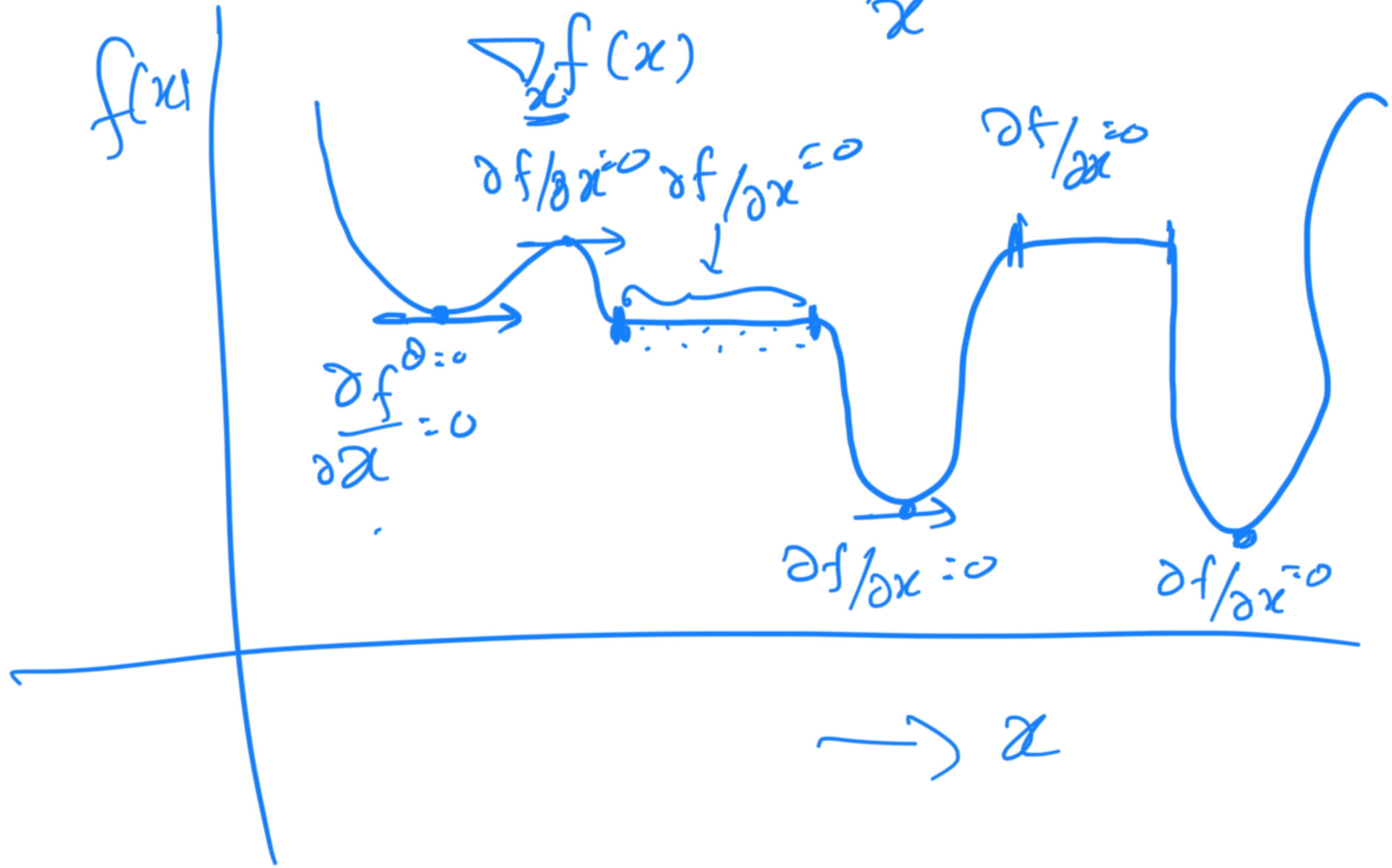
f : convex on

Local & Global Minima are same

non. Convex f^n



$\nabla_{x^{t-1}} f(x)$



$x^0 = \text{random}(\qquad)$

$$x^1 = x^0 - \eta \cdot \nabla_{x^0} f(x)$$

$$x^2 = x^1 - \eta \cdot \nabla_{x^1} f(x)$$

$$\vdots$$

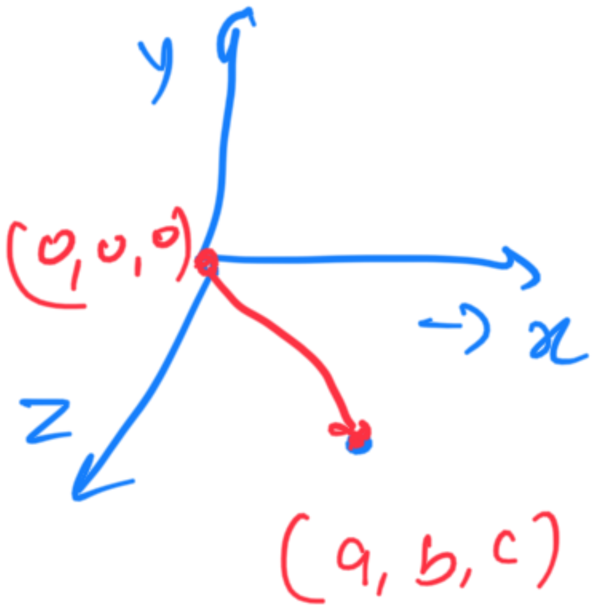
$$x^t = x^{t-1} - \eta \cdot \underbrace{\nabla_{x^{t-1}} f(x)}_{\simeq 0}$$

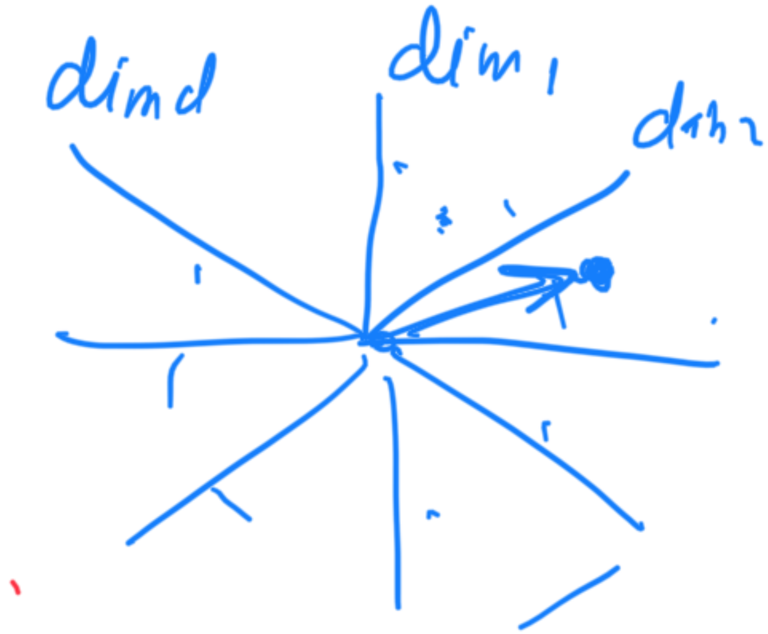
$$\begin{cases} \left| f(x^t) - f(x^{t-1}) \right| \leq 10^{-12} \\ \left\| \nabla_{x^t} f(x) \right\| \simeq 0 \end{cases}$$

x

$x = \langle x_1, x_2 \rangle$ $\qquad$ $\underline{f([x_1, x_2])}$

$$\Delta_x f(x) = \left[\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial x_2}\right]$$





$f(x)$

$x = [x_1, x_2 \cdots x_d]$

$$\left[\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial x_2}, \cdots \frac{\partial f}{\partial x_d}\right]$$

$$\nabla_x f(x) = [\nabla_{x_1} f(x), \nabla_{x_2} f(x), \quad]$$

$$\|\nabla_x f(x)\|_2 = \sqrt{\underbrace{\left(\frac{\partial f}{\partial x_1}\right)^2}_{\rightarrow 0} + \underbrace{\left(\frac{\partial f}{\partial x_2}\right)^2}_{\rightarrow 0} + \underbrace{\left(\frac{\partial f}{\partial x_d}\right)^2}_{- 0}}$$