W.K.T

Error = Y' (Predicted) − Y (Actual)

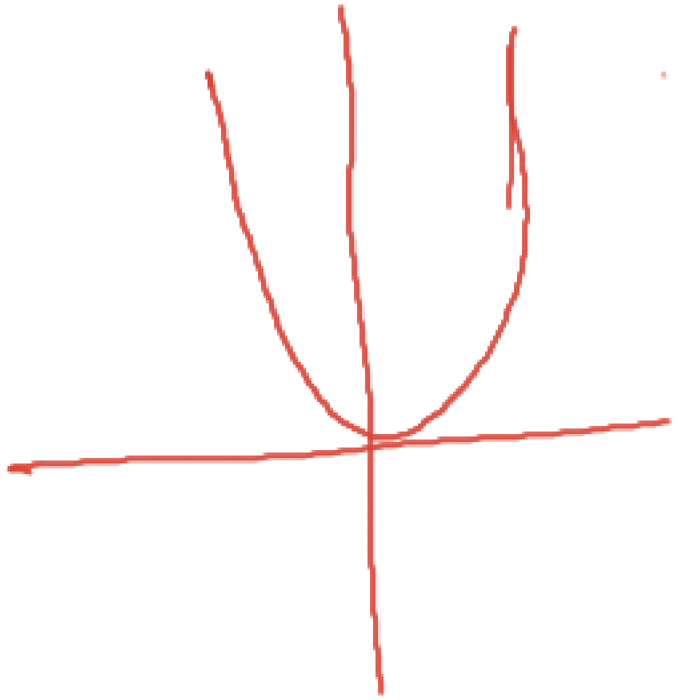
Loss function ⇒ Error Calculated for single datapoint.

Cost function ⇒ Average of Errors Calculated for whole training dataset.

$$\text{Cost} = \frac{1}{N} \sum_{i=1}^{N} (y' - y)^2$$

$N \rightarrow$ Data points — Squaring to Eliminate negative values

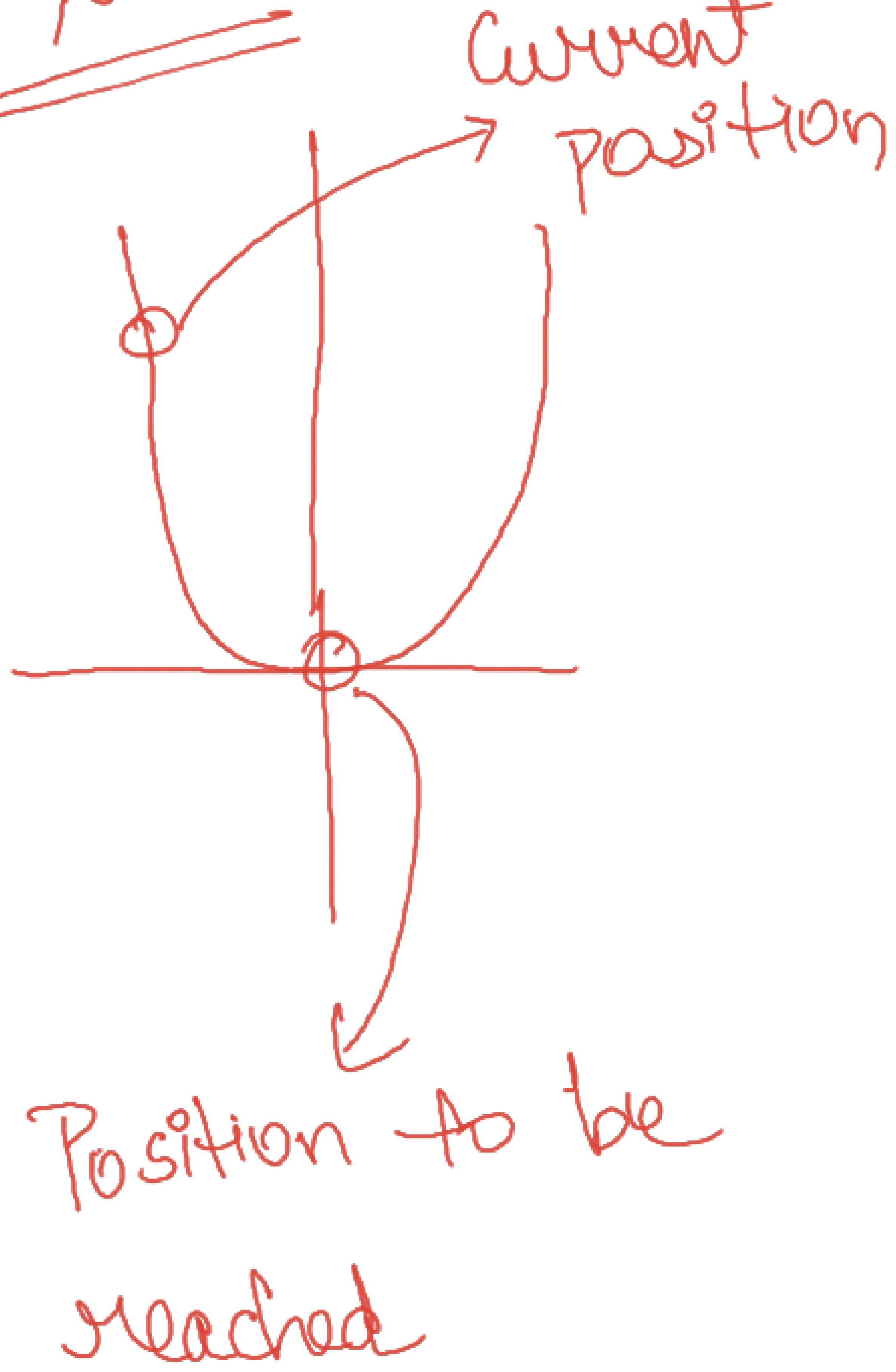
Objective - visually



$y = x^2$

To find the value of x that gives lowest y value.

Needs



Find

→ Which direction to move

→ How much big step to be taken in the direction.

Eg $y = mx + c$

m ↓ direction

c ↳ Size of Step

Cautions

If Slope = Large → take big steps
Slope = Small → Take Small steps

Steps Taken } = Learning rate
- Big — overshooting
- Small — Time will increase.

updations to be made at each step

Eq

$$y = mx + b$$

$\delta \rightarrow$ Small change

$$m = m - \delta m$$

$$b = b - \delta b$$

Maths Needed

- Power rule (univariate)
- Chain rule (Multivariate)

Power Rule

Eg of function $\rightarrow f(x) = x^n$

$\downarrow$

$$\frac{\partial f(x)}{x} = nx^{n-1}$$

Chain Rule

Eg

$$Z \xrightarrow{\text{depends}} X$$

$$Y \xrightarrow[\text{depends}]{} Z$$

$$\frac{\partial z}{\partial x} = \frac{\partial z}{\partial y} \cdot \frac{\partial y}{\partial z}$$

Sample

$y = x^2$, $x = z^2$

$$\frac{\partial y}{\partial x} = 2x$$

$$\frac{\partial x}{\partial z} = 2z$$

$$\frac{\partial y}{\partial z} = 2x \cdot 2z$$

So Let's take $y = mx + b \rightarrow (1)$

To update (m, b)

$b \rightarrow$ bias

$m \rightarrow$ weight

$$\therefore K_{(m,b)} = \frac{1}{N} \sum_{i=1}^{N} (\text{Error})^2$$

$$\frac{\partial K}{\partial m} = 2 * \text{Error} * \frac{\partial}{\partial m}(\text{Error}) \longrightarrow 2$$

$$\frac{\partial K}{\partial b} = 2 * \text{Error} * \frac{\partial}{\partial b}(\text{Error}) \longrightarrow 3$$

Calc on 2

$$\frac{\partial}{\partial m} Error = \frac{\partial}{\partial m}(y' - y)$$

$$= \frac{\partial}{\partial m}(\underline{m}x + b - y)$$

Constant

$$\boxed{\frac{\partial}{\partial m} Error = x}$$

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Calc on 3

$$\frac{\partial}{\partial b} Error = \frac{\partial}{\partial b}(y' - y)$$

$$\frac{\partial}{\partial b} Error = \frac{\partial}{\partial b}(mx + \underline{b} - y)$$

constant

$$\boxed{\frac{\partial}{\partial b} Error = 1}$$

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$$m' = m_0 - \text{Error} * X * LR$$

m from 1   4

$$b' = b_0 - \text{Error} * 1 * LR$$

b from 1   5

Error – Direction

LR – How big Step

next Evolution

m' – Direction

b' – How big step

$y' = m'x + b'$ → New update

→ Iterate it until

minima Or lowest

cost function

is found.