⟨Goal of the cost function⟩

① Model : $f_{w,b}(X) = WX + b$

② Parameters : W, b

③ cost function : $J(w,b) = \frac{1}{2m} \sum_{i=1}^{m} (f_{w,b}(x^{(i)}) - y^{(i)})^2$ ⇒ To find out the optimal W, b for training data $= \underset{w,b}{\text{minimize}}\ J(w,b)$

④ Goal : $\underset{w,b}{\text{minimize}}\ J(w,b)$

⟨Comparison of changes in Model (hypothesis) according to Cost function by changing W value⟩

- Let's use simplified model

model: $f_w(X) = WX \quad (b=0)$ ⇒ cost func : $J(w) = \frac{1}{2m} \sum_{i=1}^{m} (f_w(x^{(i)}) - y^{(i)})^2$

⇒ goal : $\underset{w}{\text{minimize}}\ J(w)$

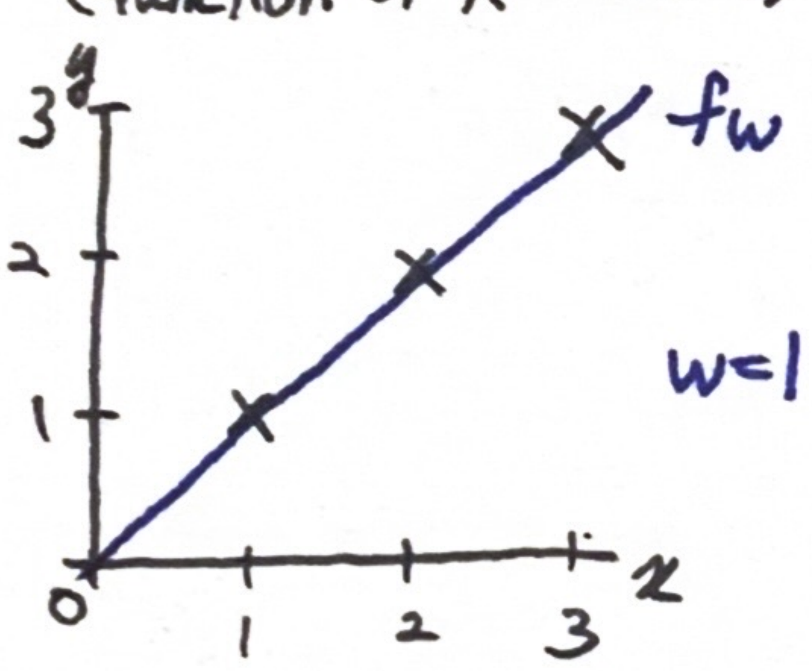
e.g. Training set

X	Y
1	1
2	2
3	3

① $W=1$

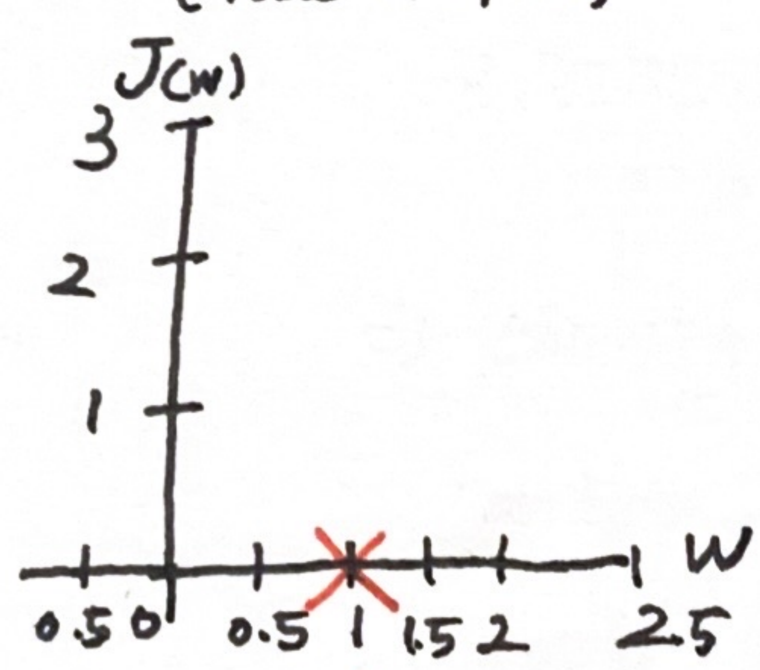
i) $f_w(X)$

(function of X = model)



$J(w)$

(function of w)



$$J(w) = \frac{1}{2m} \sum_{i=1}^{m} (f_w(x^{(i)}) - y^{(i)})^2$$

$$= \frac{1}{2m} \sum_{i=1}^{m} (wx^{(i)} - y^{(i)})^2$$

$$= \frac{1}{2m} \sum_{i=1}^{m} (x^{(i)} - y^{(i)})^2 \quad (w=1)$$

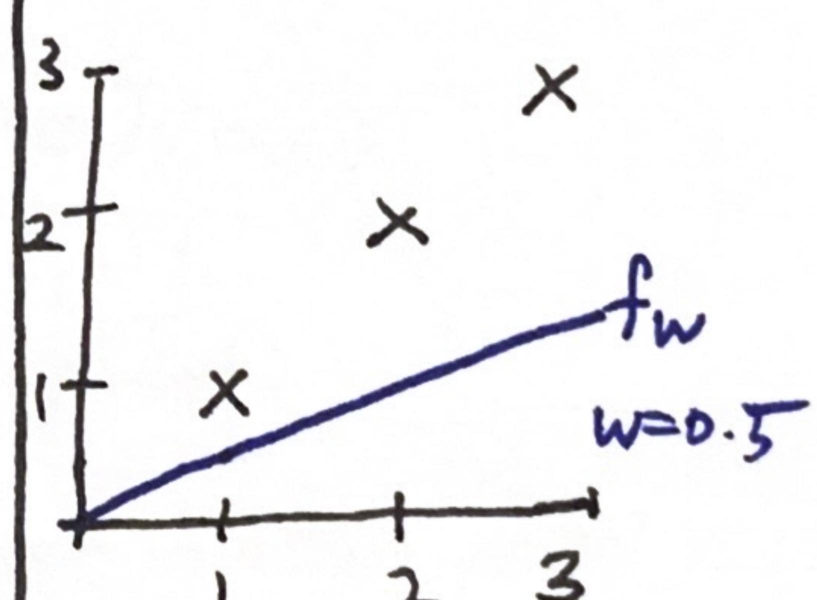
$$= \frac{1}{2m} (0^2 + 0^2 + 0^2) = \underline{0}$$

∴ if $W=1$, $J(w)=0$

$\underline{J(1)=0}$

② $W=0.5$

ii) $f_w(X)$



$$J(0.5) = \frac{1}{2m}\left[(0.5-1)^2 + (1-2)^2 + (1.5-3)^2\right]$$

$$= \frac{1}{6} \times 3.5 \approx \underline{0.58}$$

$(m=3)$