

California State University, Dominguez Hills

Department of Computer Science

CSC 595

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- Gradient Descent for Logistic Regression
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Cost Function

Cost Function

Training set

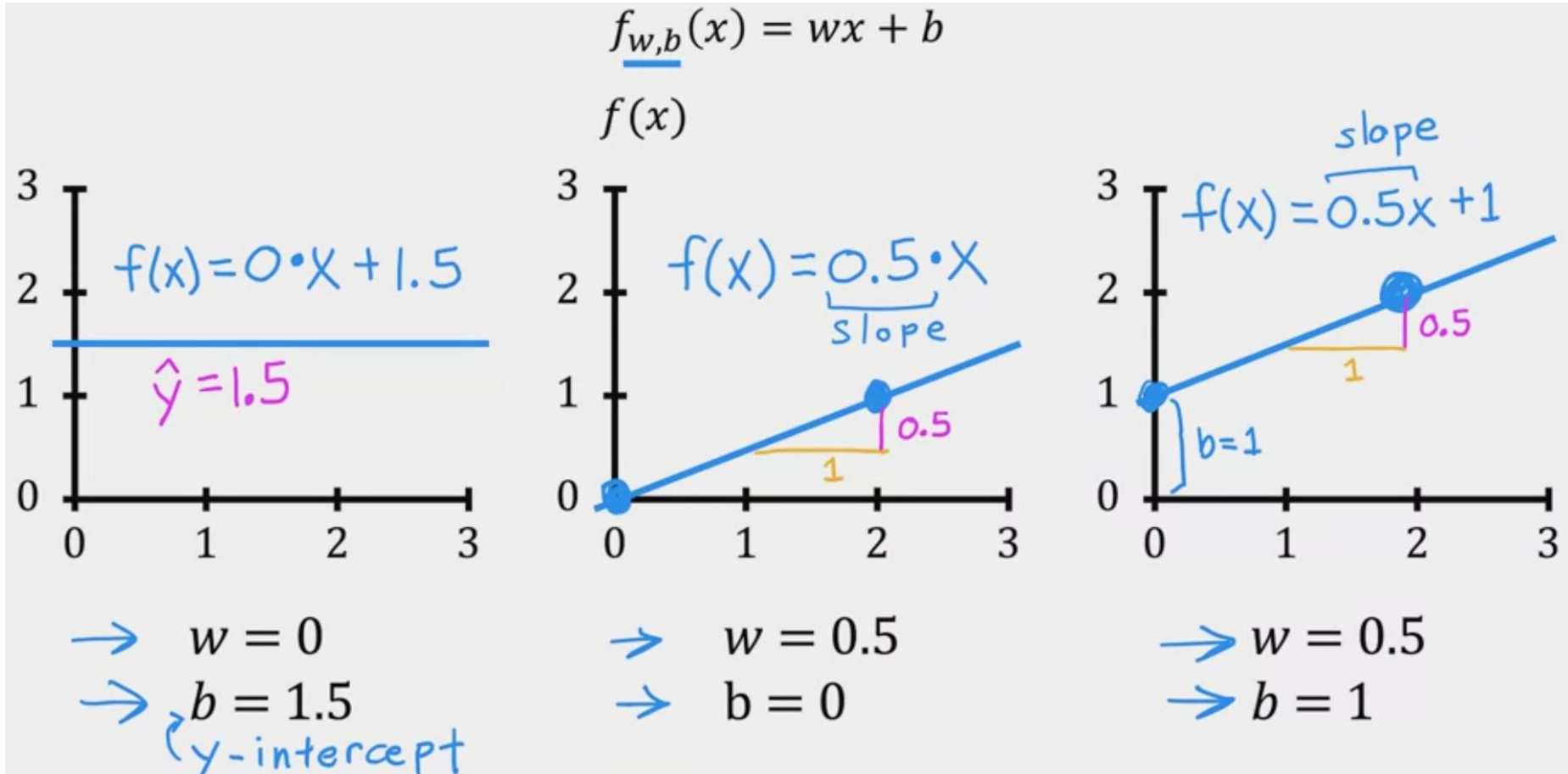
<i>features</i> size in feet ² (x)	<i>targets</i> price \$1000's (y)
2104	460
1416	232
1534	315
852	178
...	...

Model: $f_{w,b}(x) = wx + b$

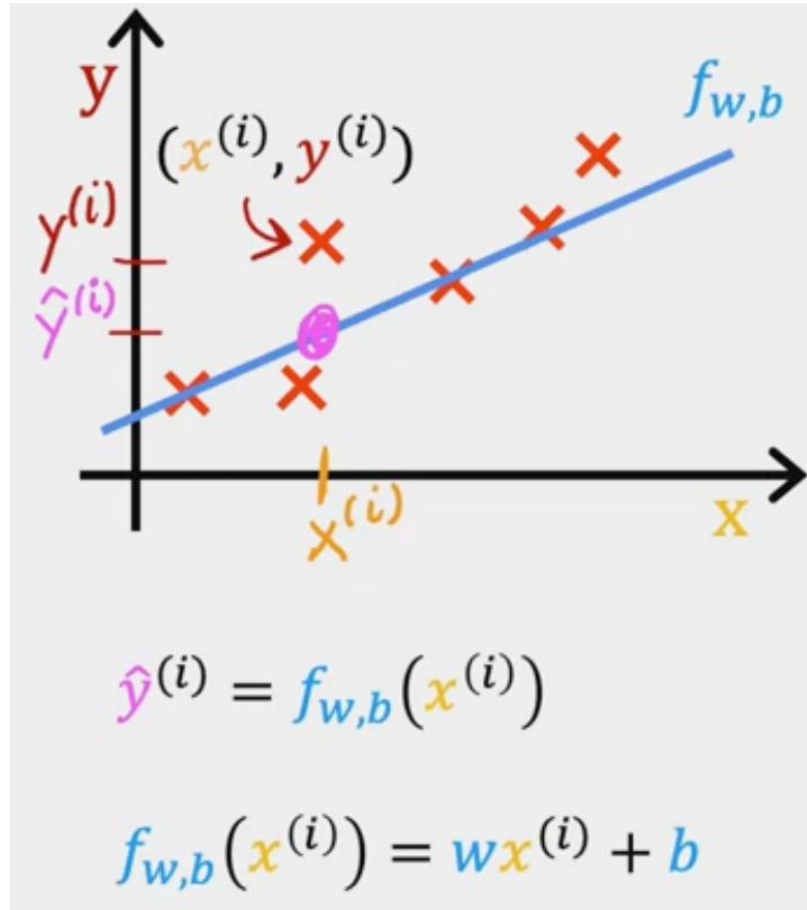
w, b : parameters
coefficients
weights

What do w, b do?

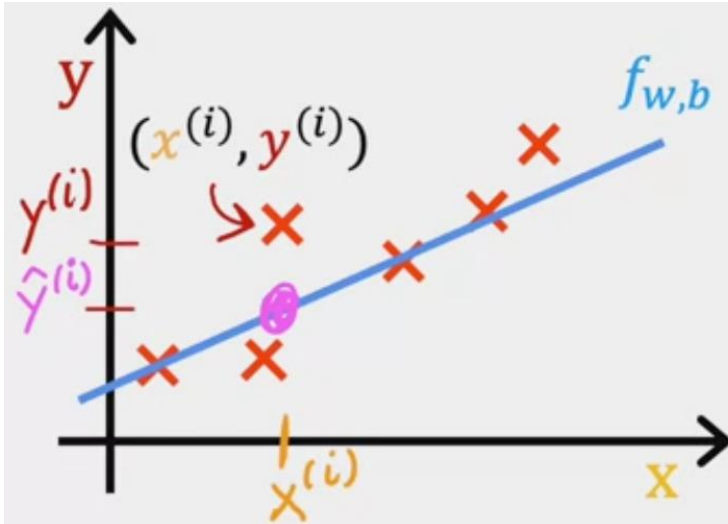
Cost Function



Cost Function



Cost Function



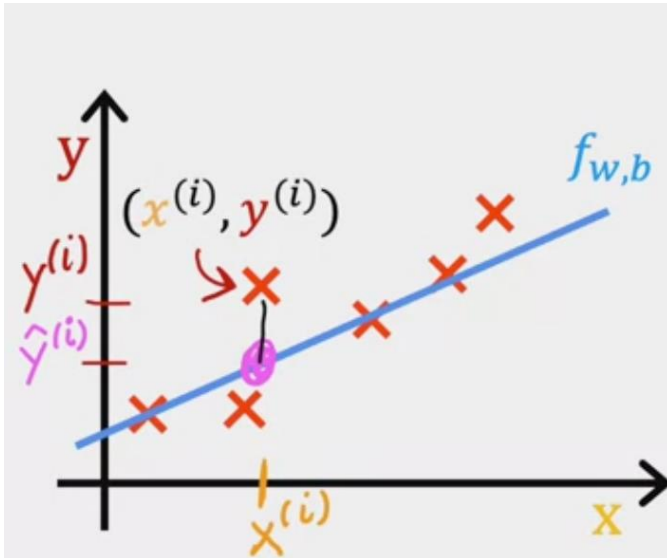
$$\hat{y}^{(i)} = f_{w,b}(x^{(i)})$$

$$f_{w,b}(x^{(i)}) = wx^{(i)} + b$$

Find w, b :

$\hat{y}^{(i)}$ is close to $y^{(i)}$ for all $(x^{(i)}, y^{(i)})$.

Cost Function



$$\hat{y}^{(i)} = f_{w,b}(x^{(i)})$$

$$f_{w,b}(x^{(i)}) = wx^{(i)} + b$$

Cost function: Squared error cost function

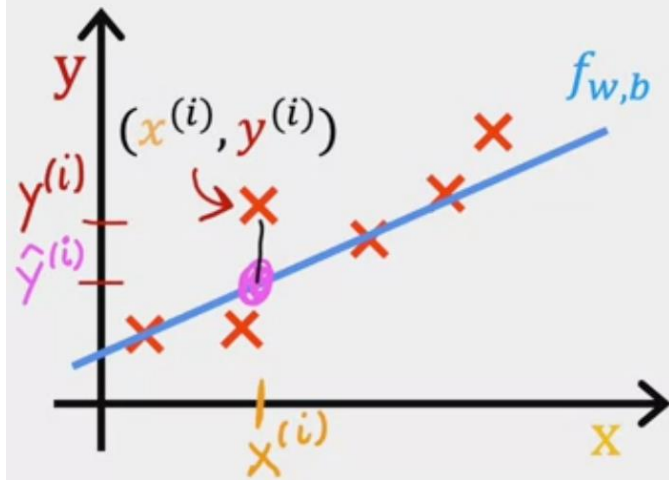
$$J(w,b) = \frac{1}{2m} \sum_{i=1}^m \left(\underset{\text{error}}{\hat{y}^{(i)} - y^{(i)}} \right)^2$$

m = number of training examples

Find w, b :

$\hat{y}^{(i)}$ is close to $y^{(i)}$ for all $(x^{(i)}, y^{(i)})$.

Cost Function



$$\hat{y}^{(i)} = f_{w,b}(x^{(i)}) \quad \leftarrow$$

$$f_{w,b}(x^{(i)}) = wx^{(i)} + b$$

Cost function: Squared error cost function

$$J(w,b) = \frac{1}{2m} \sum_{i=1}^m \left(\underset{\substack{\text{error}}}{\hat{y}^{(i)}} - y^{(i)} \right)^2$$

m = number of training examples

$$J(w,b) = \frac{1}{2m} \sum_{i=1}^m \left(\underset{\substack{\text{intuition (next!)}}}{f_{w,b}(x^{(i)})}} - y^{(i)} \right)^2$$

Find w, b :

$\hat{y}^{(i)}$ is close to $y^{(i)}$ for all $(x^{(i)}, y^{(i)})$.

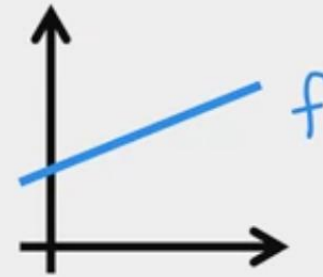
Cost Function

model:

$$\underline{f_{w,b}(x) = wx + b}$$

parameters:

$$\underline{w, b}$$



cost function:

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

goal:

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

Cost Function

model:

$$\underline{f_{w,b}(x) = wx + b}$$

parameters:

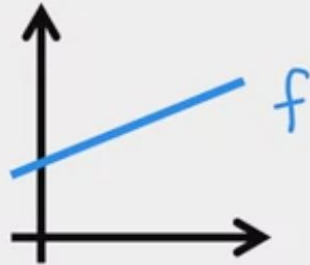
$$\underline{w, b}$$

cost function:

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

goal:

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



simplified

$$f_w(x) = \underline{wx} \quad b = \emptyset$$

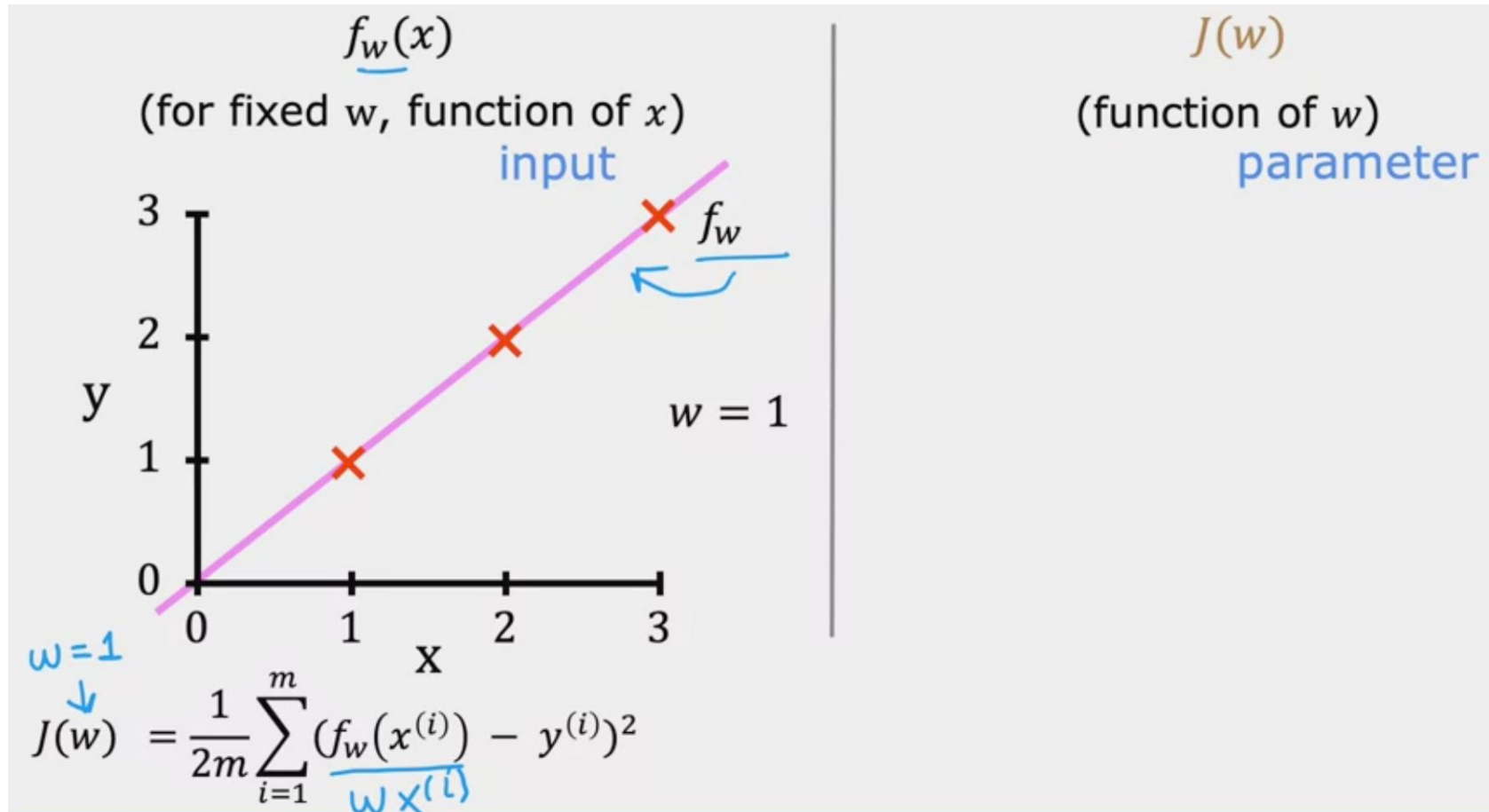
w

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

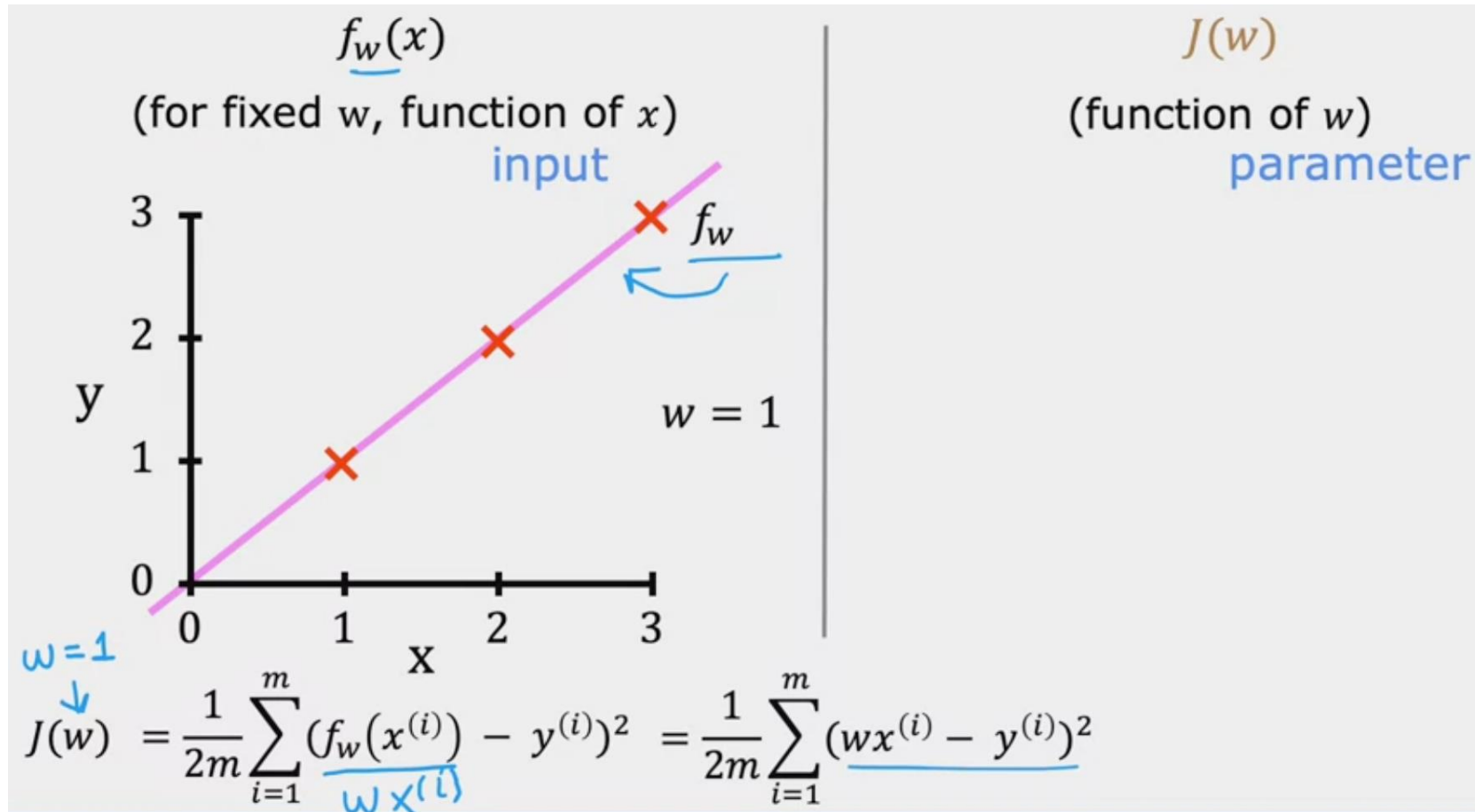
\nwarrow
 $w x^{(i)}$

$$\underset{\underline{w}}{\text{minimize}} \underline{J(w)}$$

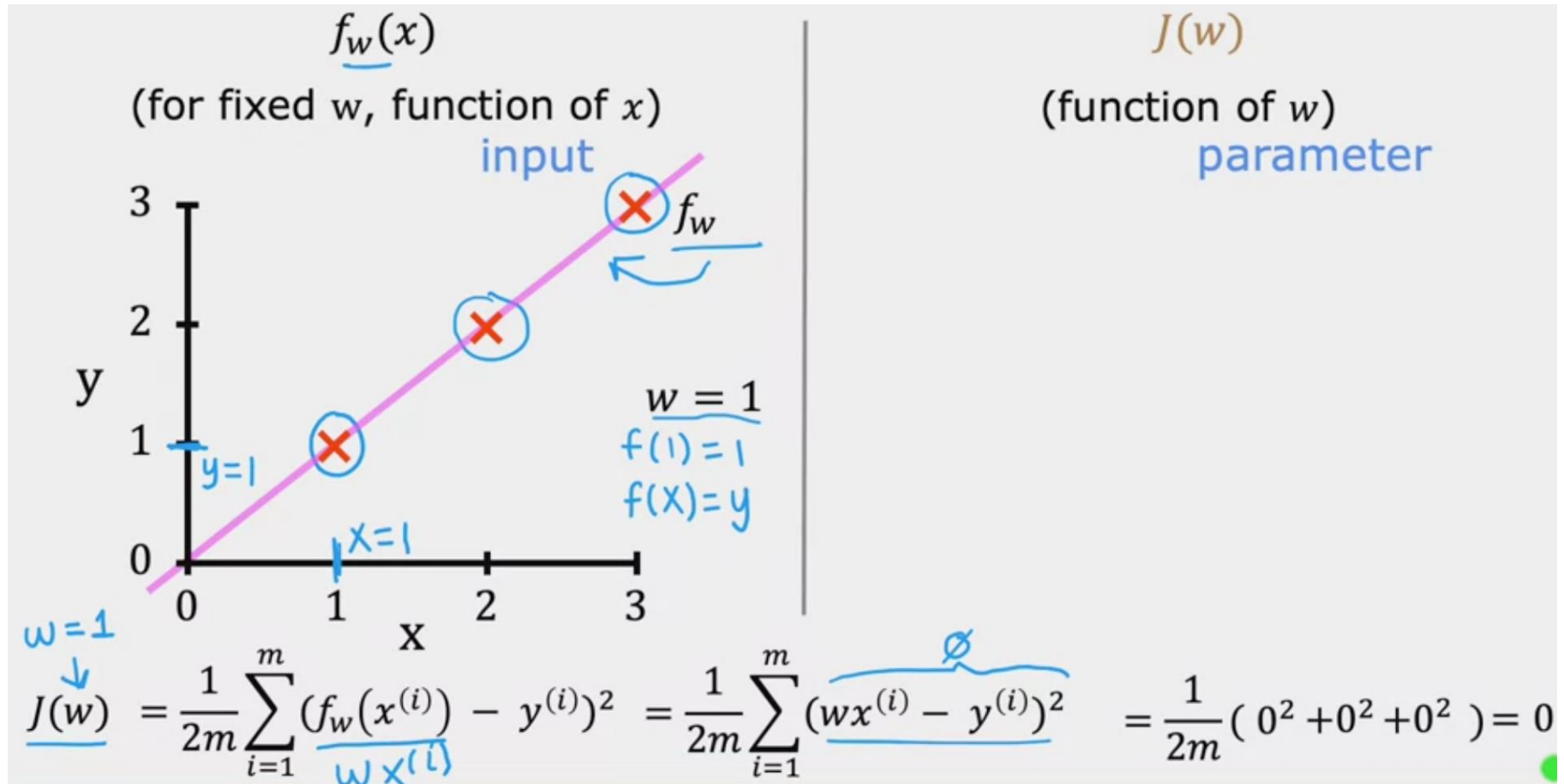
Cost Function



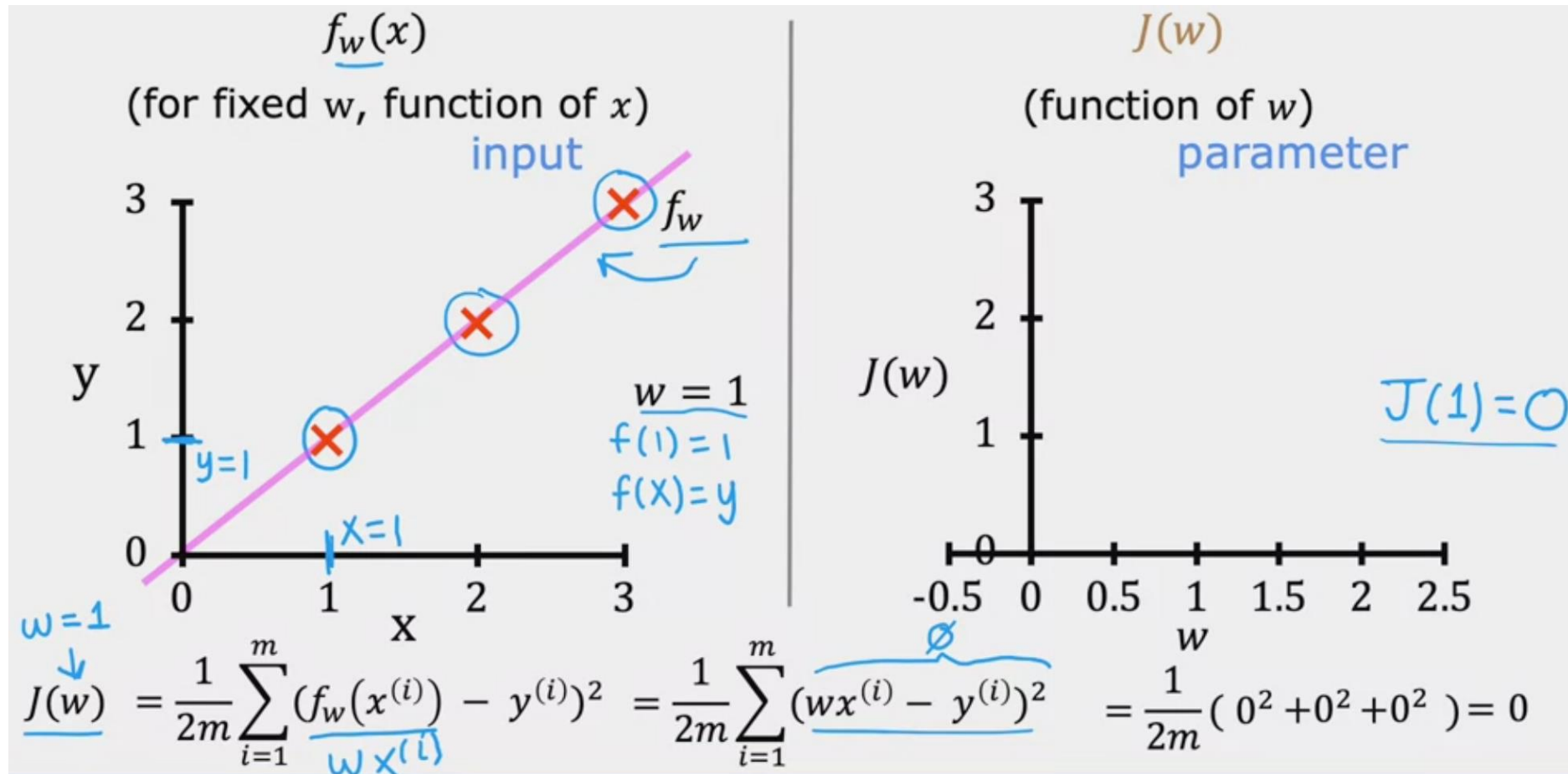
Cost Function



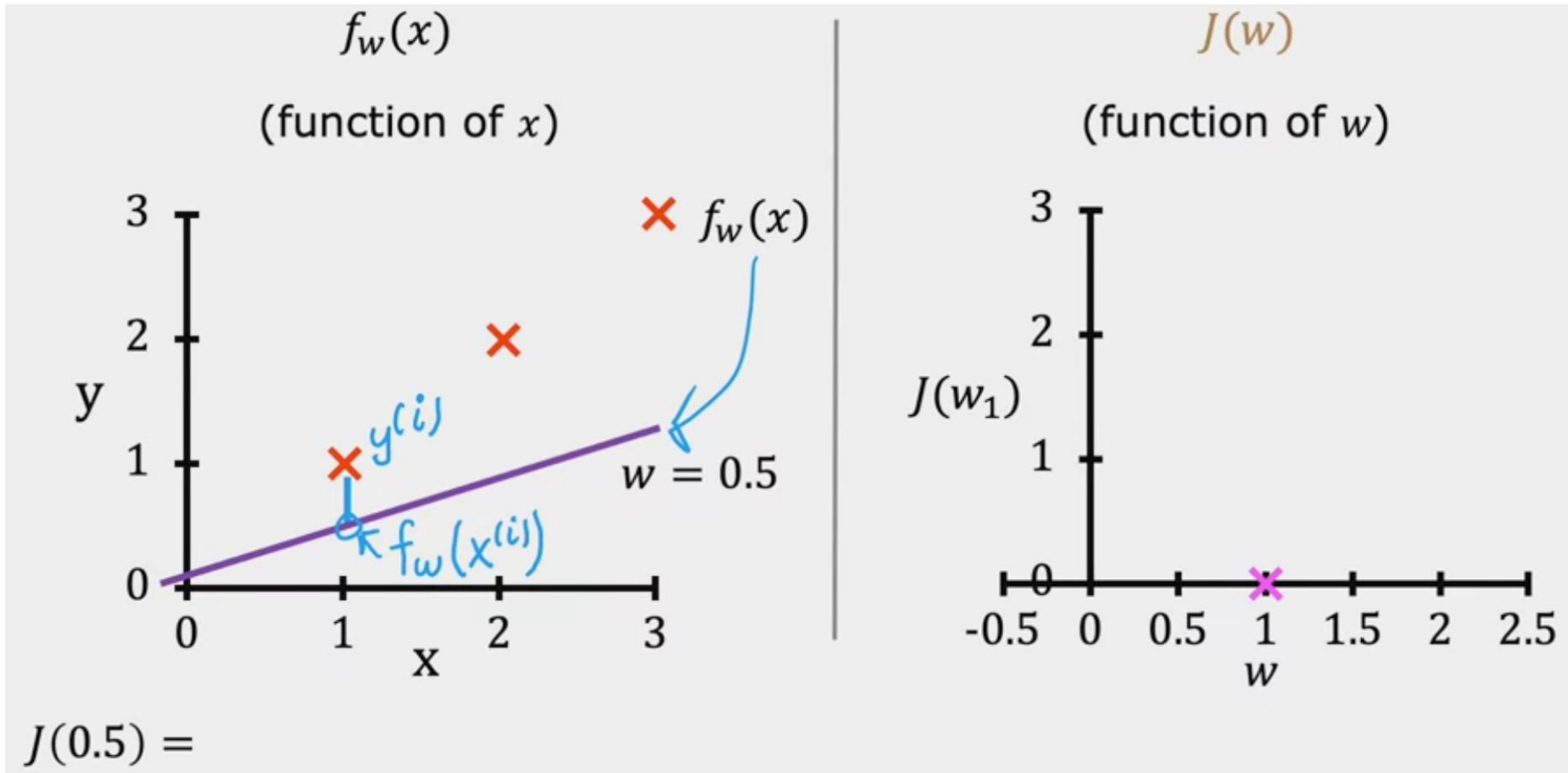
Cost Function



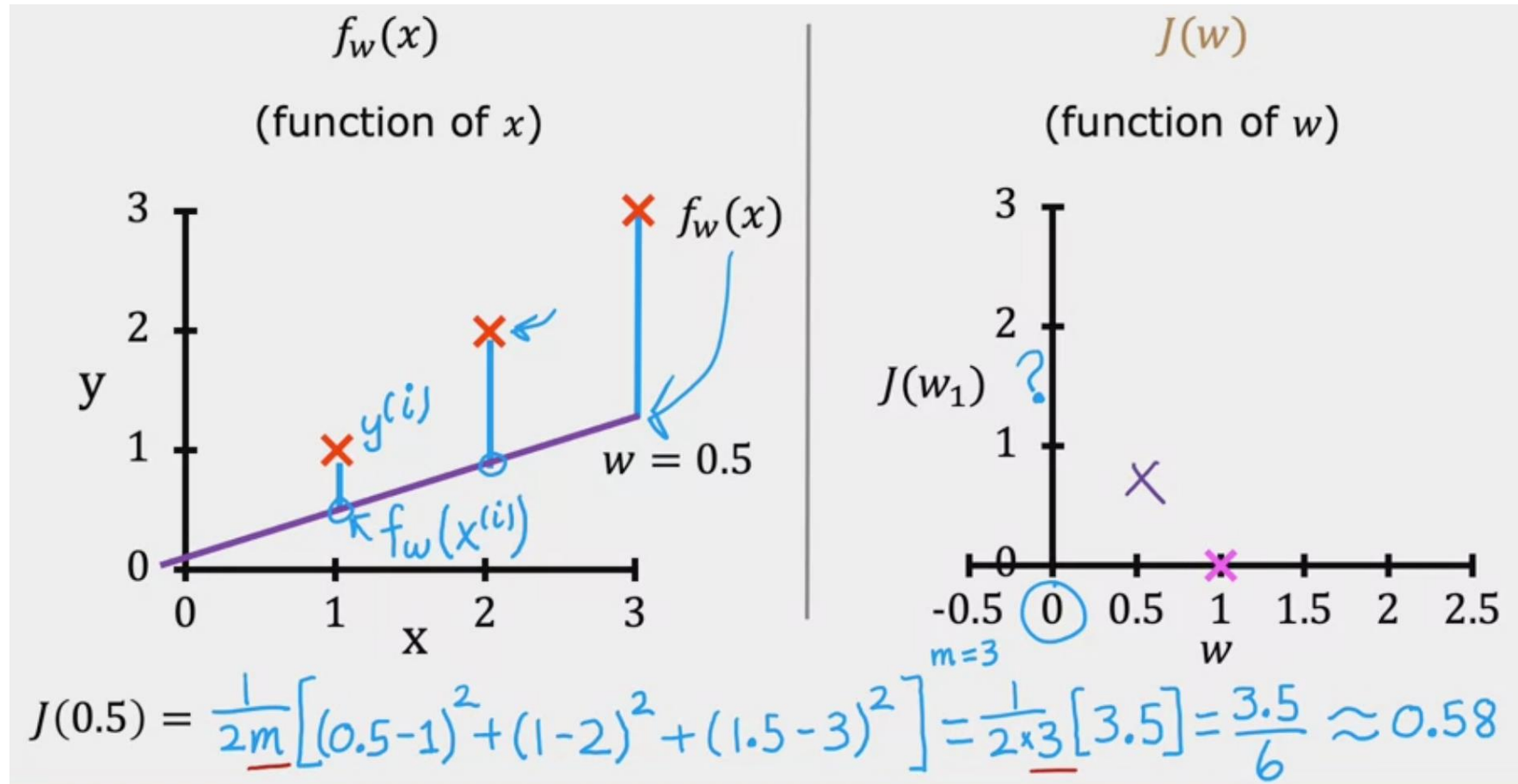
Cost Function



Cost Function



Cost Function



Visualizing the Cost Function

Model

$$f_{w,b}(x) = wx + b$$

Parameters

$$w, b$$

Cost Function

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

Objective

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