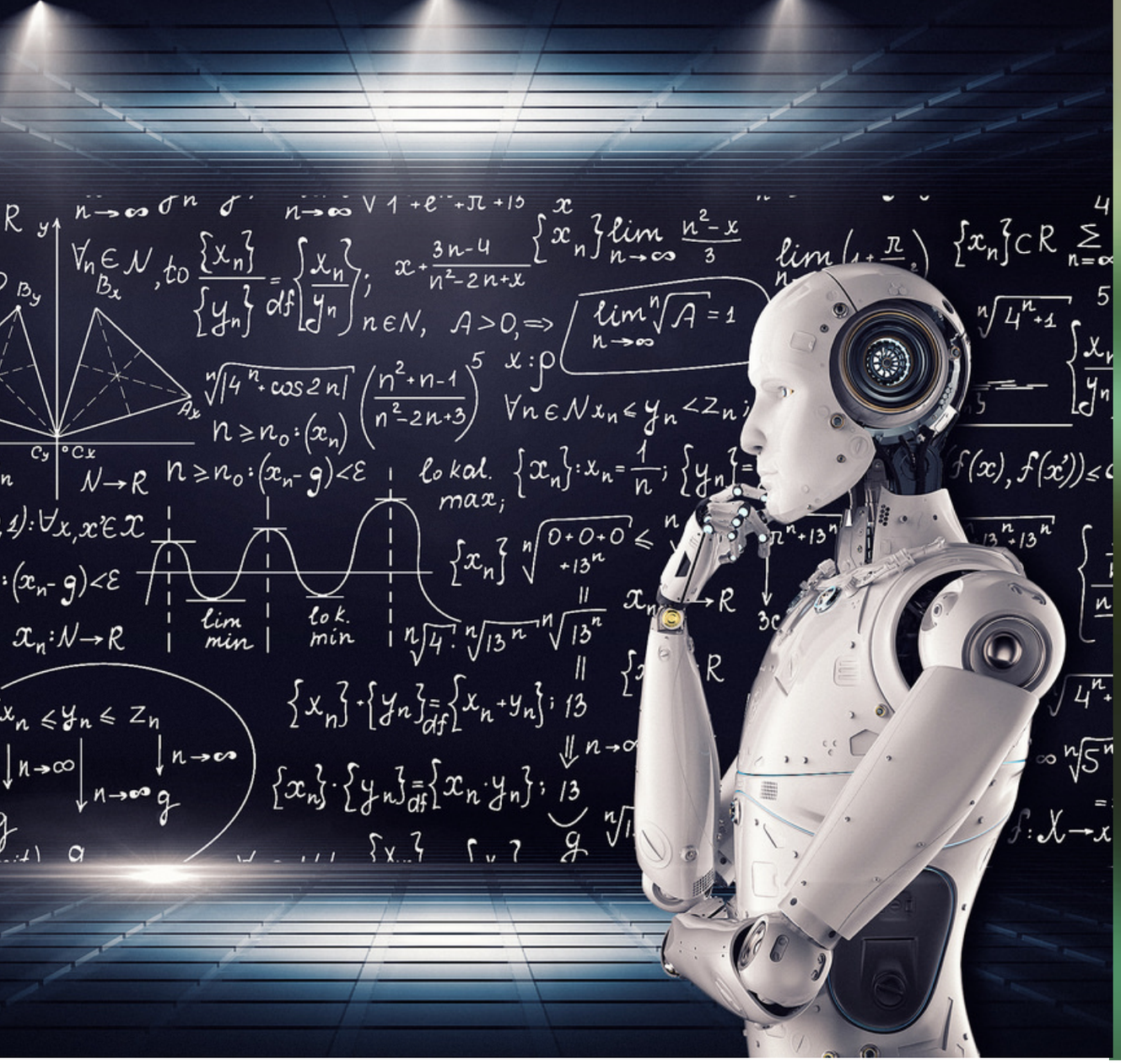

Cost Function Analysis

Rajat Modi

You are the Teacher. Classify students as good/bad

-Exams
-Marks

Recap

$$h_\theta(x) = \theta_0 + \theta_1 x$$

Hypothesis function

Choose the optimal value of θ_0, θ_1 for best possible 'fit'

Nature of Problem

- Supervised
- Regression

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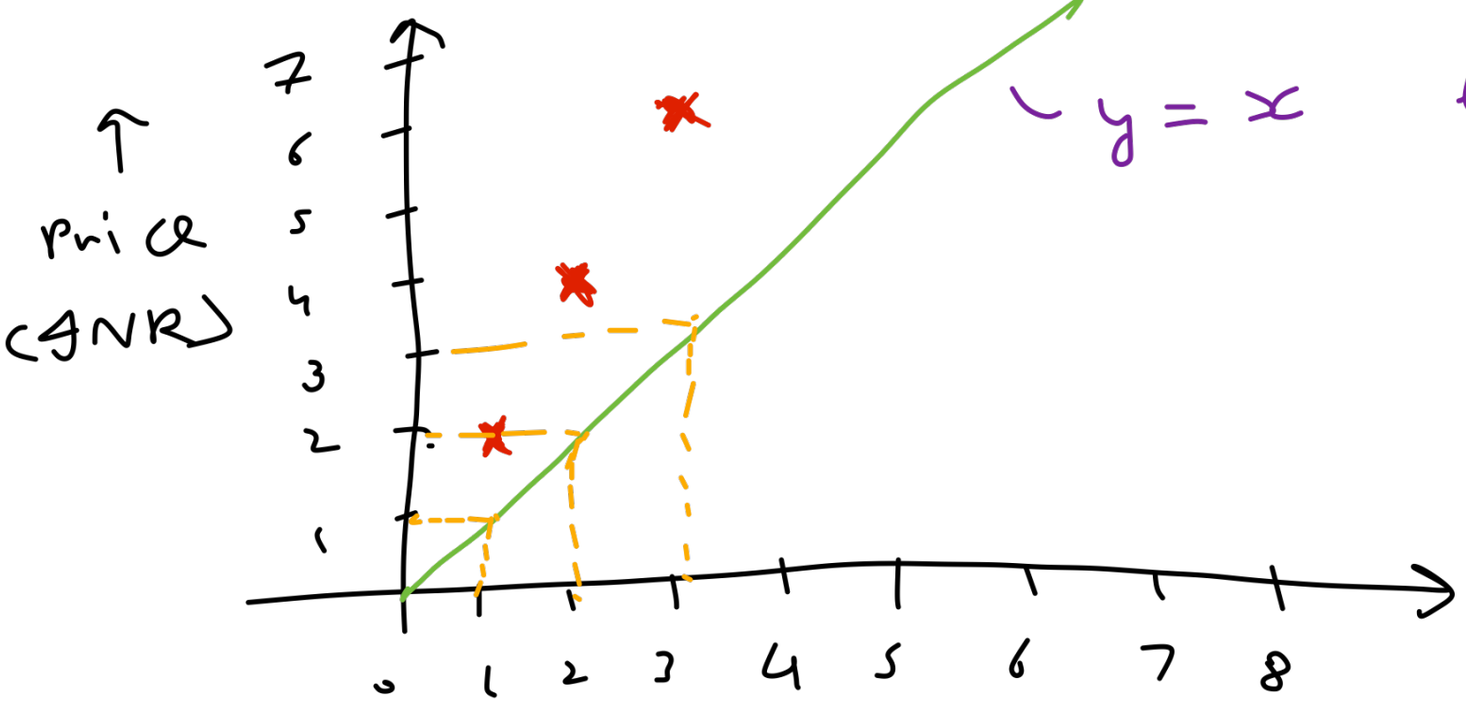
Let's go

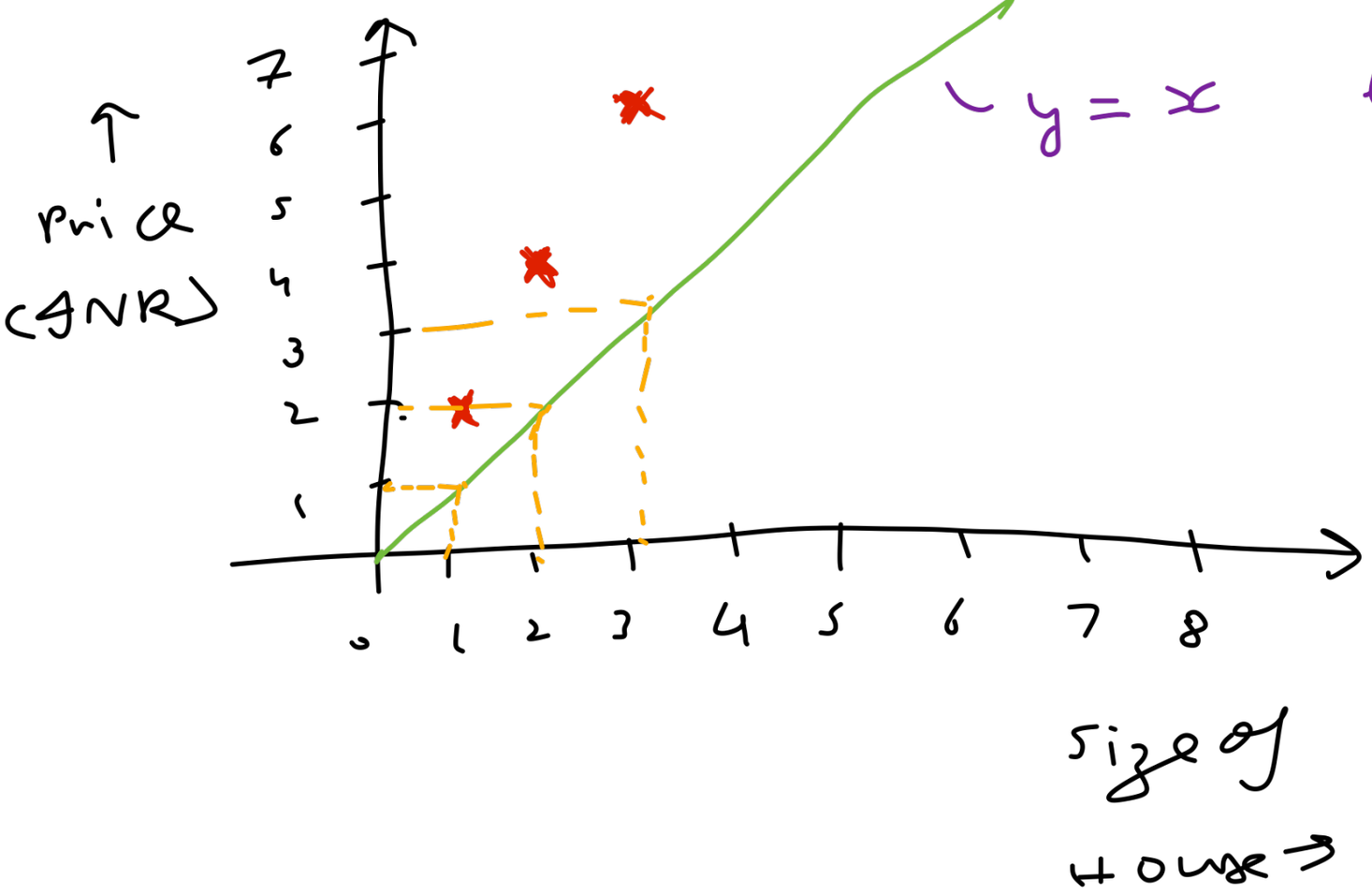


$y = x$

$h_\theta(x) = \theta_0 + \theta_1 x$

(x) size	(y) price	$(\hat{y})$ prediction
1	2	1
2	4	2
3	6	3

Let's go



$y = x$

$h_\theta(x) = \theta_0 + \theta_1 x$

(x) size	(y) price	$(\hat{y})$ prediction
1	2	1
2	4	2
3	6	3

$$\text{error} = (2-1) + (4-2) + (6-3)$$
$$= 1 + 2 + 3 = 6$$

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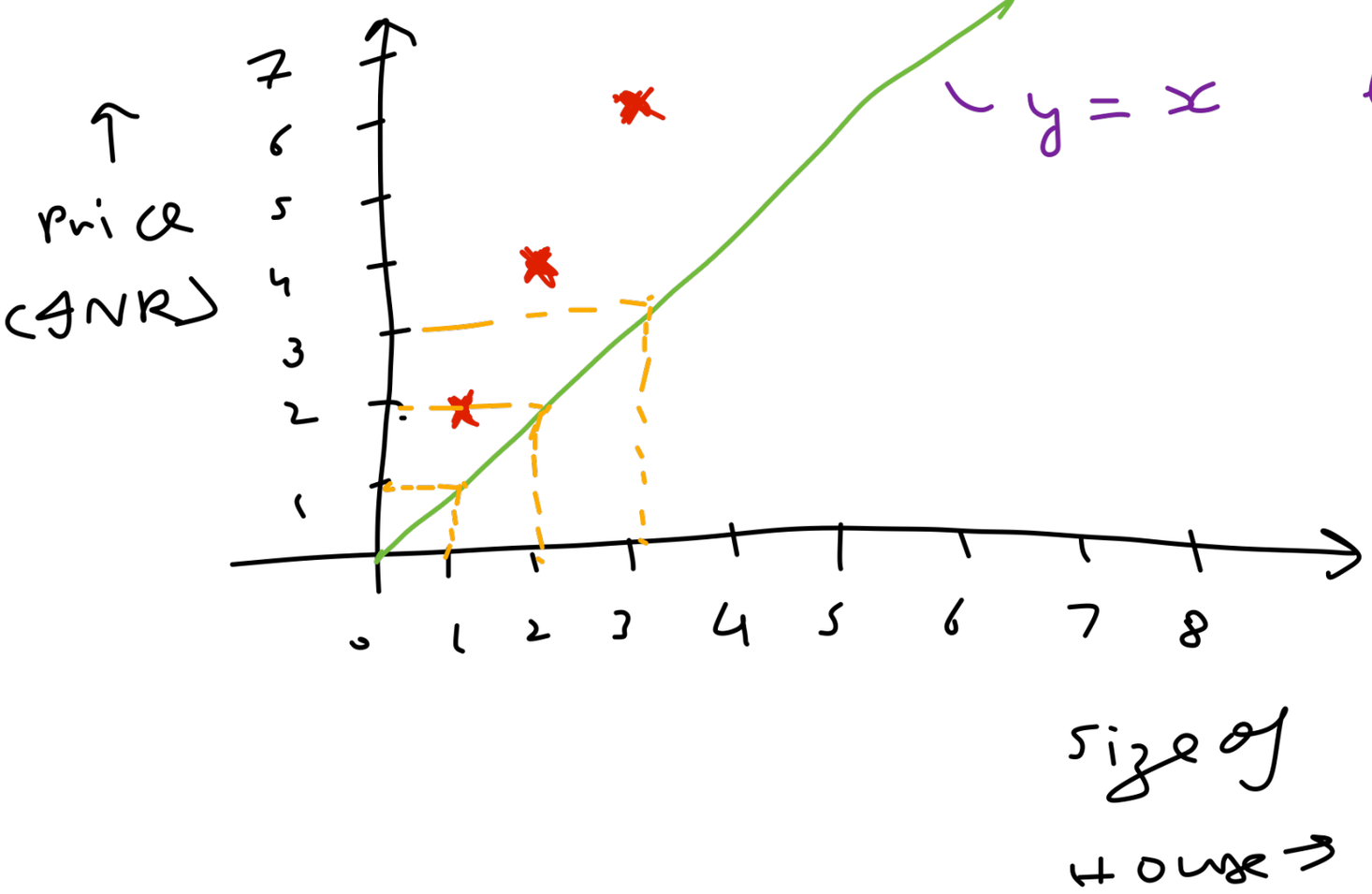
Let's go



$h_\theta(x) = \theta_0 + \theta_1 x$

(x) size	(y) price	($\hat{y}$) prediction
1	2	1
2	4	2
3	6	3

$$\text{error} = (2-1)^2 + (4-2)^2 + (6-3)^2$$
$$= 1^2 + 2^2 + 3^2 = 1 + 4 + 9 = 14$$

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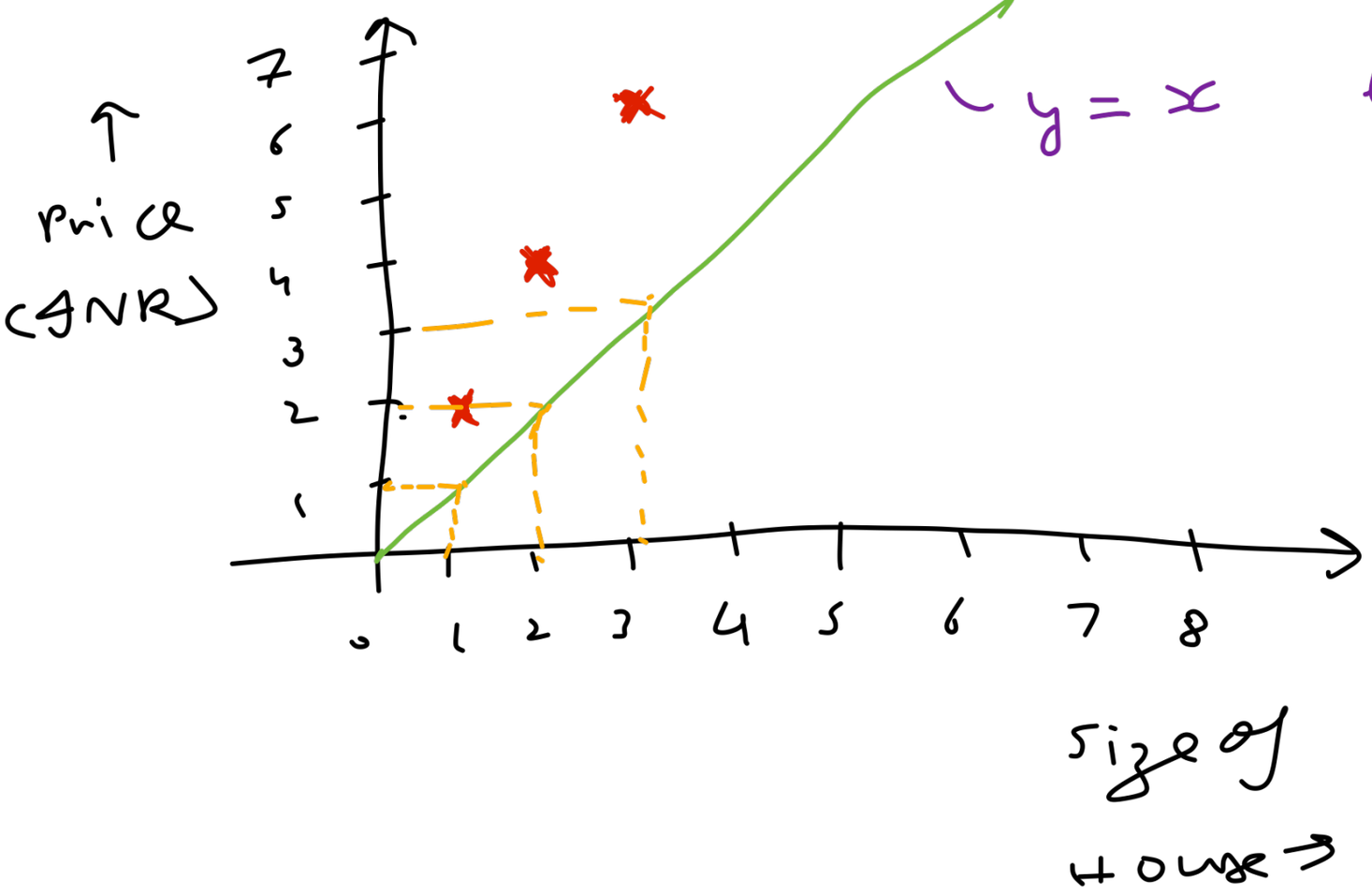
Let's go



$y = x$

$h_\theta(x) = \theta_0 + \theta_1 x$

(x) size	(y) price	$(\hat{y})$ prediction
1	2	1
2	4	2
3	6	3

$$\text{error} = (2-1)^2 + (4-2)^2 + (6-3)^2$$

$$= 1^2 + 2^2 + 3^2 = 1 + 4 + 9 = 14$$

$$\text{Total error} = (14/3) \simeq 4.66$$

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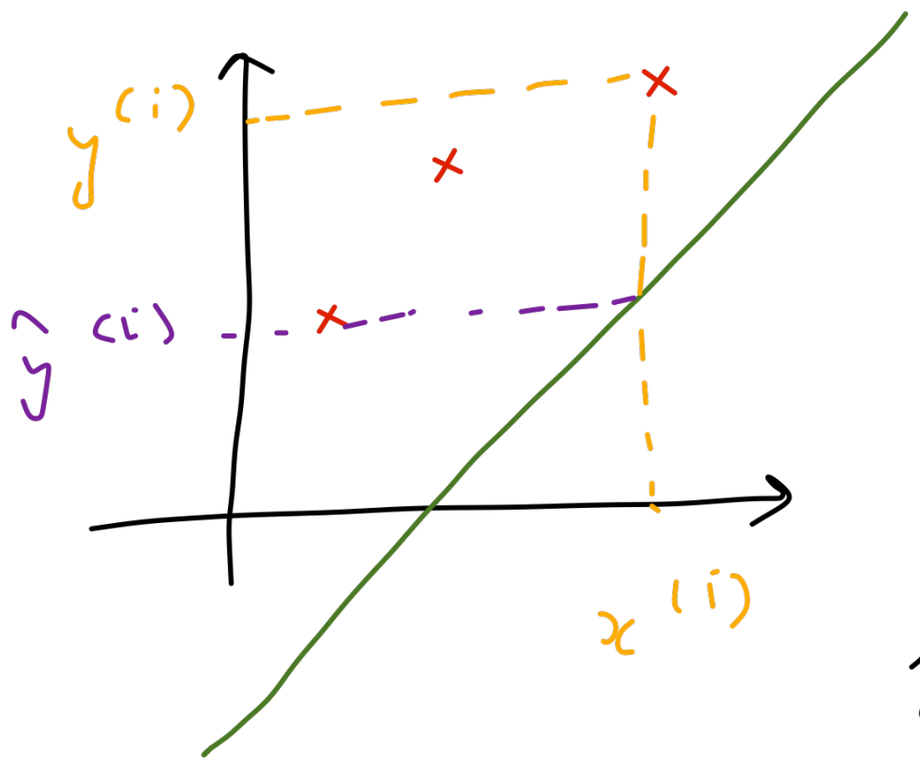
Formal Definition- Cost Function



$h_\theta(x) = \theta_0 + \theta_1 x.$

For $x = x^{(i)}$

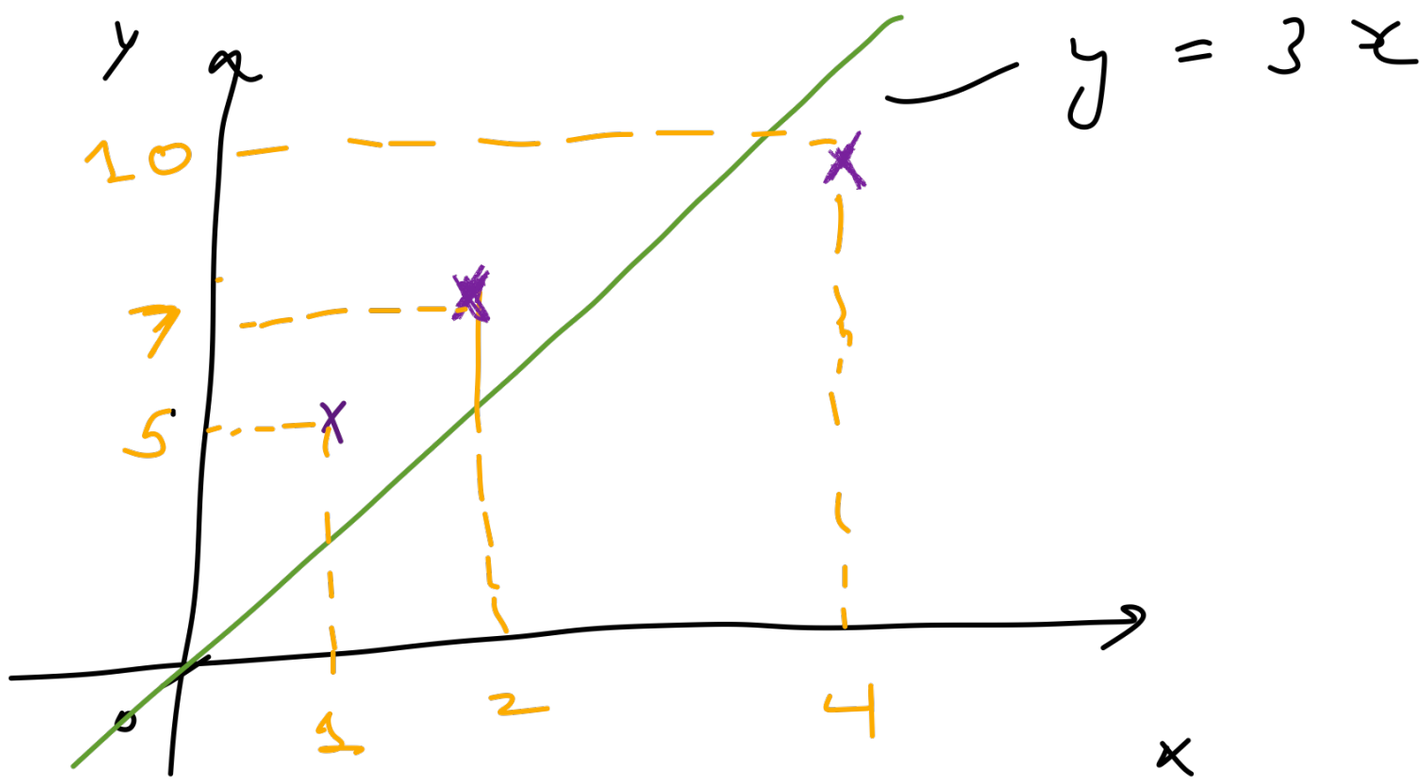
Prediction $\hat{y}^{(i)}$ is

$$\hat{y}^{(i)} = h_\theta(x^{(i)})$$

$$J(\theta) = \text{error} = \frac{1}{2 \times M} \sum_{i=1}^{M} (h_\theta(x^{(i)}) - y^{(i)})^2$$

constant factor.

Calculate the 'mean square error' for the graph



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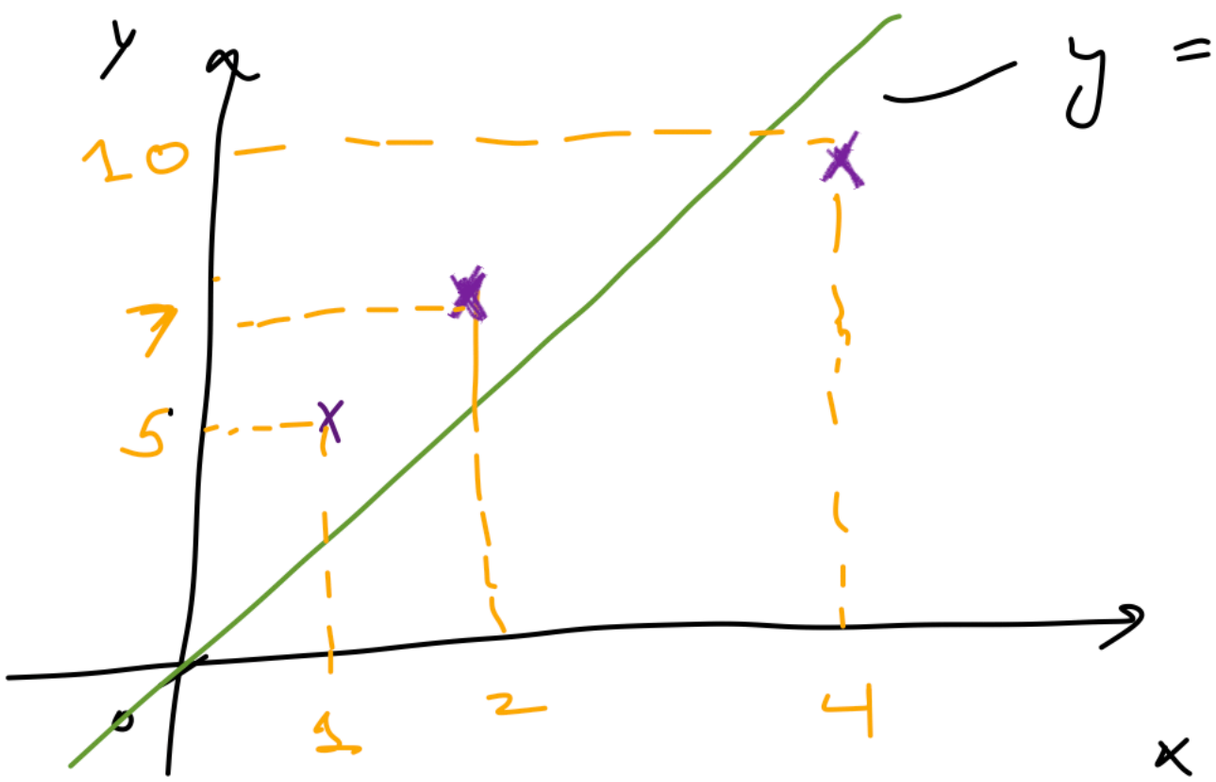

$y = 3x$

$h_\theta(x) = 3x$

x	Actual value (y)	Predict ($\hat{y}$)
1	5	3
2	7	6
4	10	12

$$\text{error} = \frac{1}{2\times 3}\cdot\left((5-3)^2 + (7-6)^2 + (10-12)^2\right)$$

$$= \frac{1}{2\times 3}\left(2^2 + 1^2 + 2^2\right) = \frac{1}{2\times \cancel{3}}(\cancel{9})^3 = \frac{3}{2}$$

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COMING NEXT……

$$J(\theta) = \frac{1}{2m} \sum_{i=1}^{m} \left(h_\theta(x^{(i)} - y^{(i)}\right)^2$$

$$J(\theta_1, \theta_2) = \frac{1}{2m} \sum_{i=1}^{m} \left(\theta_0 + \theta_1 x^{(i)} - y^{(i)}\right)^2$$

[How to find θ_1, θ_2]

THANK YOU !!!!

Rajat Modi