Important Concepts of ML, AI, Supervised, Unsupervised regression, classification, Simple Linear regressions, Convergence Algorithm

1. AI : Artificial Intelligence
2. ML : Machine Learning
3. DL : Deep Learning
4. DS : Data Science
5. Supervised
6. Unsupervised
7. Regression
8. Classification
9. Simple Linear Regression
10. Global Minima
11. Best Fit line
12. What steps do we take to make best fit line in simple linear regression
13. Mean Squared Error or Cost Function
14. Multiple Linear Regression

AI : It is creating an application where it performs all its task without human intervention.
Ex : Recommendation System
AI Chatbot

ML : It is a subset of A. It provides us stats tools to explore, visualize, analyze and perform predictions and other tasks.
Example : stats in algorithms to make predictions

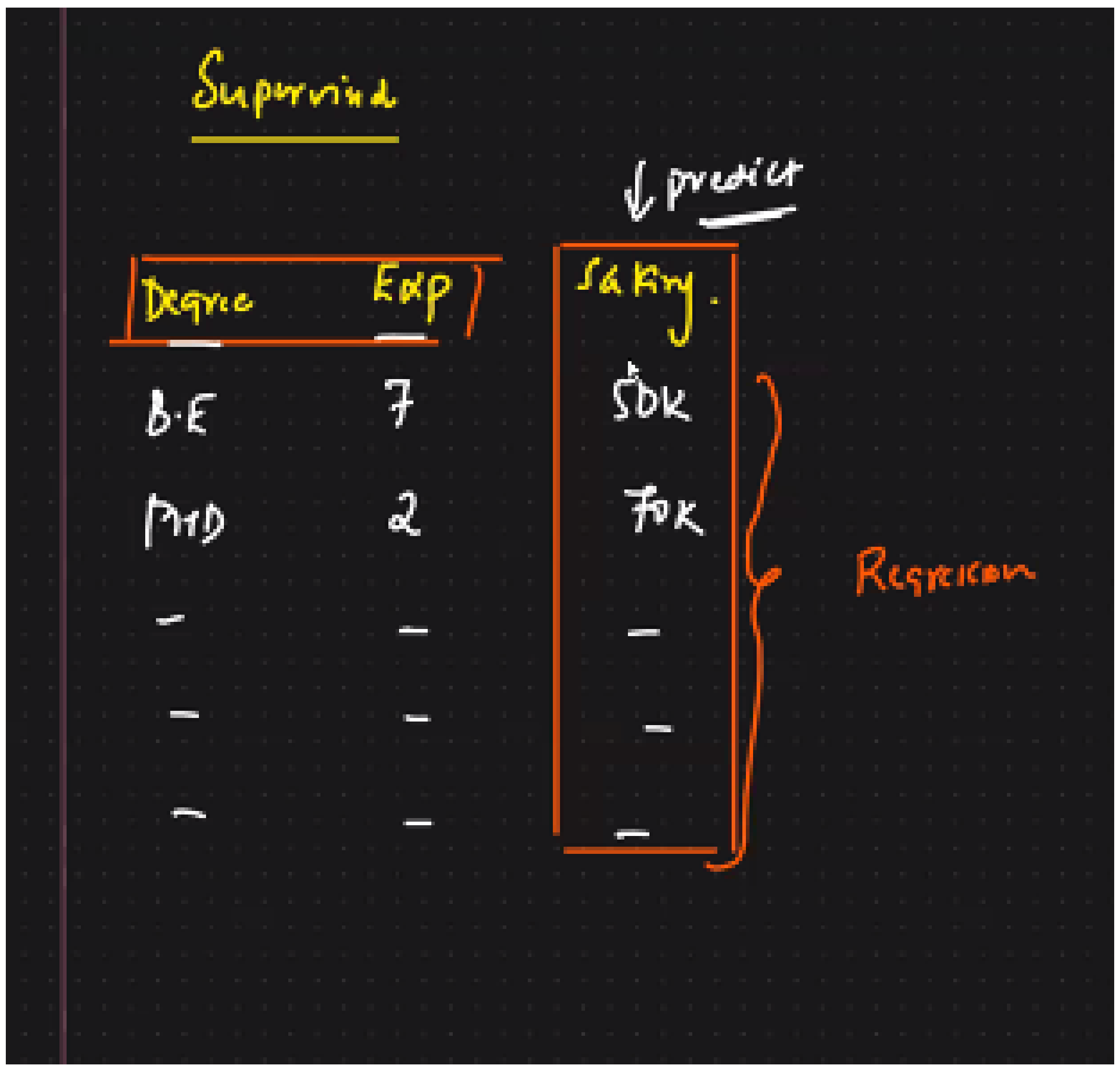
DL: It is a subset of Machine Learning.
"Can we make the machine learn as how we human being learns". Now, using "Multi layered neural network" they are doing an amazing job. Example : ANN, CNN, Object detection

NLP : It will fall both in ML and DL techniques. It’s a technique for text analysis

DS: As a Data science, we need to work in all the fields

Supervised Learning:

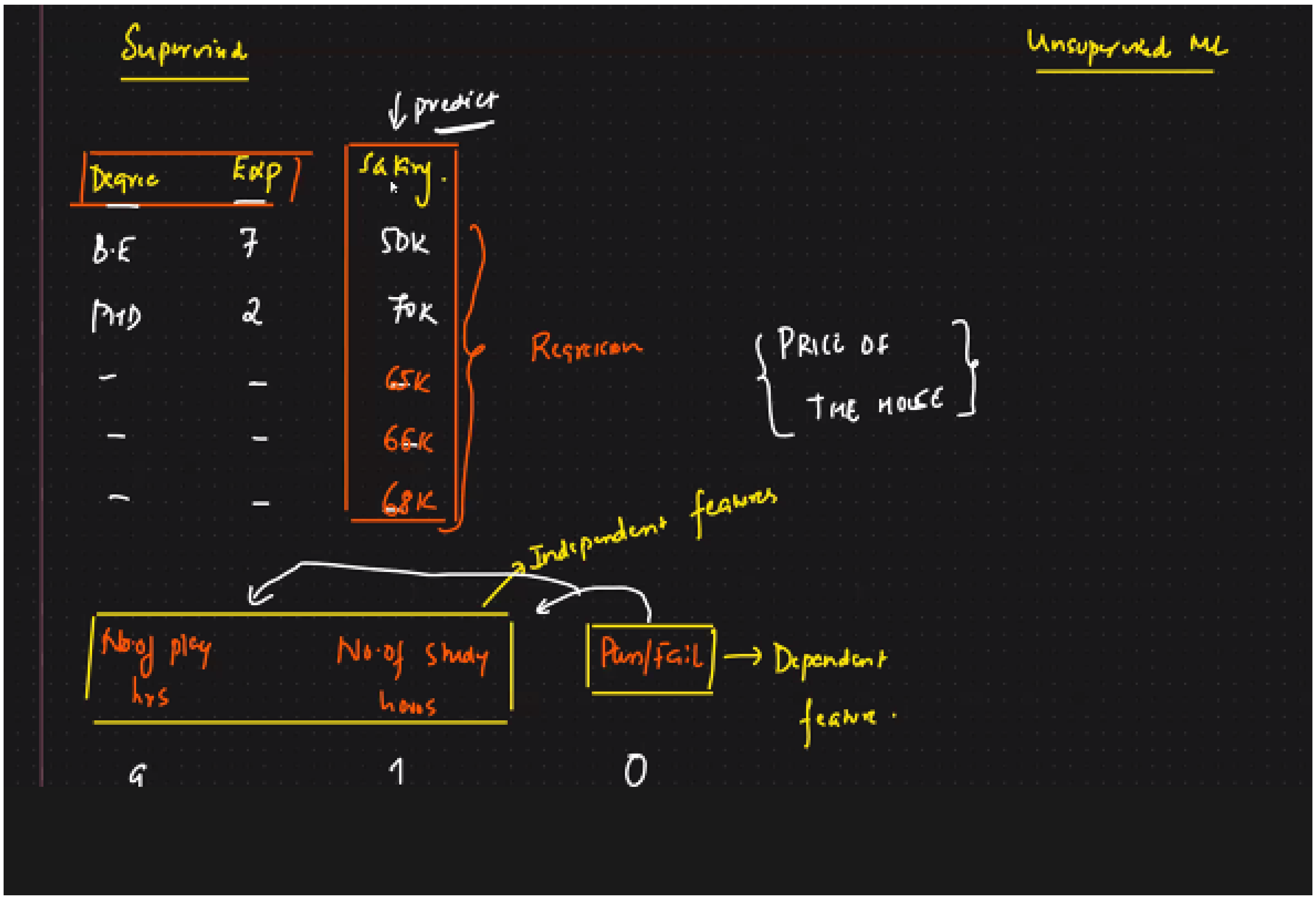
Step1 : With the help of an example. In this example we are trying to predict the Salary".



Step2: When the output feature is Continuous, then it' s a regression problem. For example: Air quality index predictions

Step3: When the output feature is a categorical variable then it' s a classification problem
Example : Algerian forest fire, House price prediction, Rain or not rain, Purchase on which day of the week etc..,

Step4: In the below example, we will know what the difference between classification problem or regression problem is. Example: **When the output feature is Continuous, then it' s a regression problem i.e, Salary and When the output feature is a categorical variable then it' s a classification problem i.e, pass/fail**



Step5: In supervised learning, we know the target variable or the dependent variable

Step6: In supervised learning, we solve two types of problems such as:

1) **Regression**:

When the output feature is Continuous, then it's a regression problem.

- Linear regression
- Logistic regression
- SVM
- SVR
- Decision Tree
- Random Forest
- XG Boost
- KNN etc..,

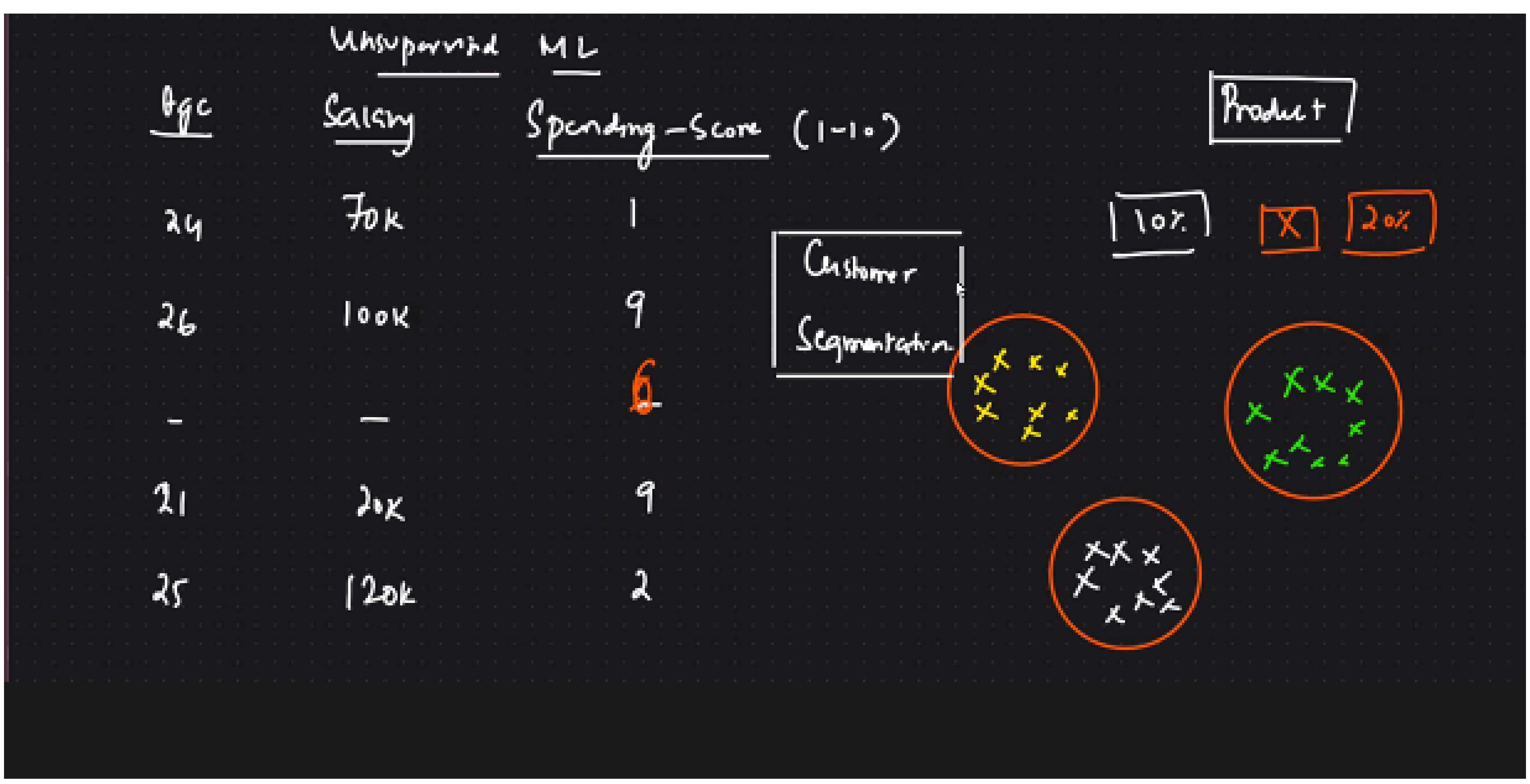
2) **Classification**:

When the output feature is a categorical variable then it' s a classification problem
Example : Algerian forest fire, House price prediction , Rain or not rain, Purchase on which day of the week, Titanic, Iris, reviews etc..,

Decision tree
Random forest
SVM
Naïve Bayes
KNN etc..,

Unsupervised Learning:

Step 1 : For example , if we have three features Age, Salary and Spending Score . Based on the spending pattern, a shop wants to sell a product.
To know these types of customers , we cluster them into different groups. This problem statement is known as "**Customer Segmentation**" (To increase sales). It's an amazing use case. This is an example of an unsupervised machine learning as shown in the below SS:



Step2: In Unsupervised Learning, we are already aware of what will be the output feature or dependent feature

Step3: We will be able to get the datapoints in clusters

Step4: Some of the examples of Unsupervised learning are as below:

Clustering Algorithms
DBScan
Kmeans
Hierarchial
Sillhoutte scoring etc..,

Simple Linear Regression:

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

Step1: We will have one Independent Feature and one Dependent feature

Step2: Problem Statement : Input as height and predict a "Weight"

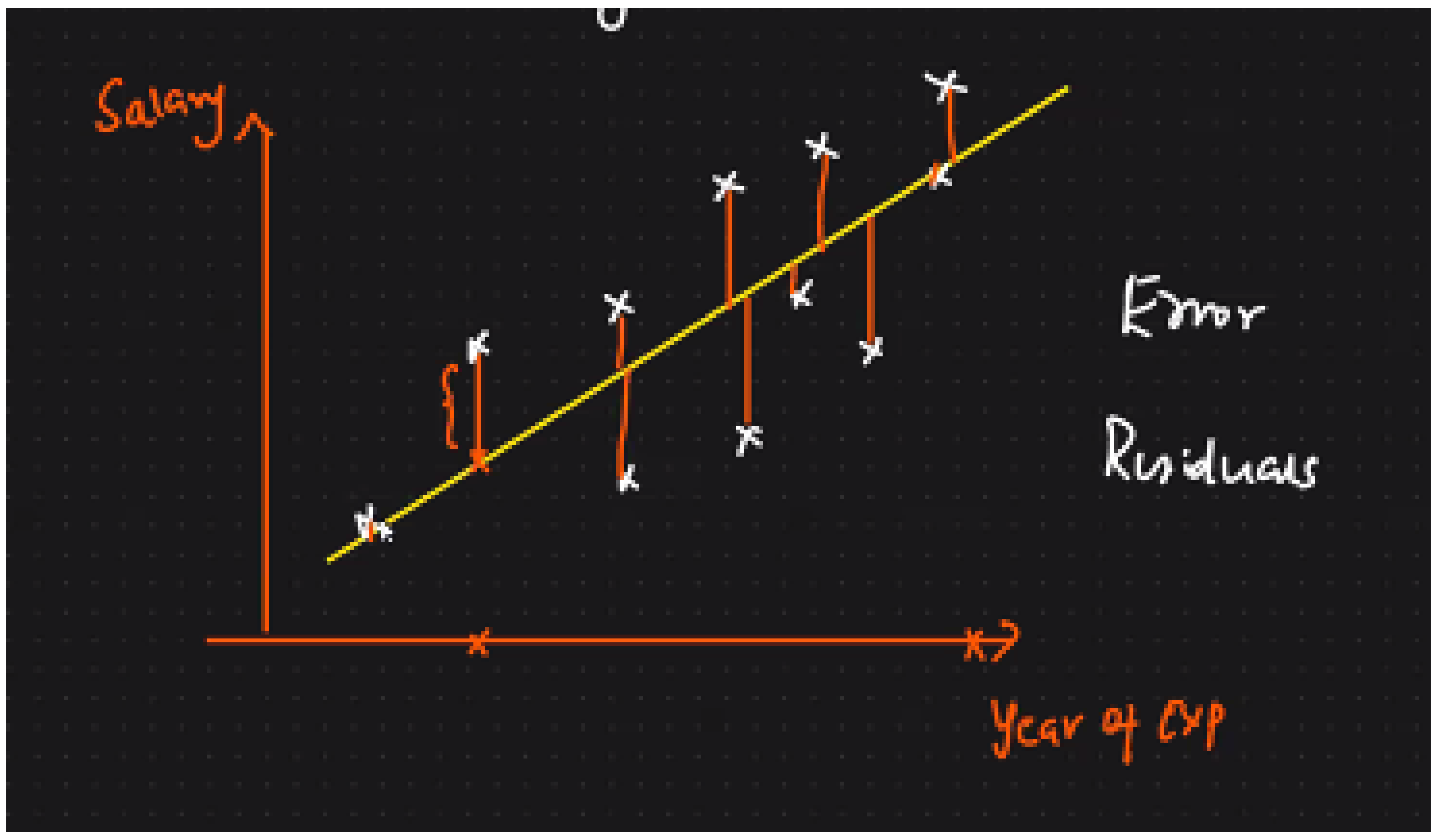
Step3: Problem Statement : Input "No of rooms" and predict "Price"

Step4: Problem Statement : Input feature "year of Experience" and Input feature "Salary" predict "Salary based on input year

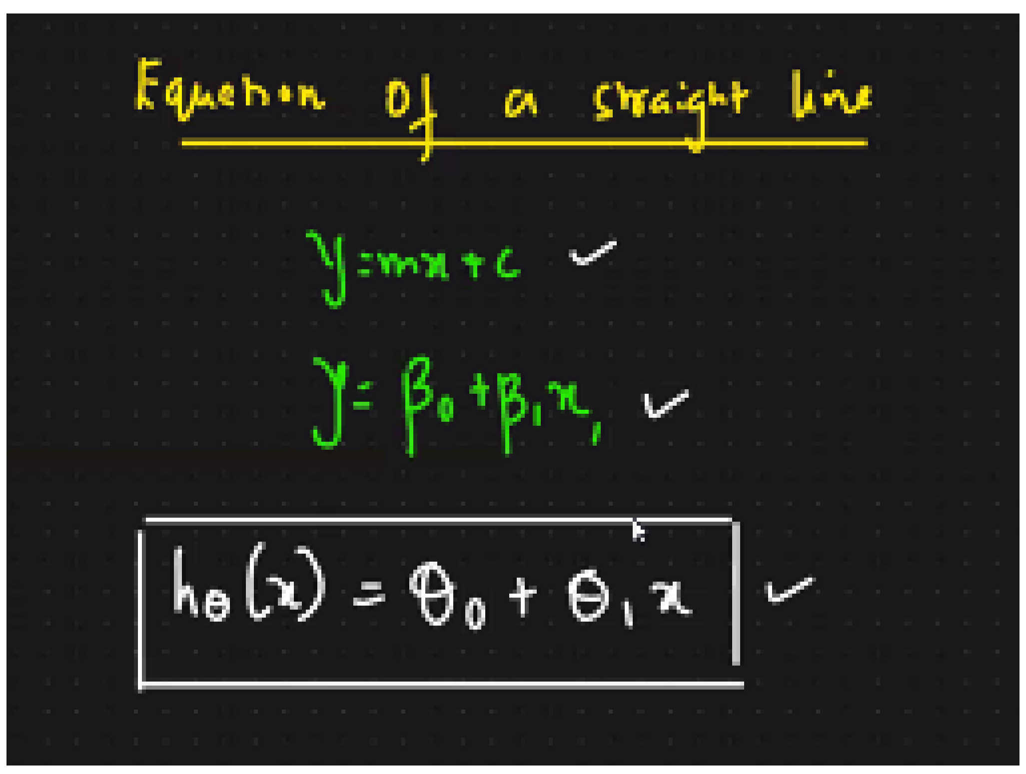
Step5: We will initialize the (Tita Not and Tita one) as the first step in building the model. We will understand what Tita is in the upcoming steps:

Step6: We must find the best fit line. Find the best fit line in such a way that the distance between the real data points and the predicted points and do the summation, it should be minimal.

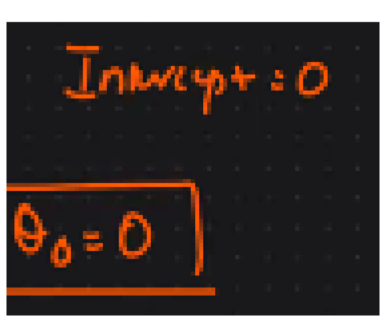
Step7: Minimal distance (**Global minima**) means the model has been trained well. This is the aim of simple linear regression



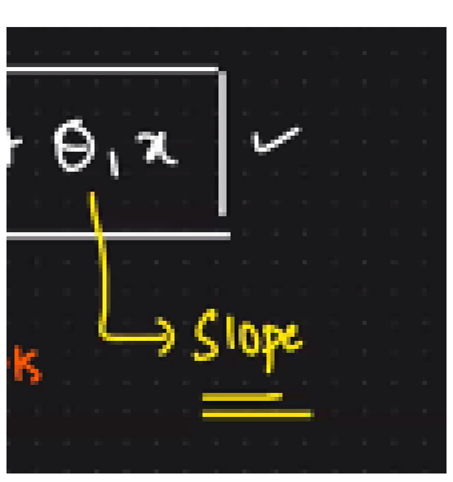
Step8: Equation of straight line is "y = mx+c" or below



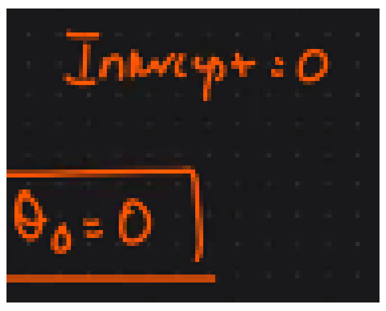
Step7: Intercept is the base line that means a default value. Intercept is denoted by "**Tita Not**"

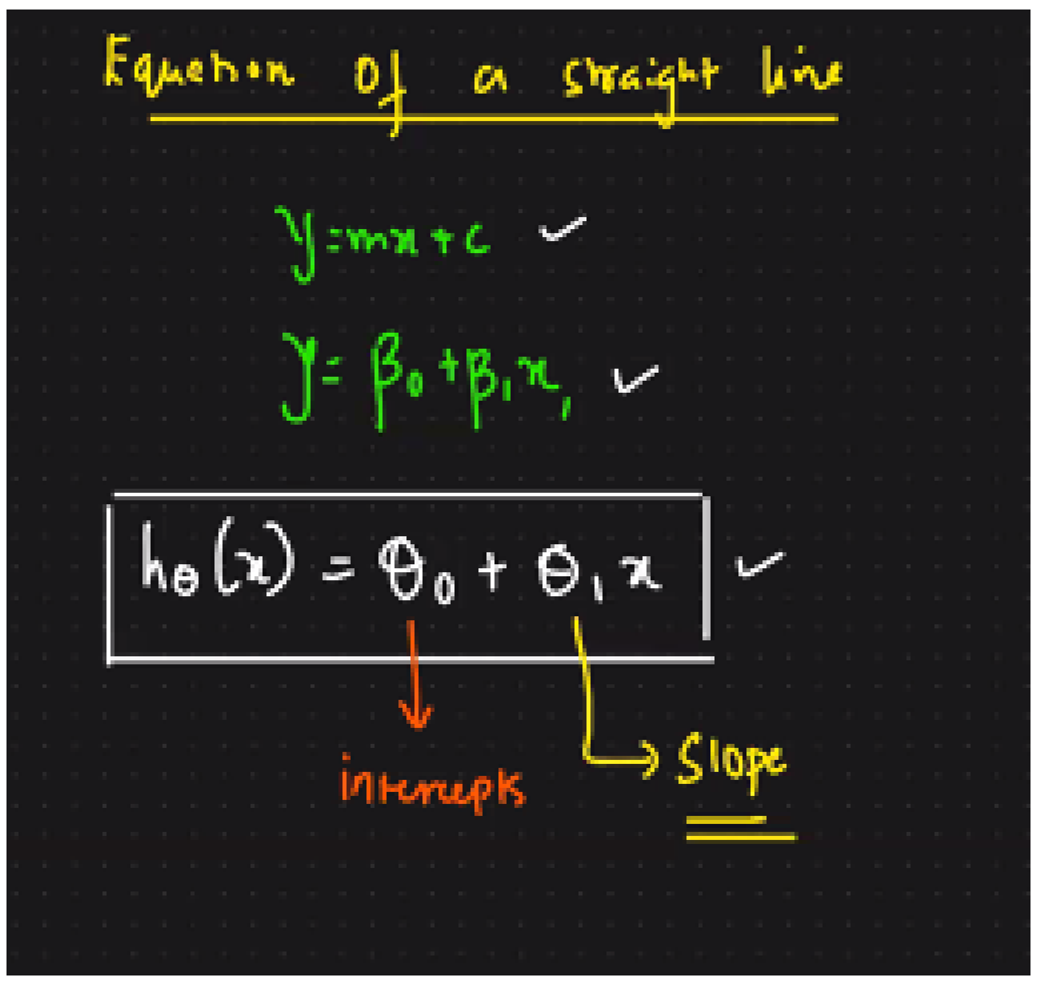


Step8: Slope is unit movement in the x-axis, what is the movement in y-axis. That is mentioned by a "Slope". Slope is denoted by

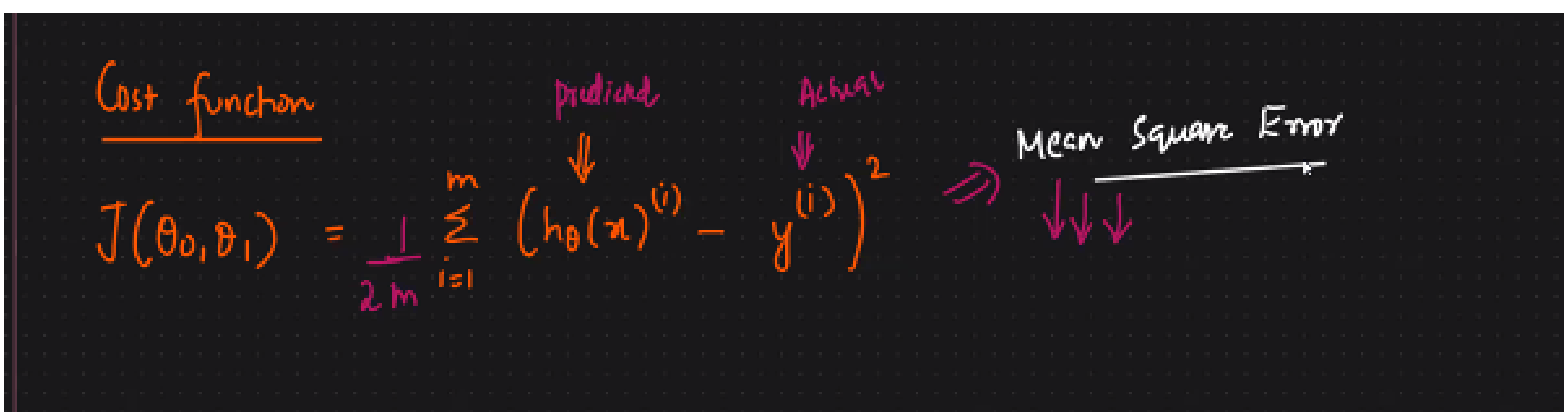


Step 9: In order to get the best fit line, we may have to change the intercept and slope i.e, (**Tita Not and Tita one**) only, as shown in the below SS.

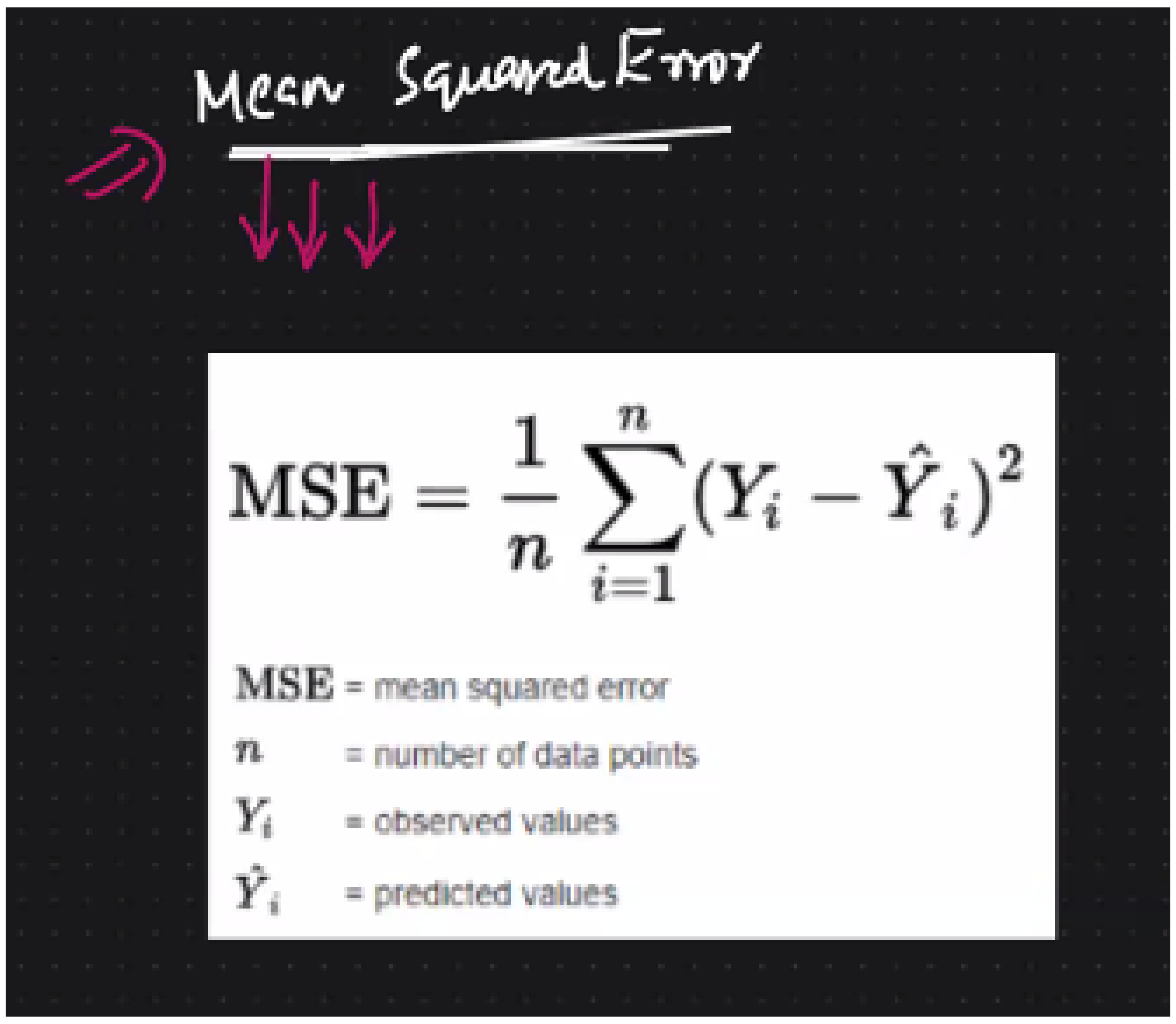




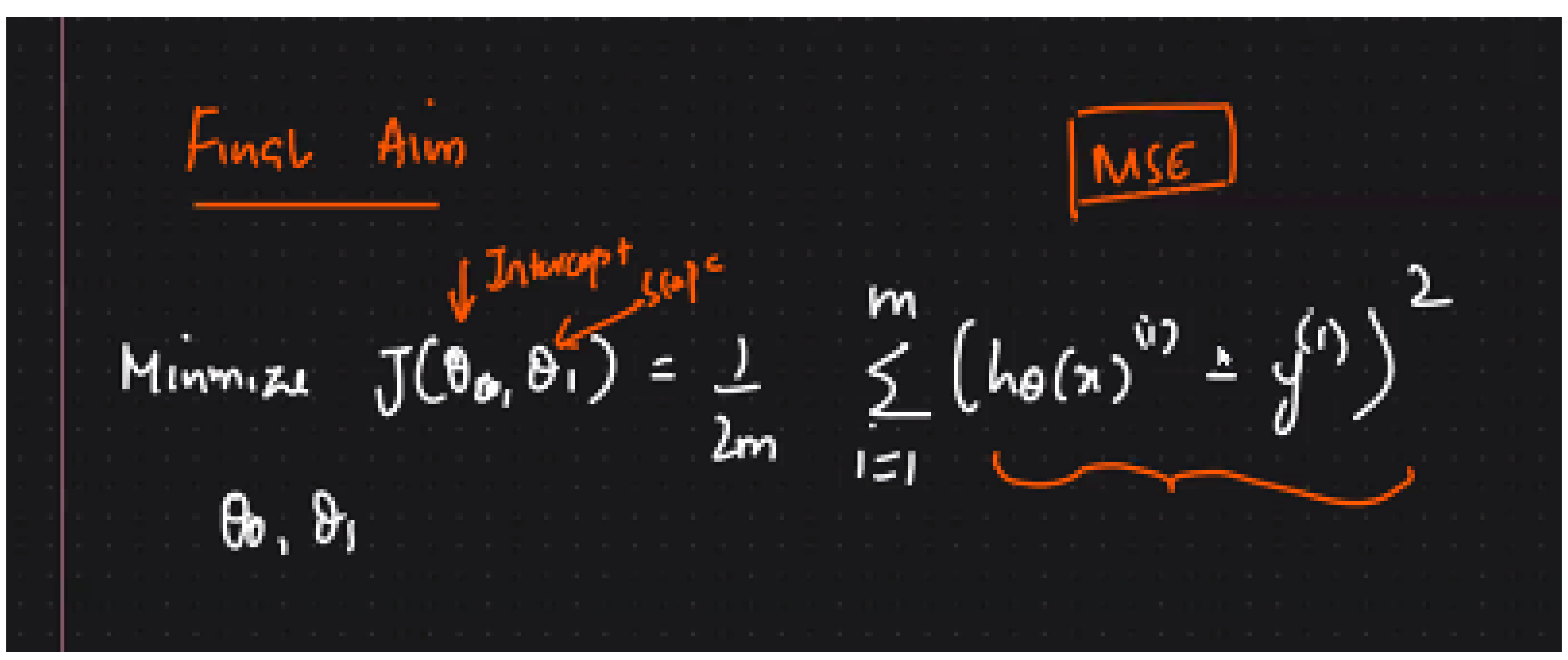
Step 10: Our main aim is to reduce/minimize the distance between the actual datapoints with the predicted data points, in order to minimize the distance, we use **Cost function or Mean squared error(MSE)**:



(Or)

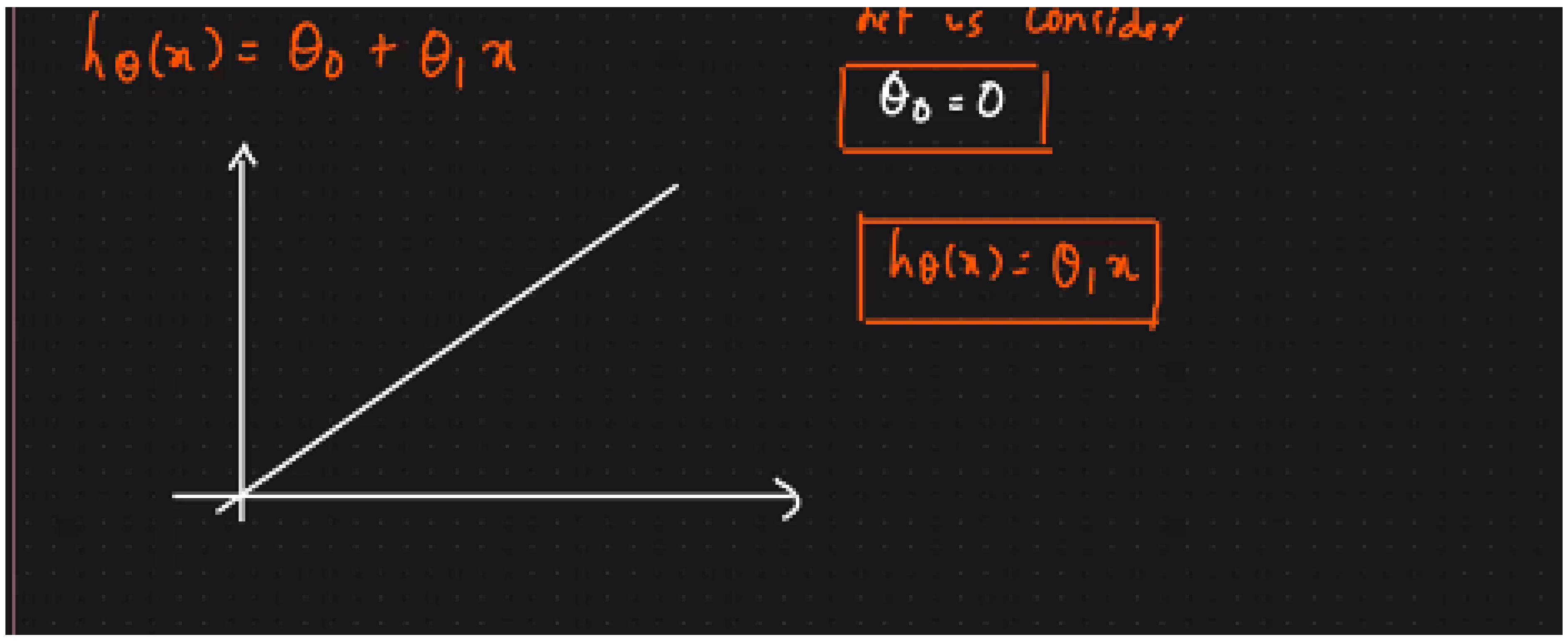


Step 11 : Final Conclusion: is by changing the Tita one(slope) and Tita not(intercept) value, we will be able to minimize the distance as shown in the below SS where MSE is Mean squared error



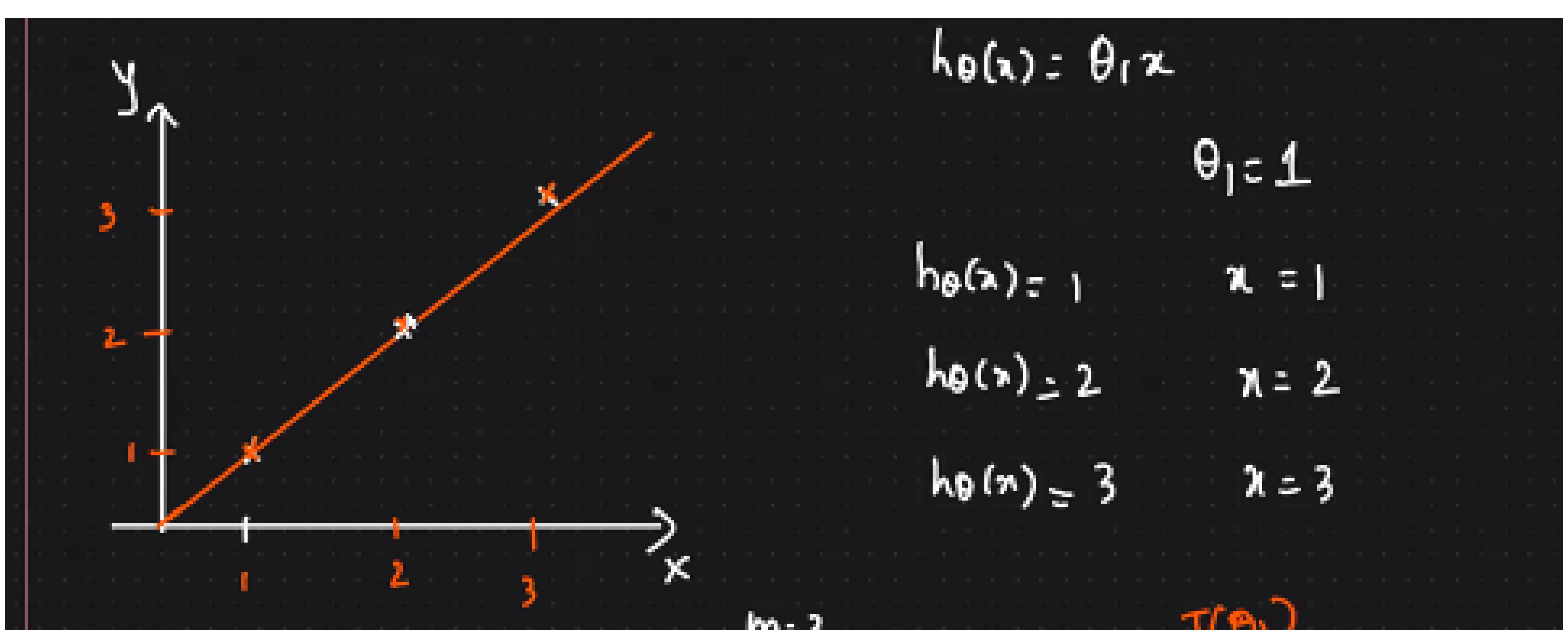
How do create the best fit lines:

Step 1 : We will initialize the (Tita Not and Tita one) as the first step in building the model as shown in the bellow SS:



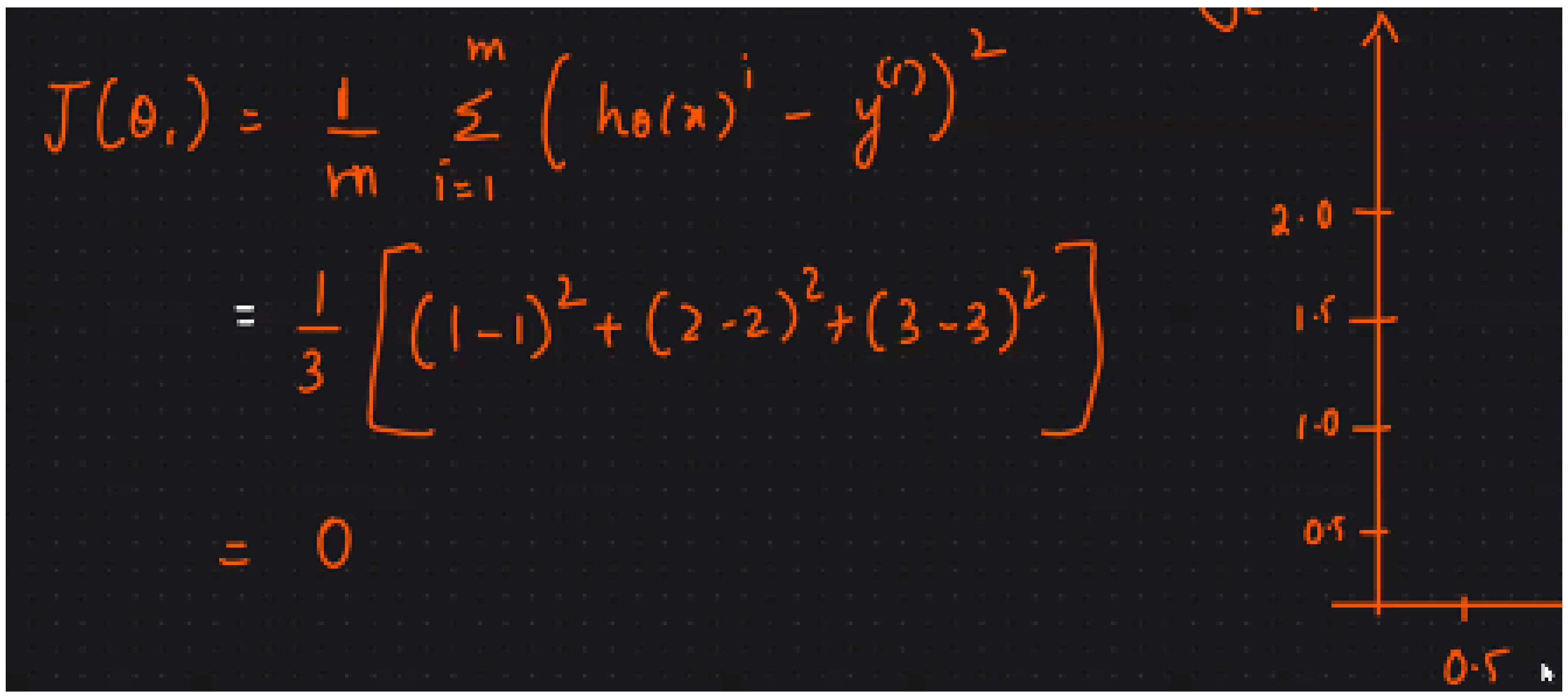
Step2: Based on the Training dataset, we plot the X axis and Y Axis

Step3: Initialize the Tita one as shown in the below SS:

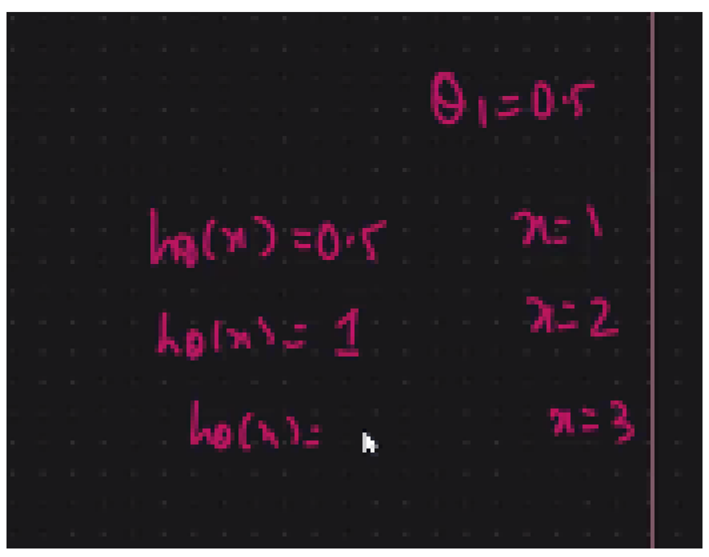


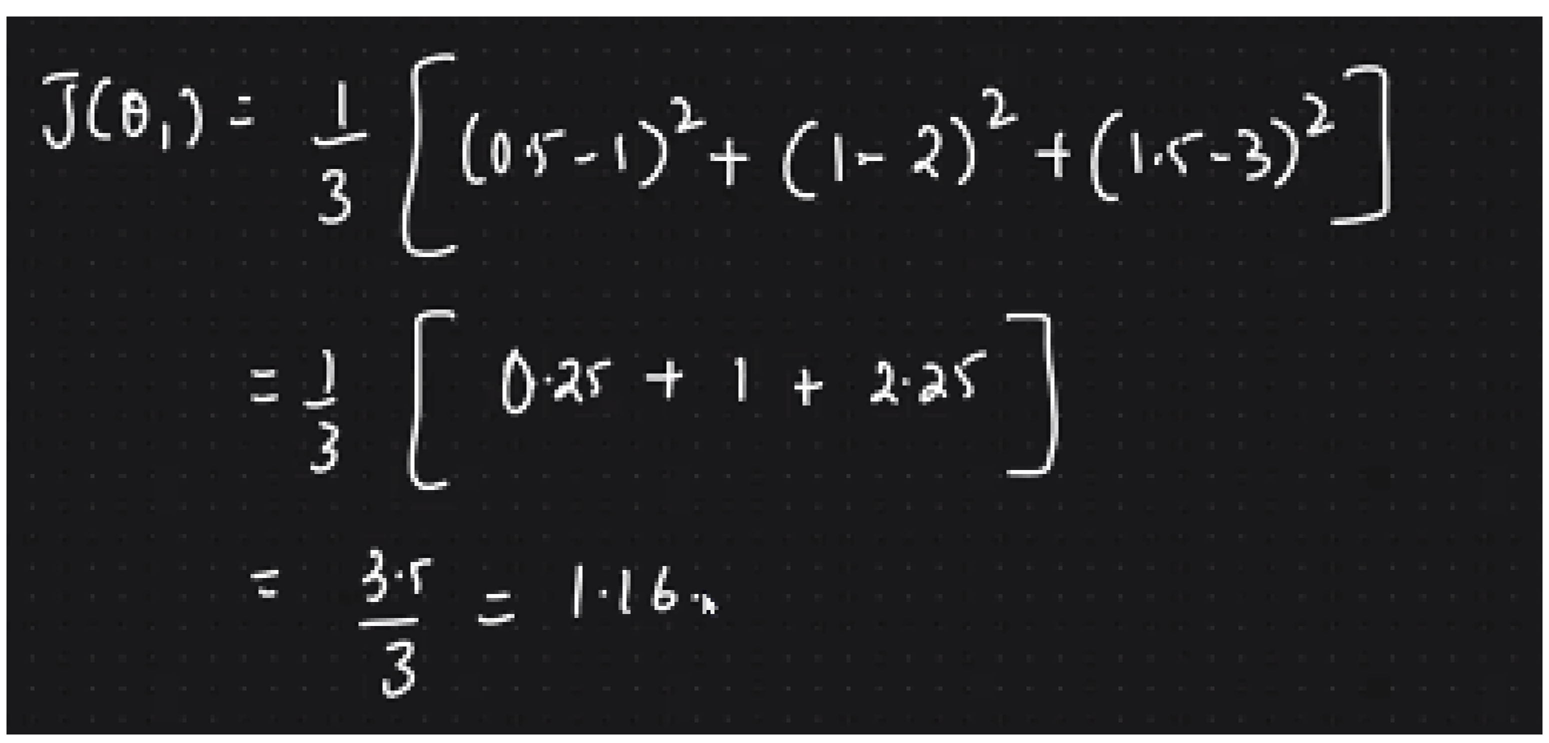
Step4: Apply the cost function or the mean squared error formula on actual data points and predicted data points

Here, M = number of datapoints



Step5: Now, we can change the Tita one value to "0.5" then so on.. To get the best fit line

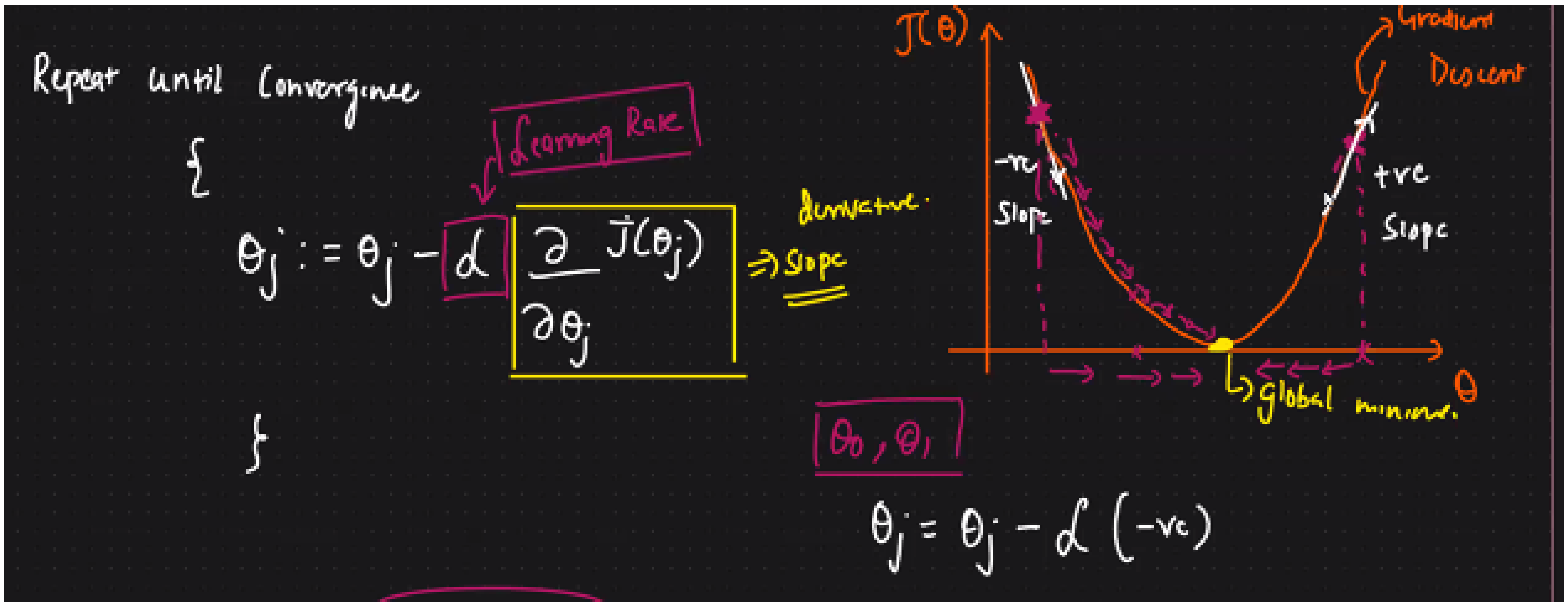




Step6: Our model should change the Tita value automatically so that we should be able to come to the datapoint i.e, (Global minima) to make best fit line. We use "**Convergence algorithm**" to optimize the Tita one value

Convergence Algorithm:

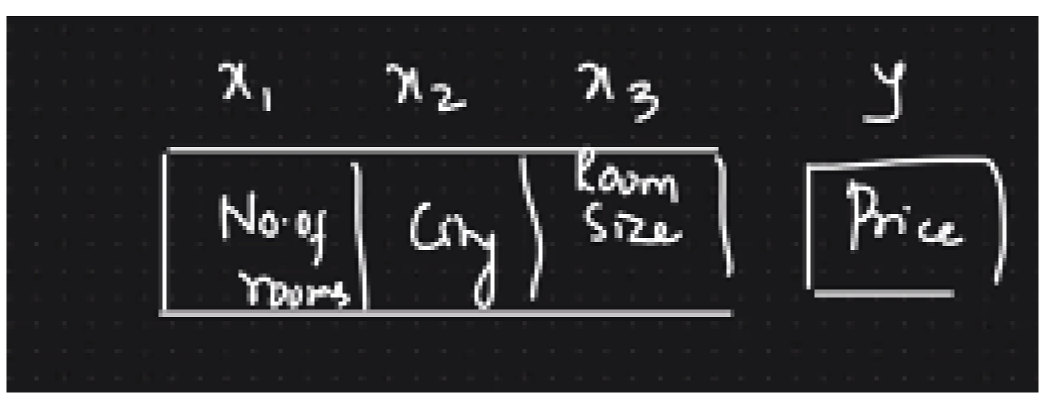
Convergence algorithm repeats until convergence



Learning rate:

It is a rate (faster or slower) at which the lines come quickly, closer to global minima datapoint to converge the best fit line.

Multiple Linear regression:



$$h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3$$

Step 1: We will have multiple independent feature and one dependent feature