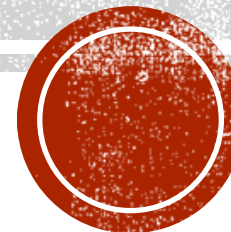


LINEAR REGRESSION



LINEAR :

linear means a straight line.

REGRESSION:

To predict the outcome (or) outputs with respect to the certain inputs.

DEFINITION:

Linear regression is **a data analysis technique that predicts the value of unknown data(dependent variable) by using another related and known data value(independent variable).**

It mathematically states that unknown or dependent variable and the known or independent variable as a linear equation.

$$y=mx+c$$

where y is a Dependent variable,
x is a Independent variable,
m is a slope, and
c is a y-intercept(constant).



LINEAR REGRESSION IN MACHINE **LEARNING:**

Linear regression is a type of supervised machine-learning algorithm that learns from the labelled datasets and maps the data points with most optimized linear functions which can be used for prediction on new datasets.

It assumes that there is a linear relationship between the input and output, meaning the output changes at a constant rate as the input changes. This relationship is represented by a straight line



TYPES OF LINEAR REGRESSION:

1. SIMPLE LINEAR REGRESSION.

2. MULTIPLE LINEAR REGRESSION.

- 1. Simple linear regression.

- Simple linear regression uses one independent variable to predict a dependent variable
- $Y = mx + c$

- 2. Multiple linear regression.

- Multiple linear regression uses two or more independent variables to predict a dependent variable
- $y = m_1x_1 + m_2x_2 + \dots + m_nx_n + c$



Example:

Temperature (°C)	Ice Cream Sales (\$)
20	120
22	135
25	160
27	180
30	200
32	215
35	240

Sol:

$$y = mx + c$$

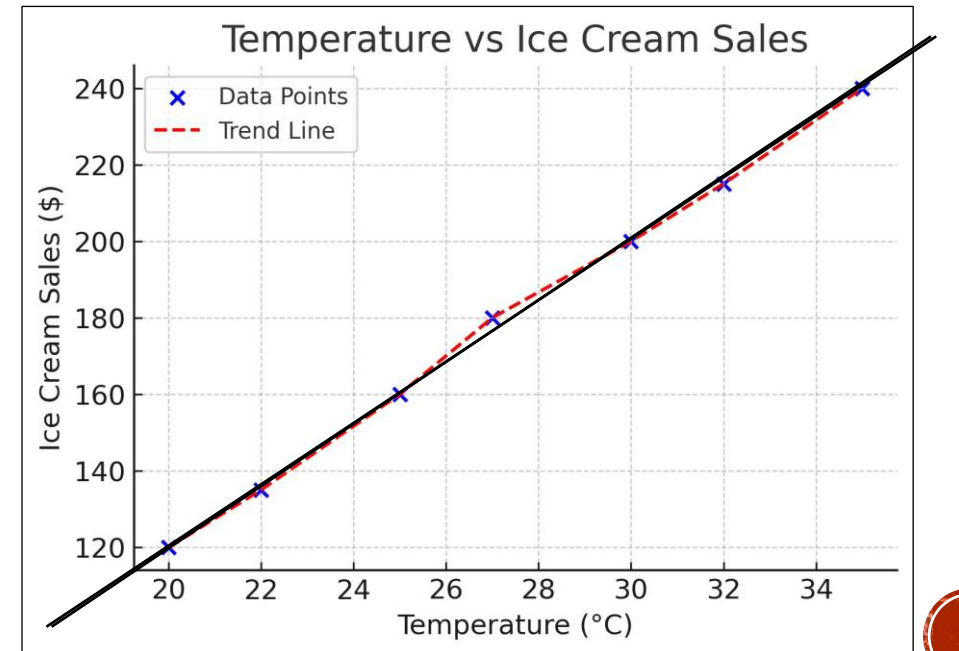
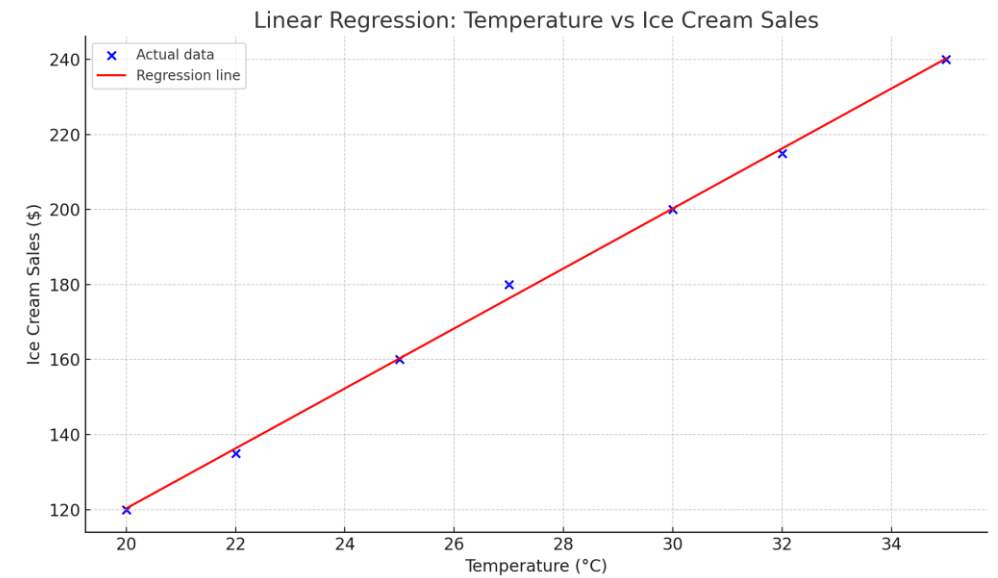
$$m = [n * \Sigma(x y) - \Sigma x * \Sigma y] / [n * \Sigma(x^2) - (\Sigma x)^2]$$

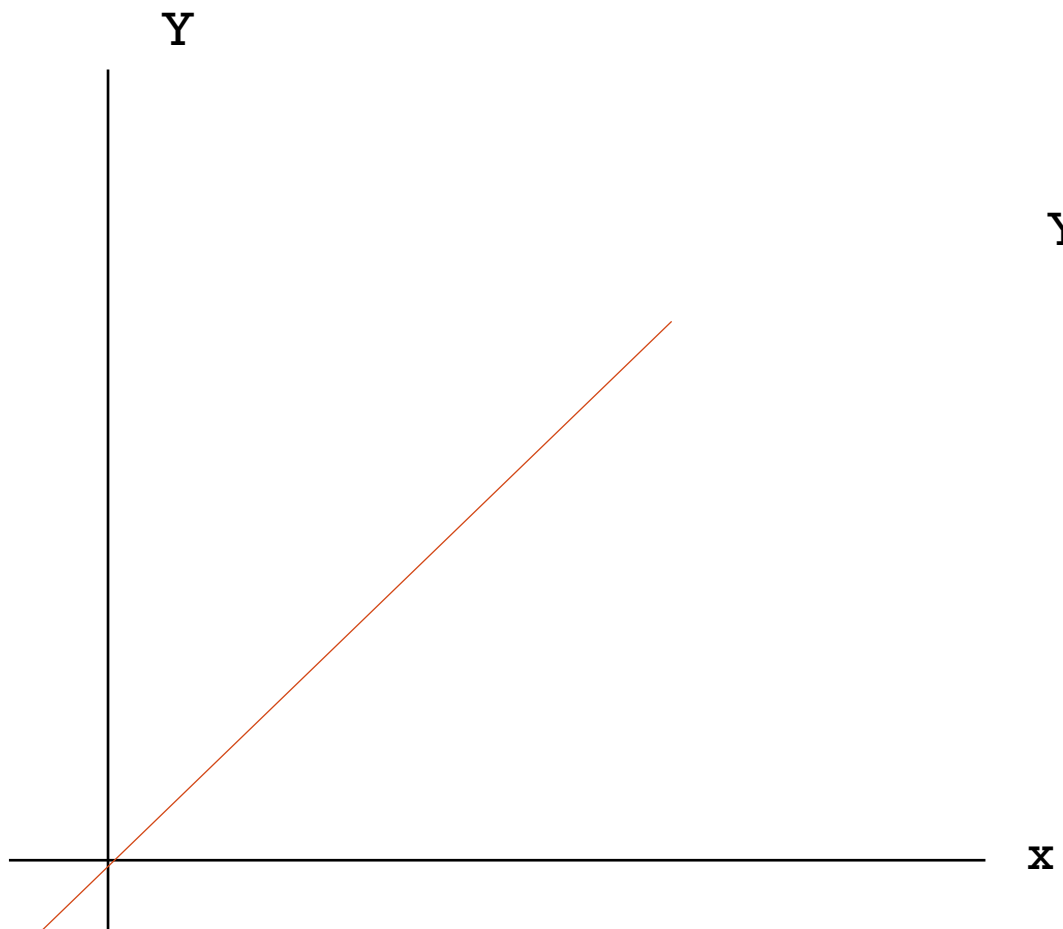
$$c = (\Sigma y - m \Sigma x) / n$$

$$m = [(7 * 35510) - (191 * 1250)] / [(7 * 5387) - 191^2]$$
$$= 7.997$$

$$C = [1250 - (7.997 * 191)] / 7$$
$$= -39.63$$

$$Y = 7.997x - 39.63$$





$$Y = mx + c$$



Example:

S.No	product1 (x_1)	product2 (x_2)	sales (y)
1	1	4	1
2	2	5	6
3	3	8	8
4	4	2	12

Sol:

$$y = m_1x_1 + m_2x_2 + \dots + m_nx_n + c$$

$$y = y = m_1x_1 + m_2x_2 + m_0$$

now,

$$X = \begin{bmatrix} 1 & 1 & 4 \\ 1 & 2 & 5 \\ 1 & 3 & 8 \\ 1 & 4 & 2 \end{bmatrix}, \quad y = \begin{bmatrix} 1 \\ 6 \\ 8 \\ 12 \end{bmatrix} \quad \& \quad m = \begin{bmatrix} m_0 \\ m_1 \\ m_2 \end{bmatrix}$$

$$m = [(X^T X)^{-1} X^T] y$$



THANK YOU

