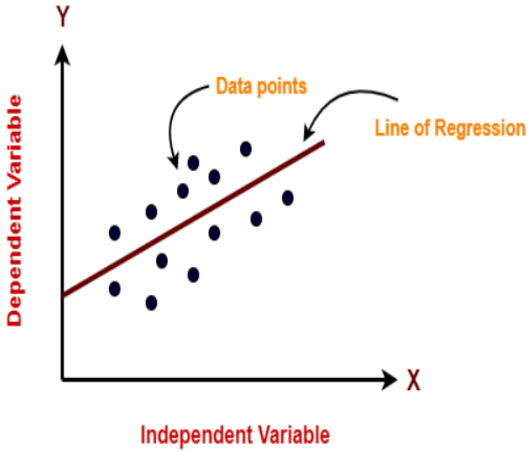
Simple Linear Regression

Linear Regession

- Linear Regression is a supervised machine learning algorithm.
- It tries to find out the best linear relationship that describes the data you have.
- It assumes that there exists a linear relationship between a dependent variable and independent variable(s).
- The value of the dependent variable of a linear regression model is a continuous value i.e. real numbers.

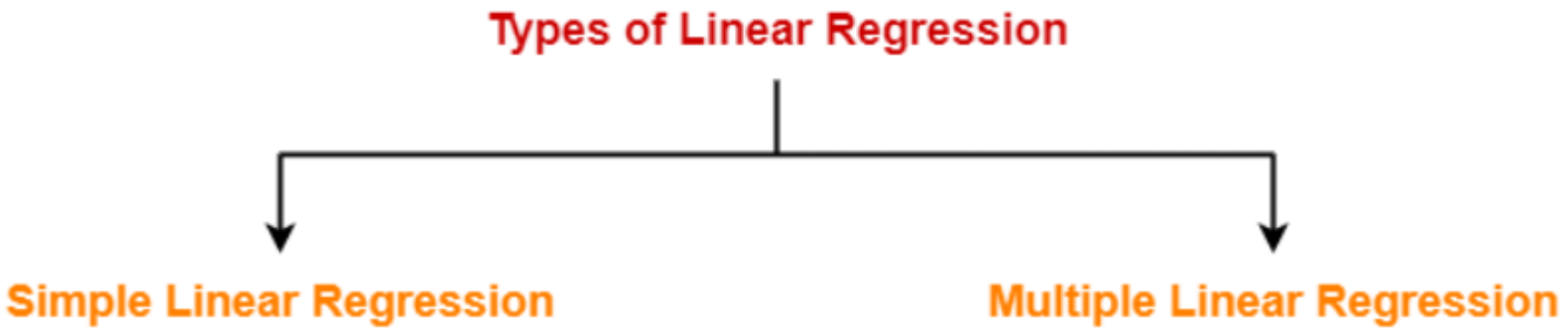
Linear Regession

- **Representing Linear Regression Model**
  - Represents the linear relationship between a dependent variable and independent variable(s) via a sloped straight line.
  - The sloped straight line representing the linear relationship that fits the given data best is called as a regression line.
  - It is also called as best fit line.



Linear Regession

- Based on the number of independent variables, there are two types of linear regression



Simple Linear Regession

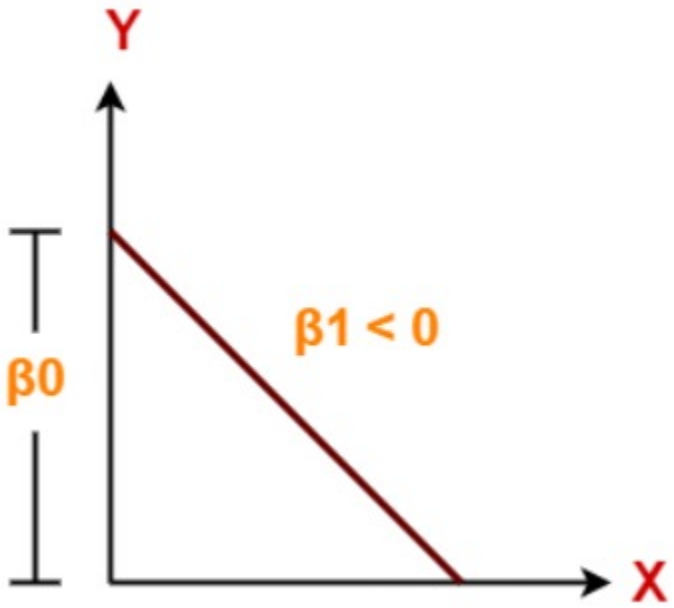
- the dependent variable depends only on a single independent variable.
- The model is represented as:

$$\mathbf{Y = \beta_0 + \beta_1 X}$$

  - Y is a dependent variable.
  - X is an independent variable.
  - β_0 and β_1 are the regression coefficients.
  - β_0 is the intercept or the bias that fixes the offset to a line.
  - β_1 is the slope or weight that specifies the factor by which X has an impact on Y.

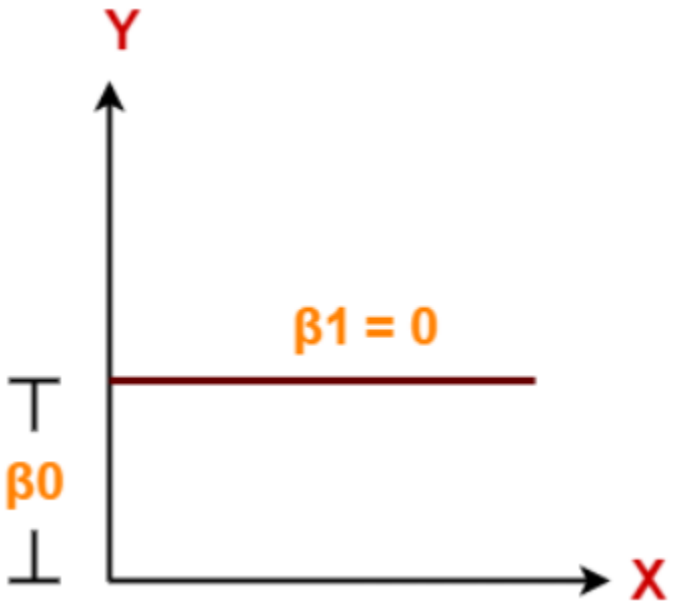
SimpleLinear Regession

- **Case-01: $\beta_1 < 0$**
  - It indicates that variable X has negative impact on Y.
  - If X increases, Y will decrease and vice-versa.



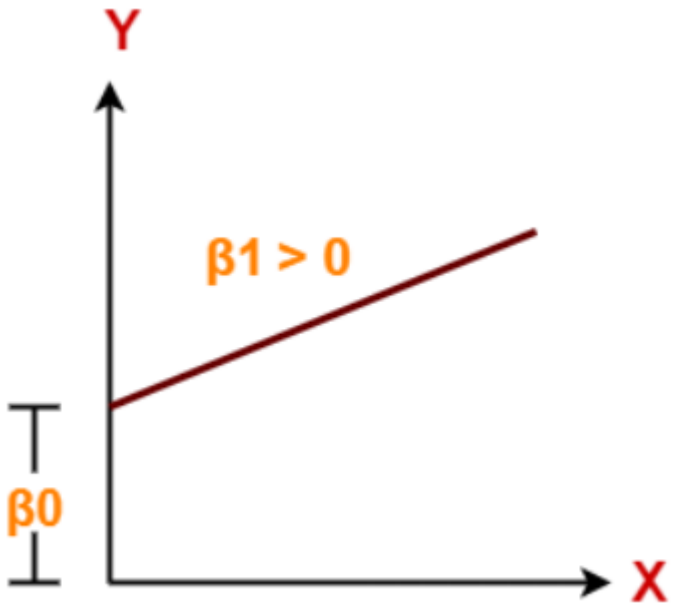
SimpleLinear Regession

- **Case-02: $\beta_1 = 0$**
  - It indicates that variable X has no impact on Y.
  - If X changes, there will be no change in Y.



SimpleLinear Regession

- **Case-03: $\beta_1 > 0$**
  - It indicates that variable X has positive impact on Y.
  - If X increases, Y will increase and vice-versa.



$$y = a\,x + b$$

where a and b are given by

$$a = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

$$b = \frac{1}{n}(\sum_{i=1}^{n} y_i - a\sum_{i=1}^{n} x_i)$$