Linear Regression

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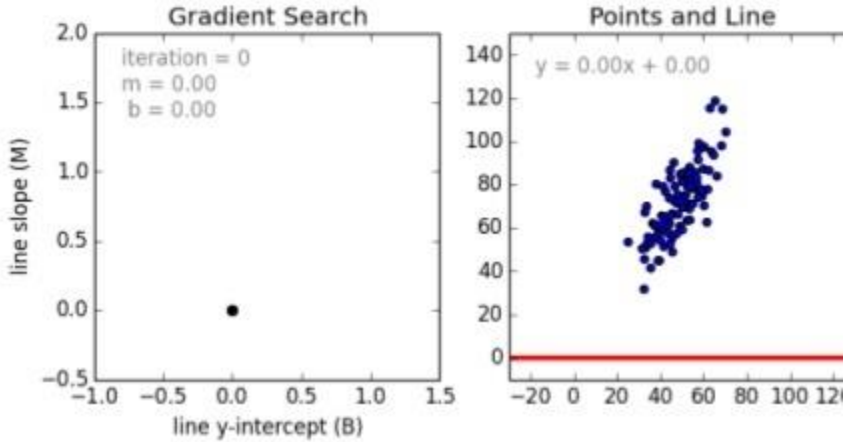
Linear Regression Algorithm

Agenda for Today's Session

- What is Regression?
- Regression Use-case
- Types of Regression – Linear vs Logistic Regression
- What is Linear Regression?
- Finding best fit regression line using Least Square Method
- Checking goodness of fit using R squared Method
- Implementation of Linear Regression using Python
  - Linear Regression Algorithm using Python from scratch
  - Linear Regression Algorithm using Python (scikit lib)



What is Regression?

"Regression analysis is a form of predictive modelli
technique which investigates the relationship betwe
a **dependent** and **independent variable**"

Uses of Regression

Three major uses for regression analysis are

- Determining the strength of predictors
- Forecasting an effect, and
- Trend forecasting

Linear vs Logistic Regression

Basis	Linear Regression	Logistic Regression
Core Concept	The data is modelled using a straight line	The probability of some obtained event is represented as a linear function of a combinatio predictor variables.
Used with	Continuous Variable	Categorical Variable
Output/Prediction	Value of the variable	Probability of occurrenc event
Accuracy and Goodness of fit	measured by loss, R squared, Adjusted R squared etc.	Accuracy, Precision, Rec F1 score, ROC curve, Confusion Matrix, etc

What is Linear Regression?

"Linear Regression is a method to predict dependent variable (
based on values of independent variables (X). It can be used for
cases where we want to predict some continuous quantity."

Linear Regression

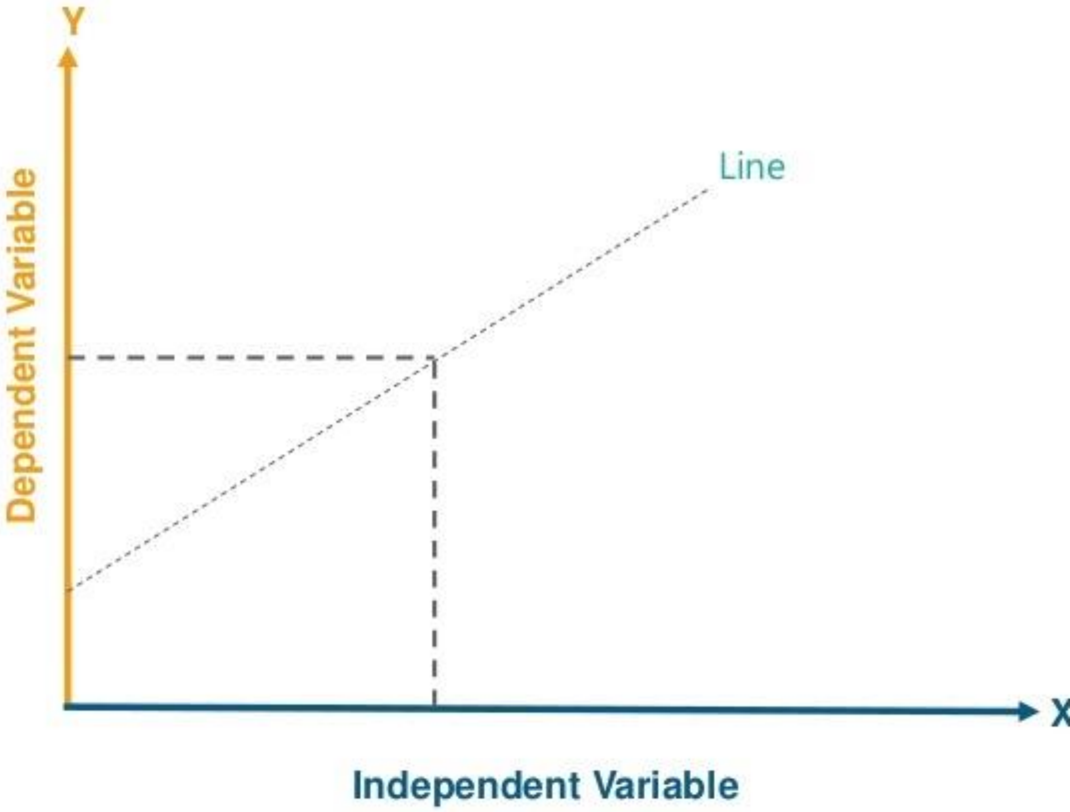
Selection Criteria

- Classification and Regression Capabilities
- Data Quality
- Computational Complexity
- Comprehensible and Transparent

Where is Linear Regression used?

- Evaluating Trends and Sales Estimates
- Analyzing the Impact of Price Changes
- Assessment of risk in financial services and insurance domain

Understanding Linear Regression Algorithm



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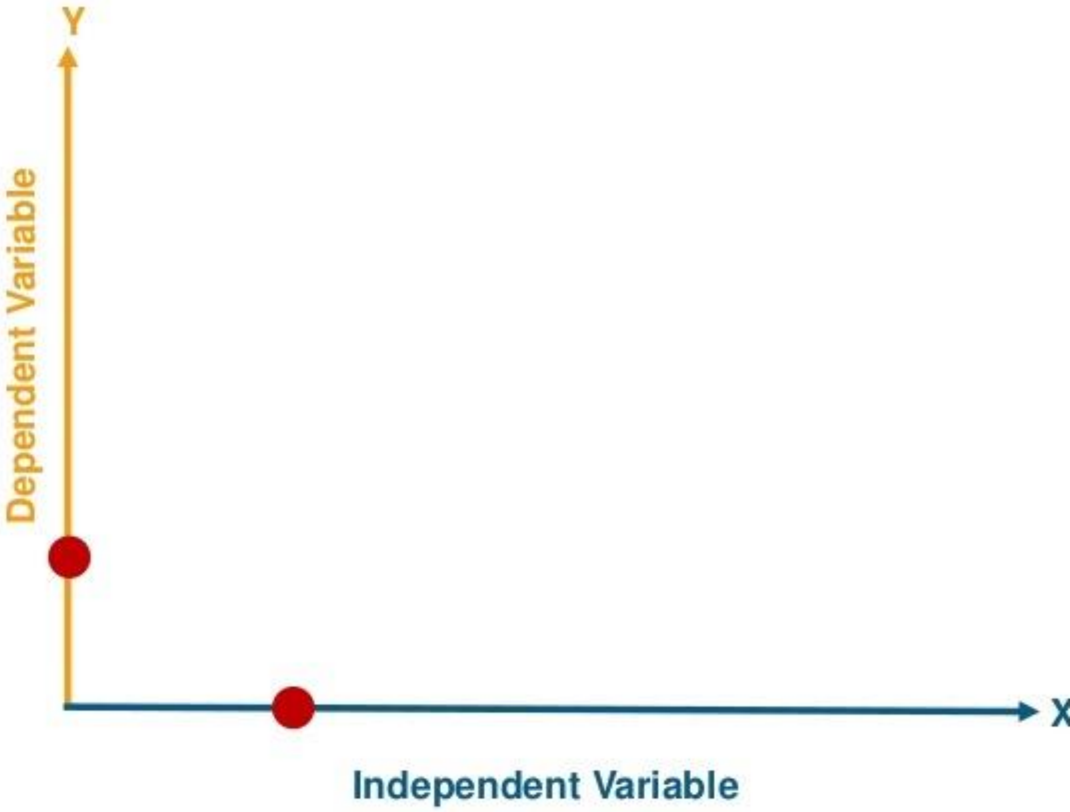
Understanding Linear Regression Algorithm



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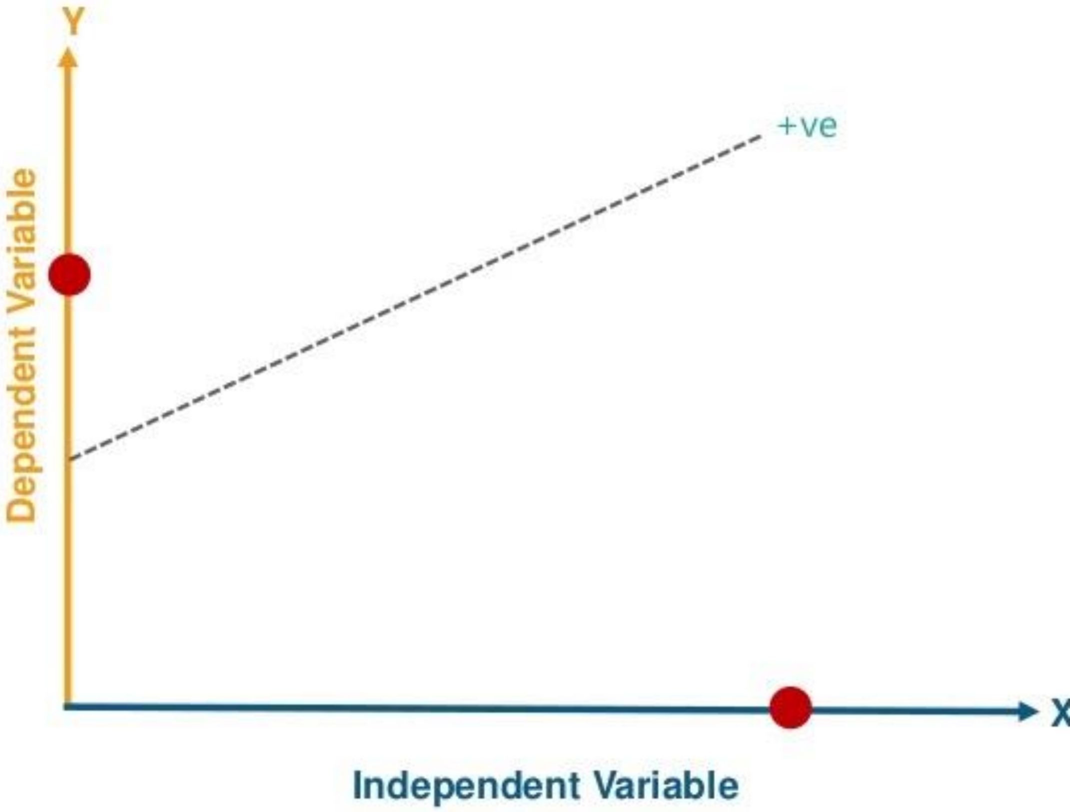

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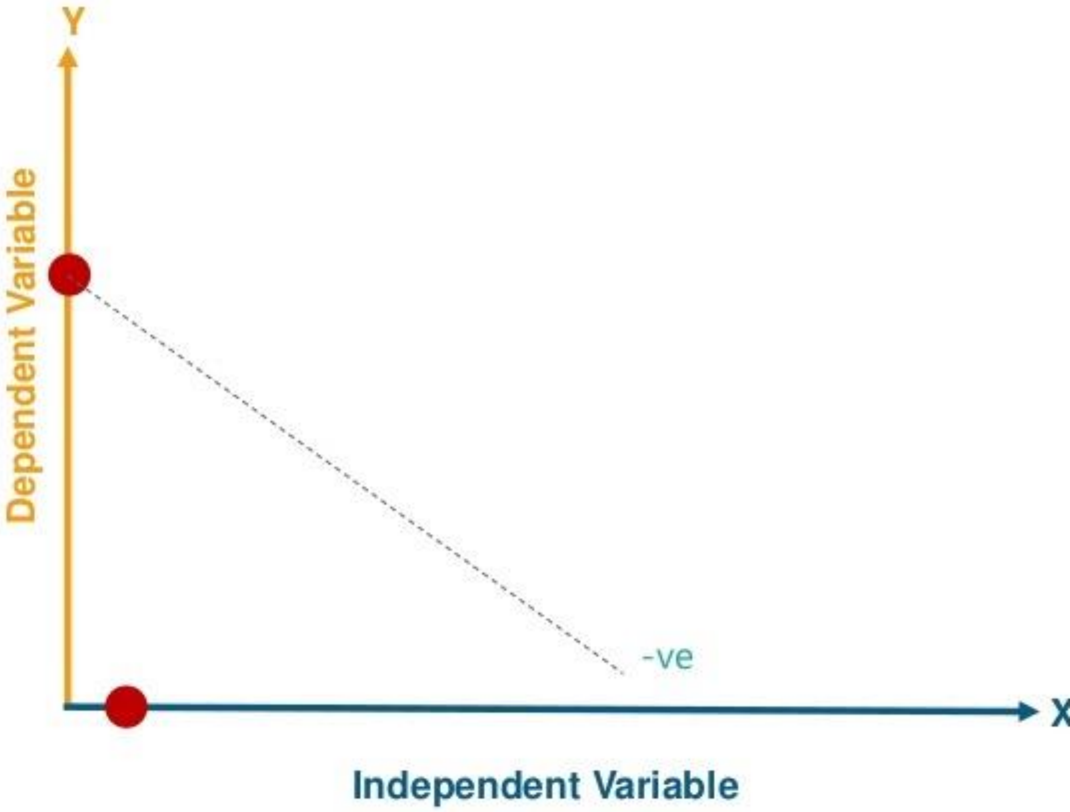

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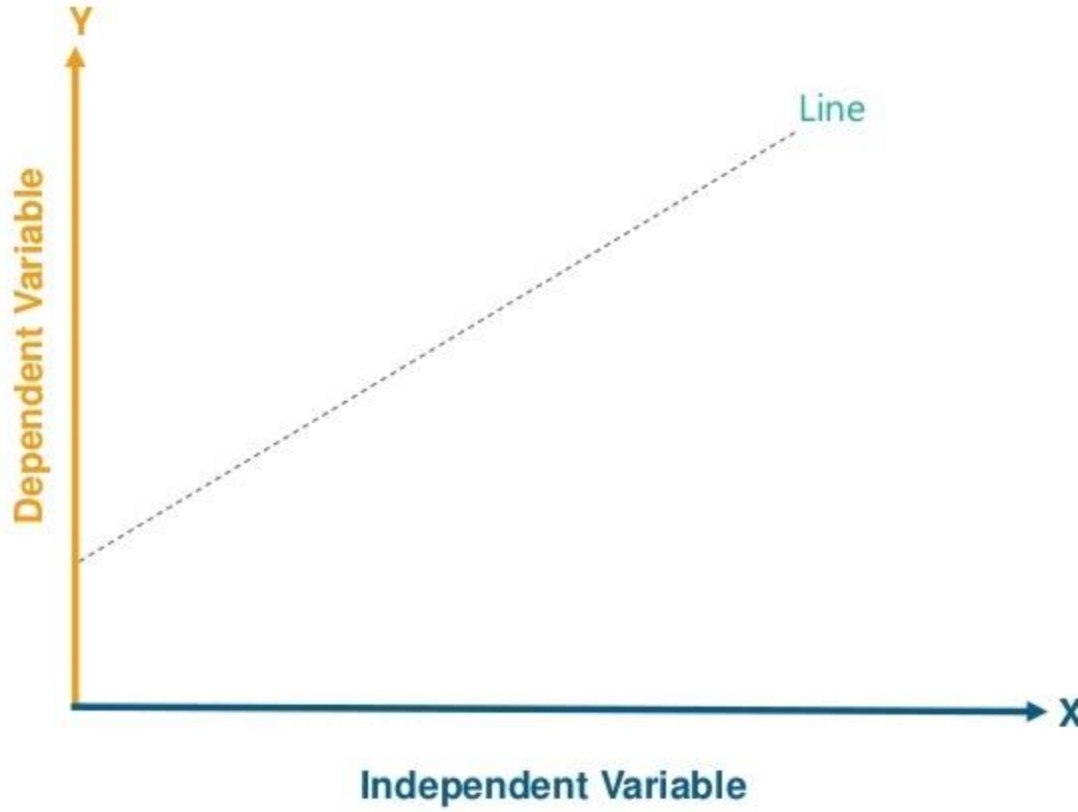

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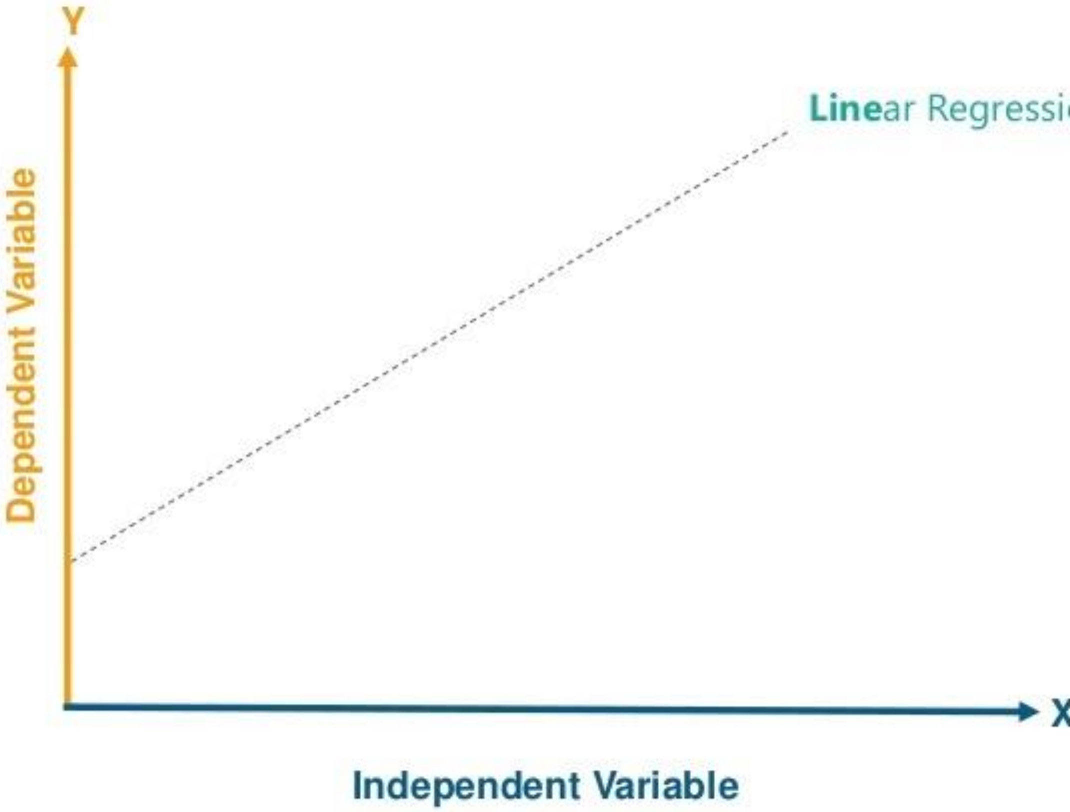

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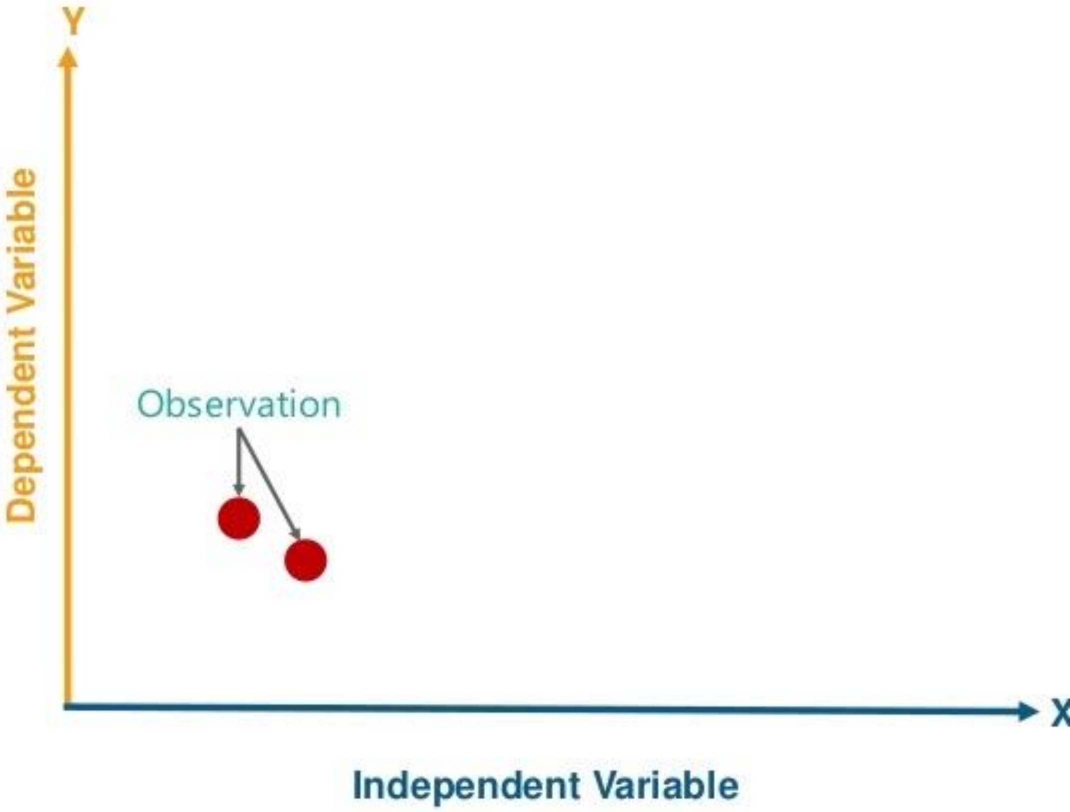

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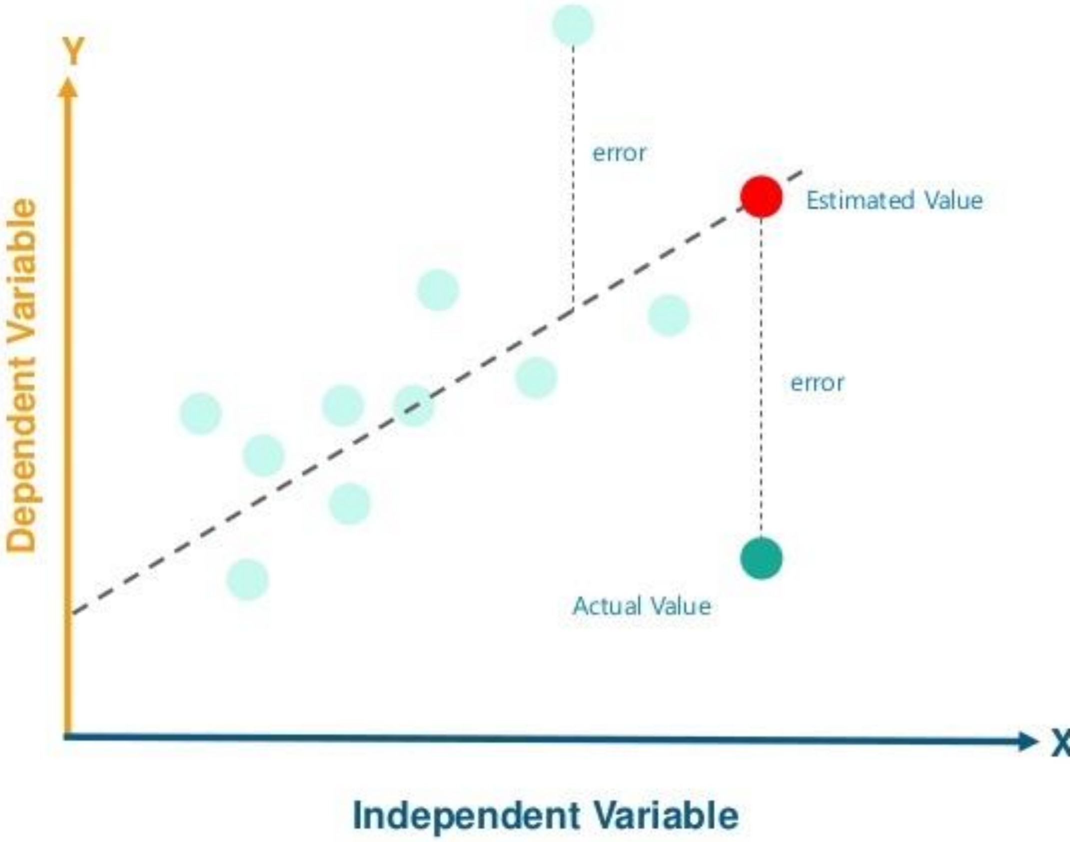

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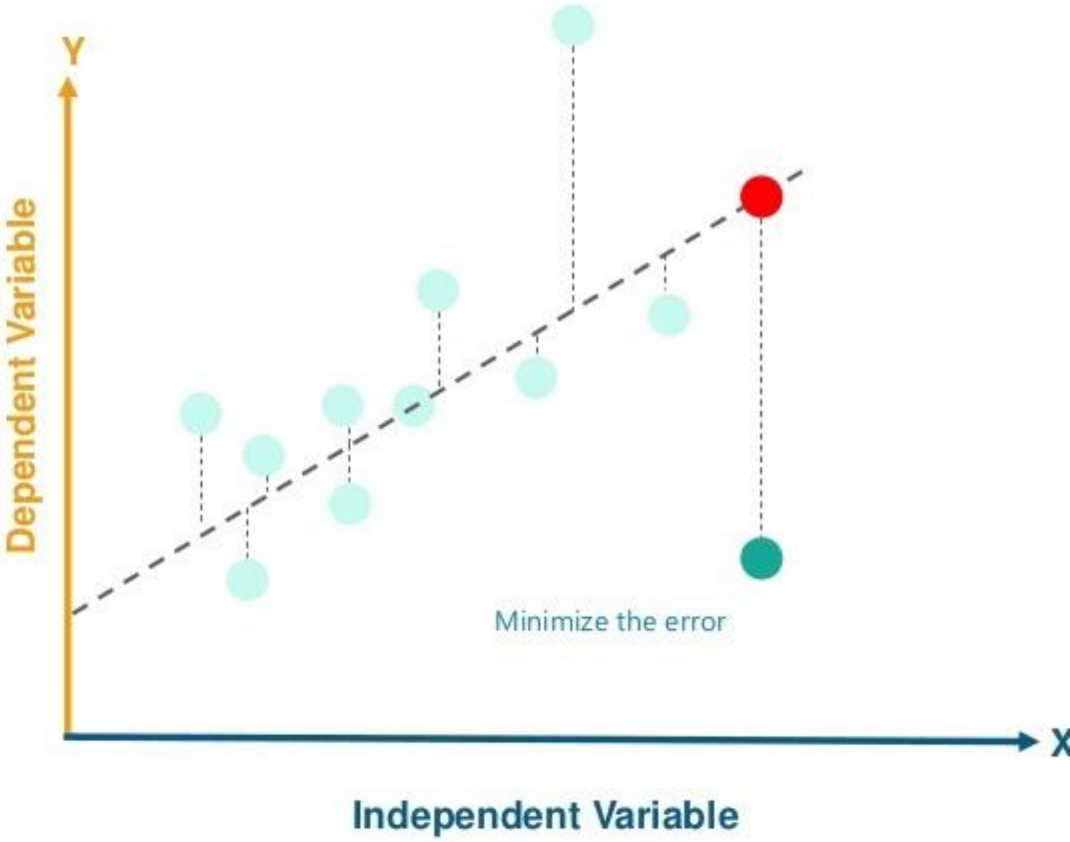

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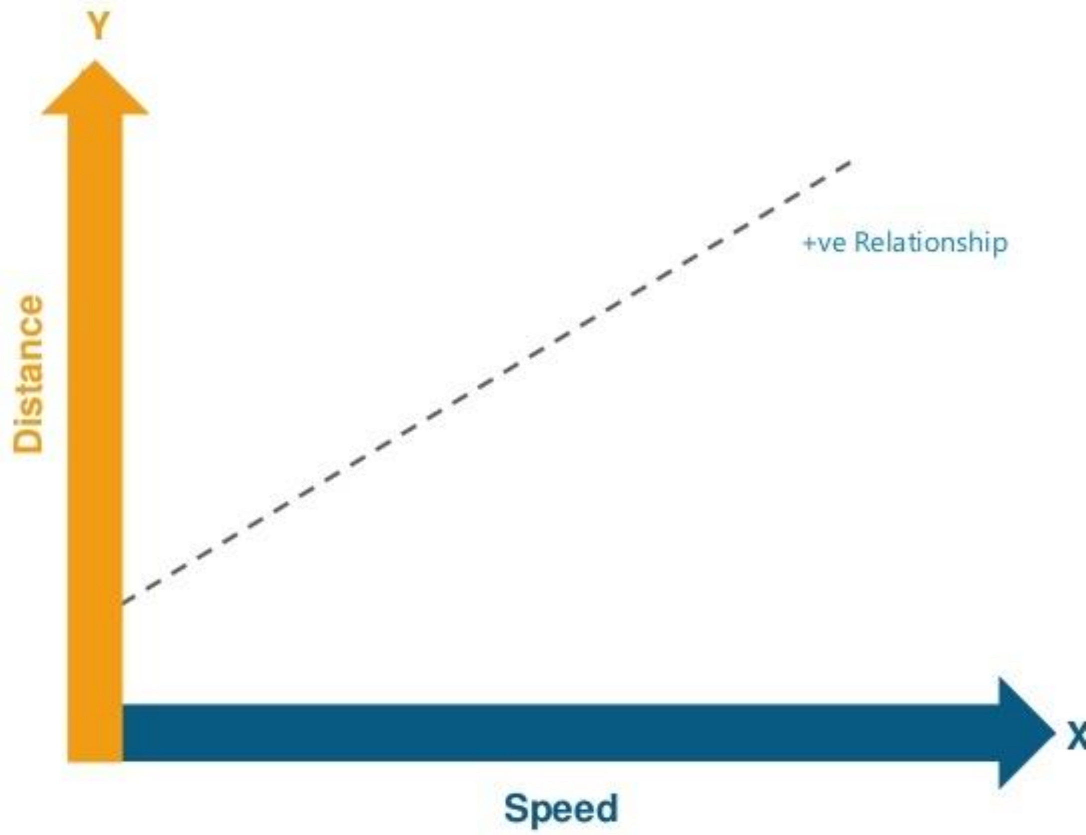

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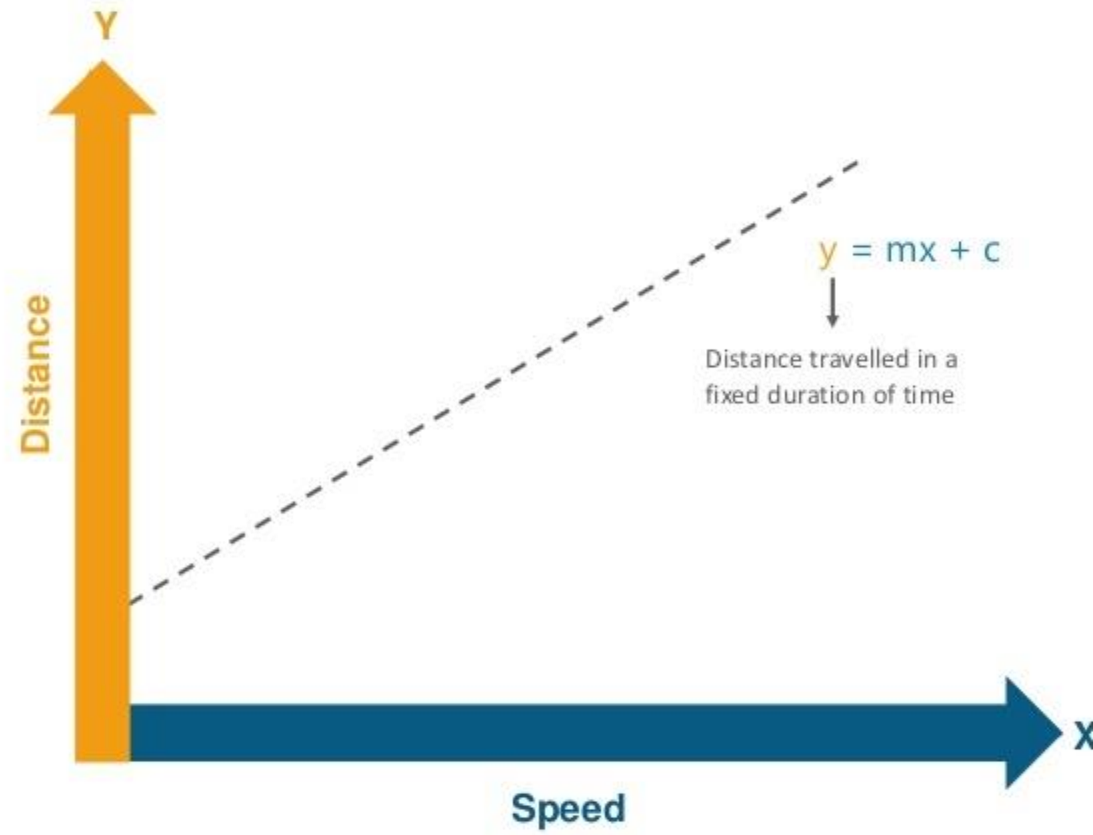

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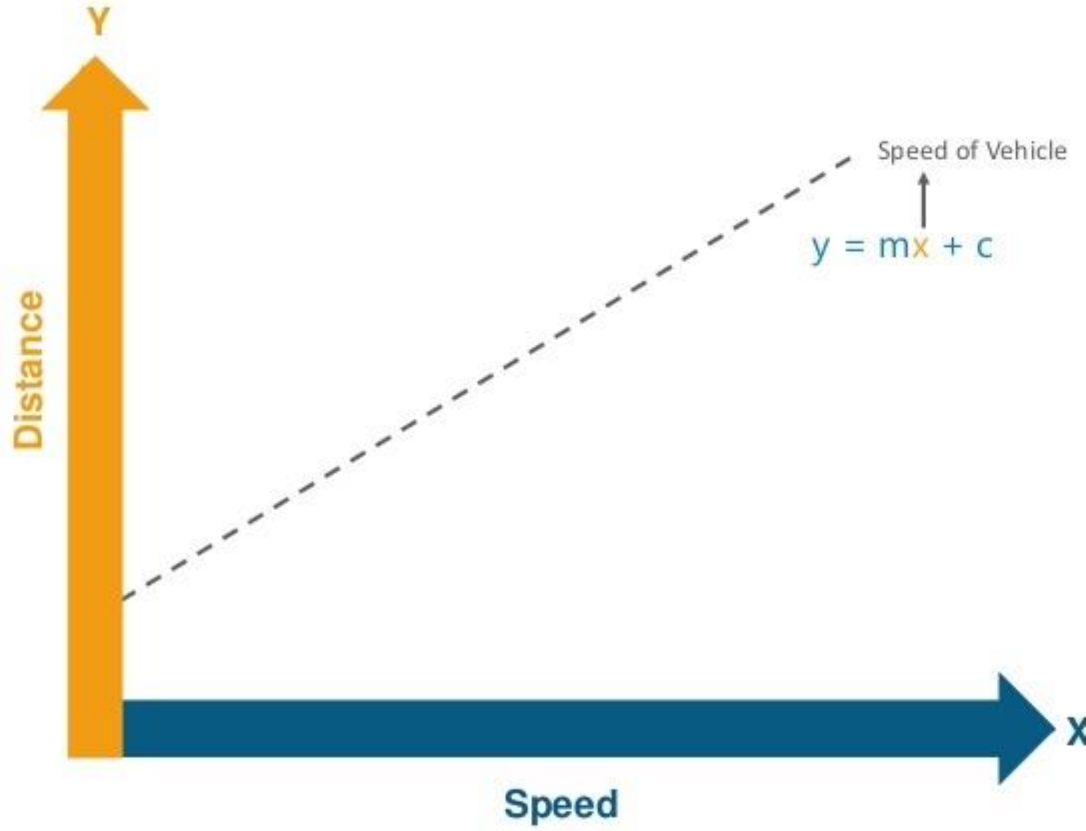

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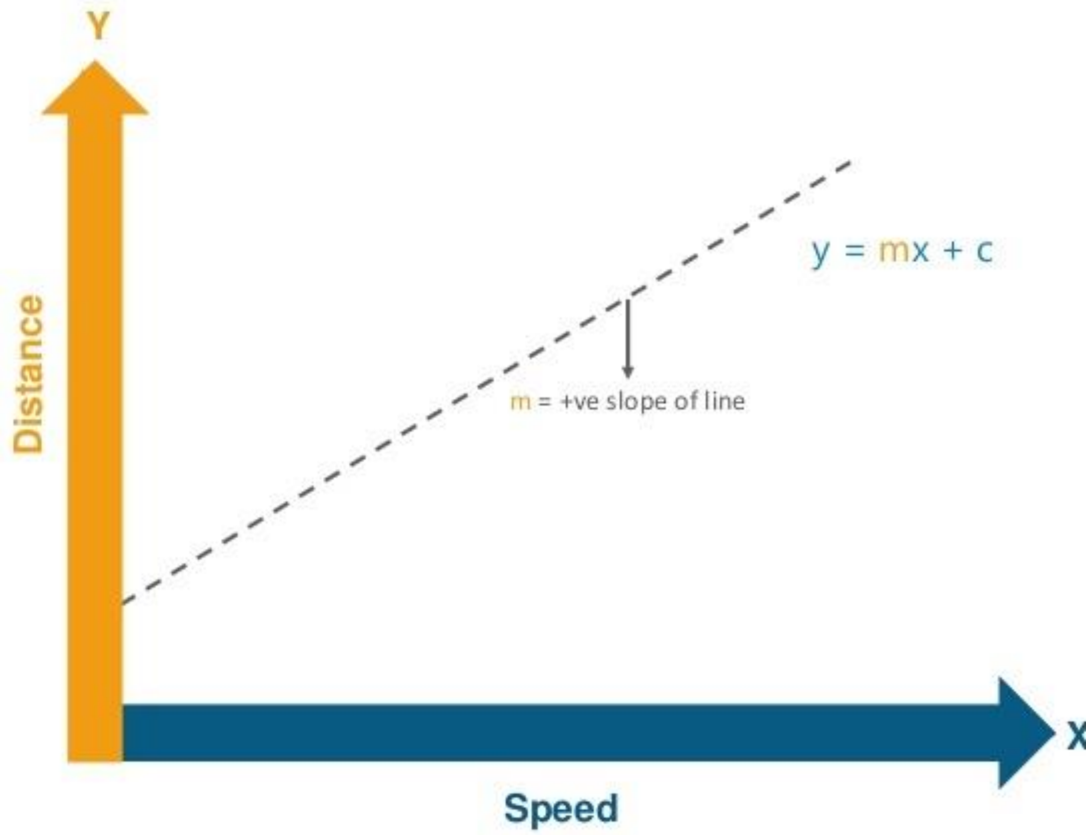

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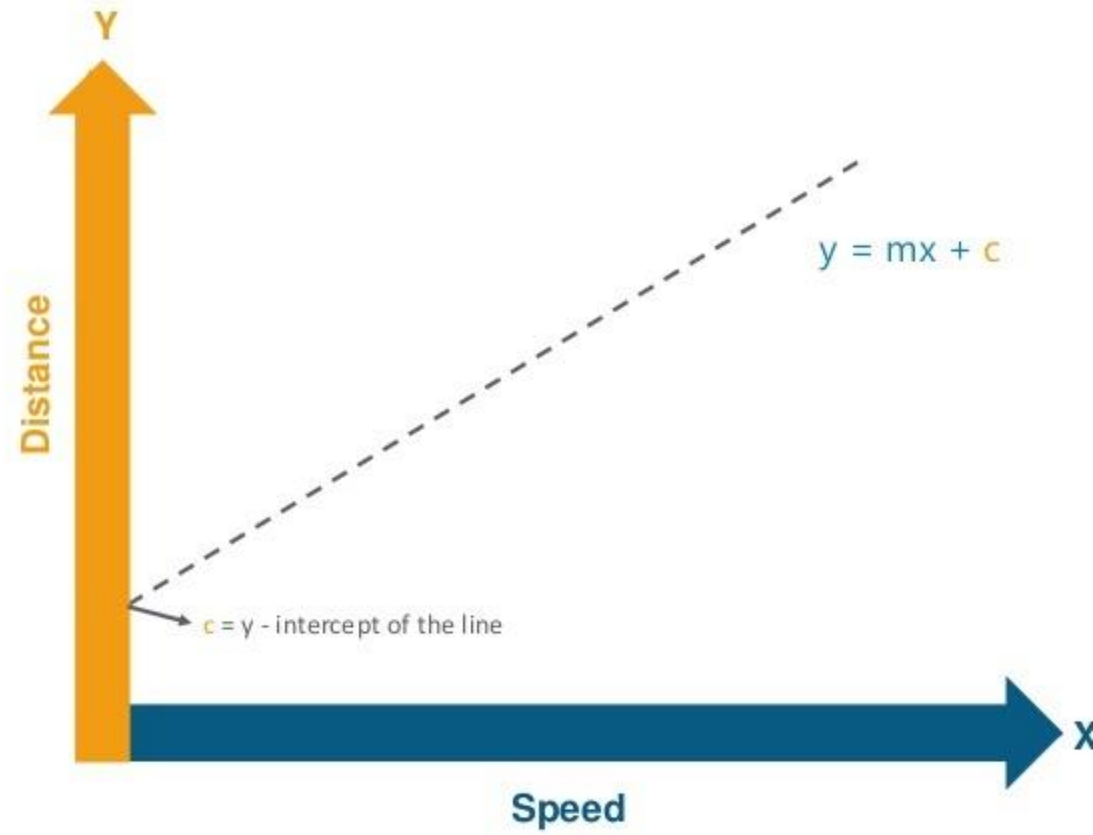

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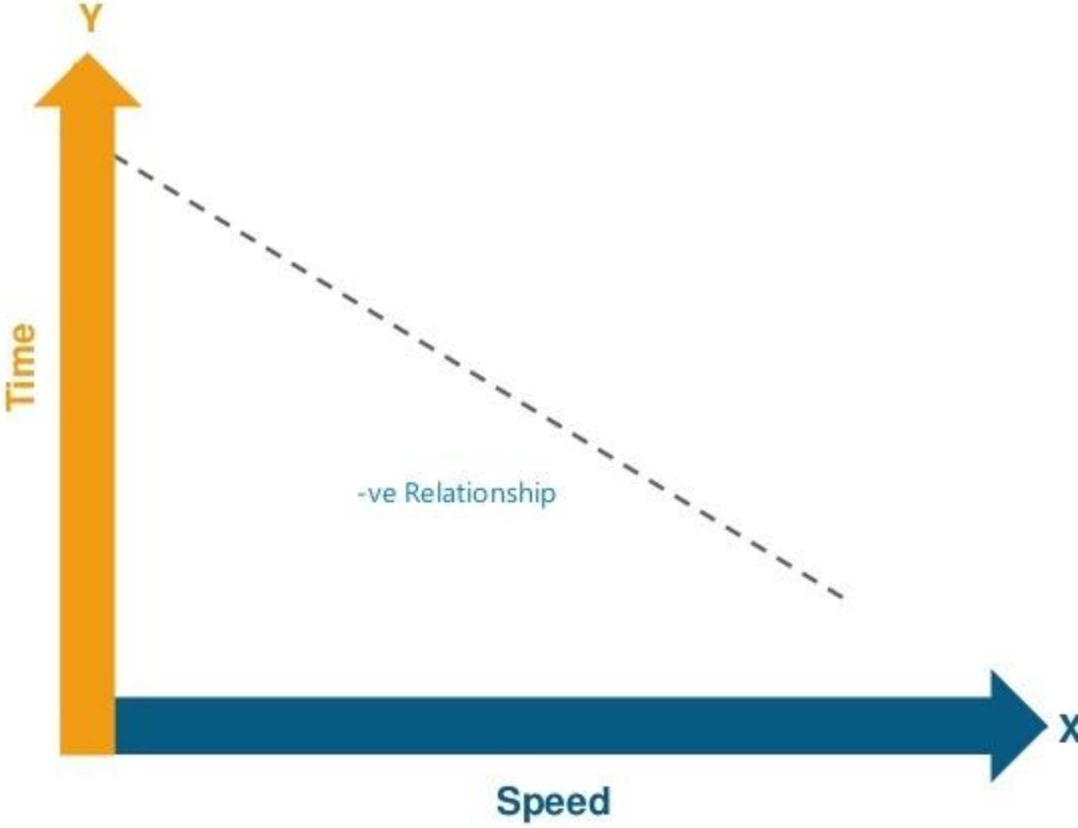

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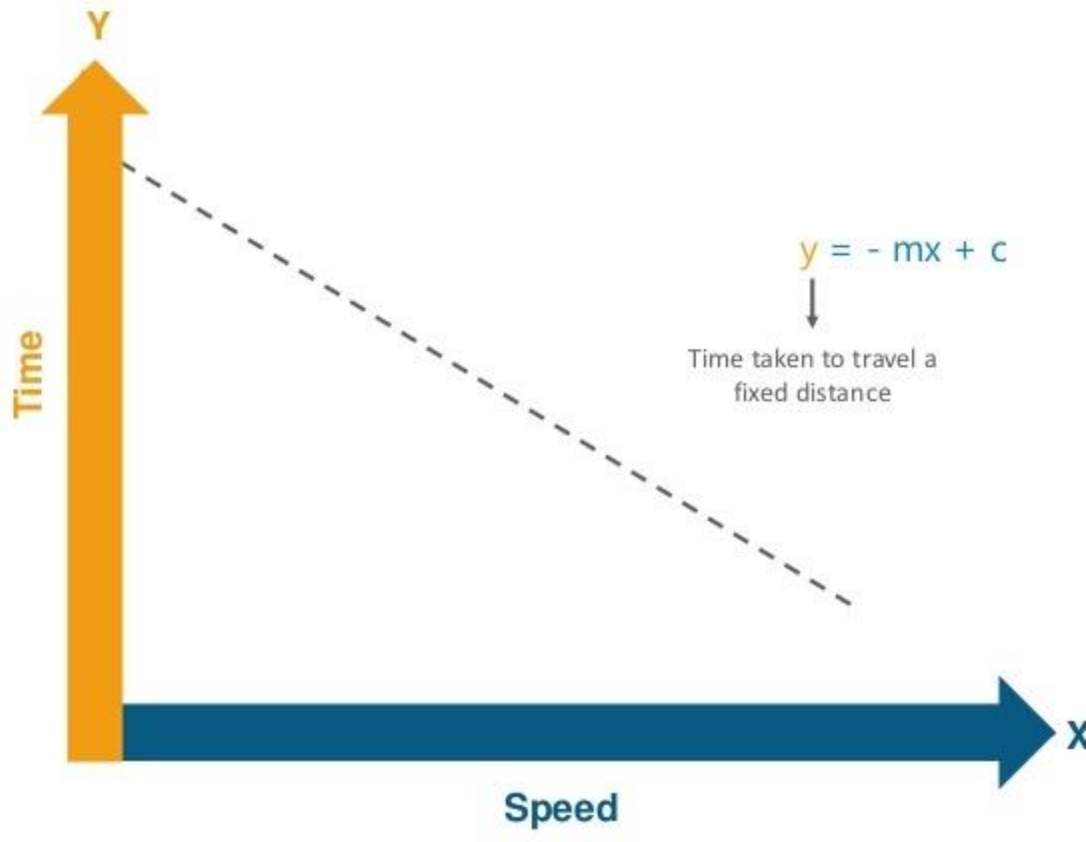

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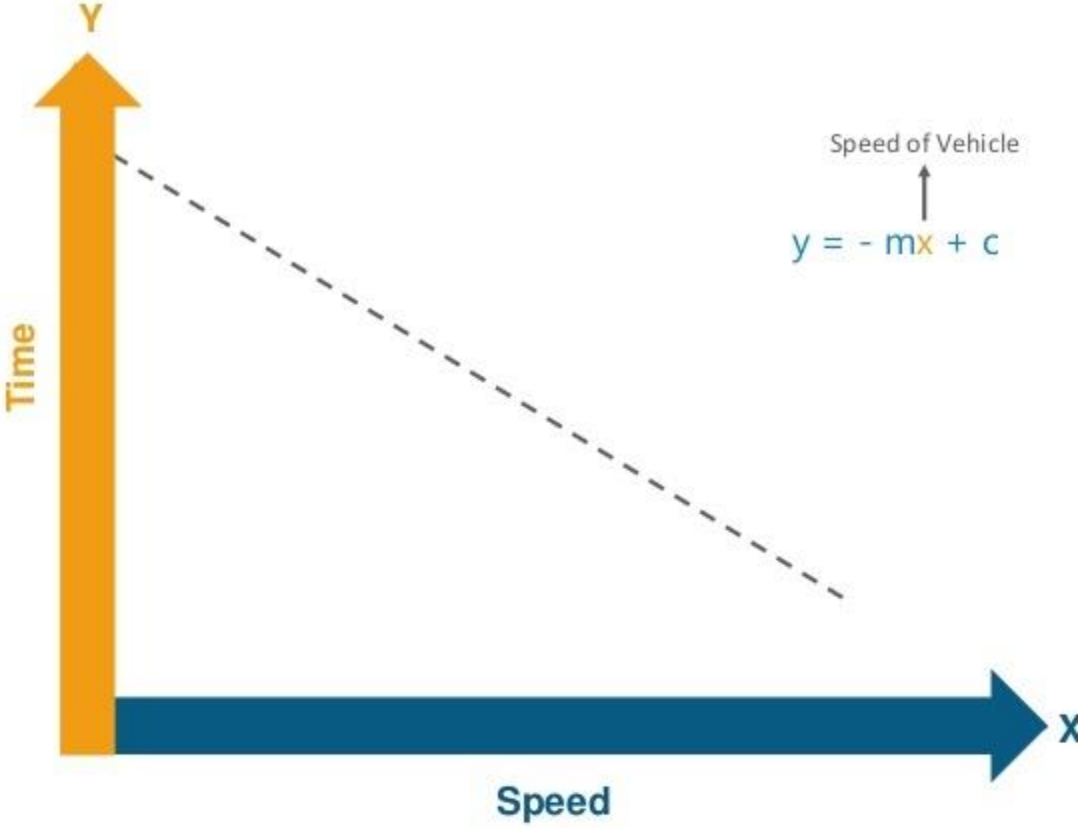

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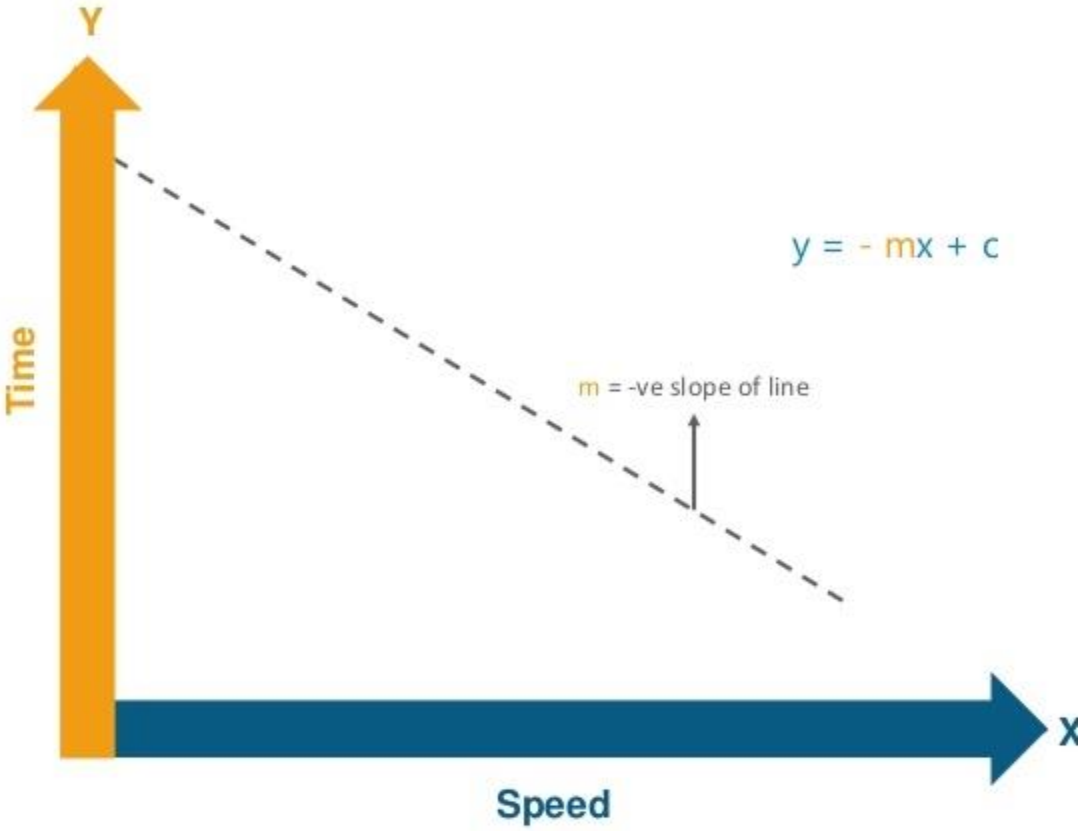

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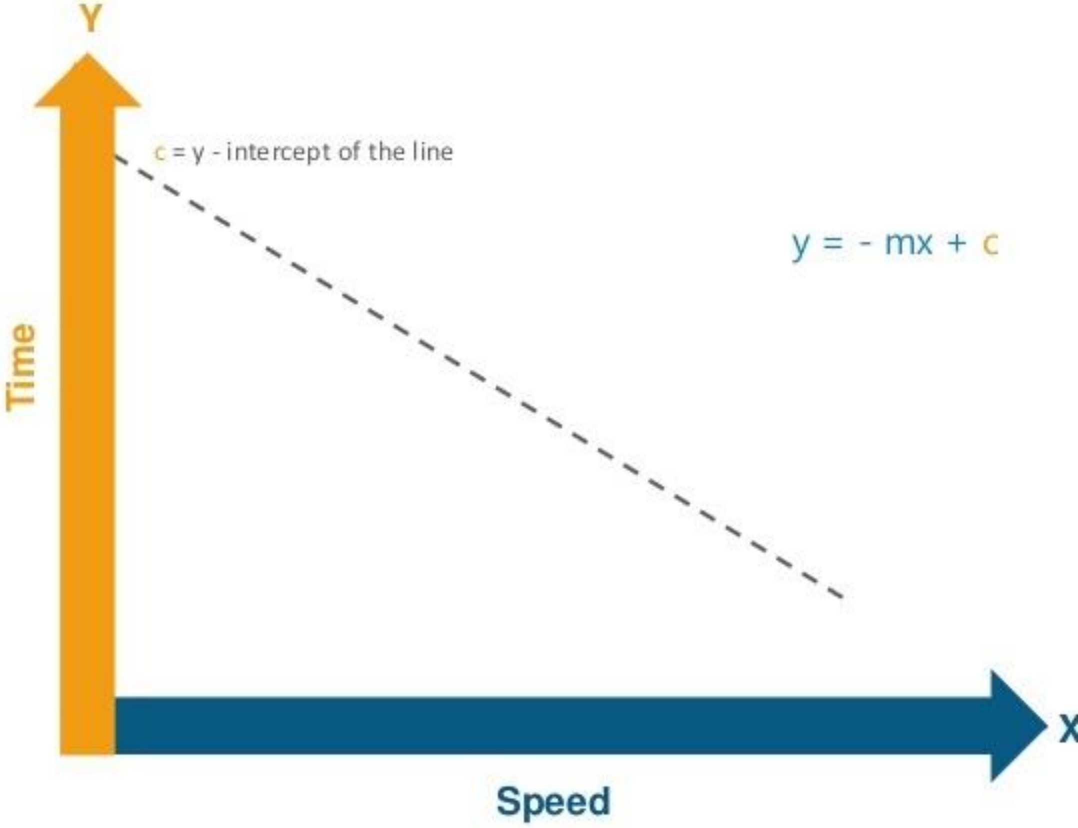

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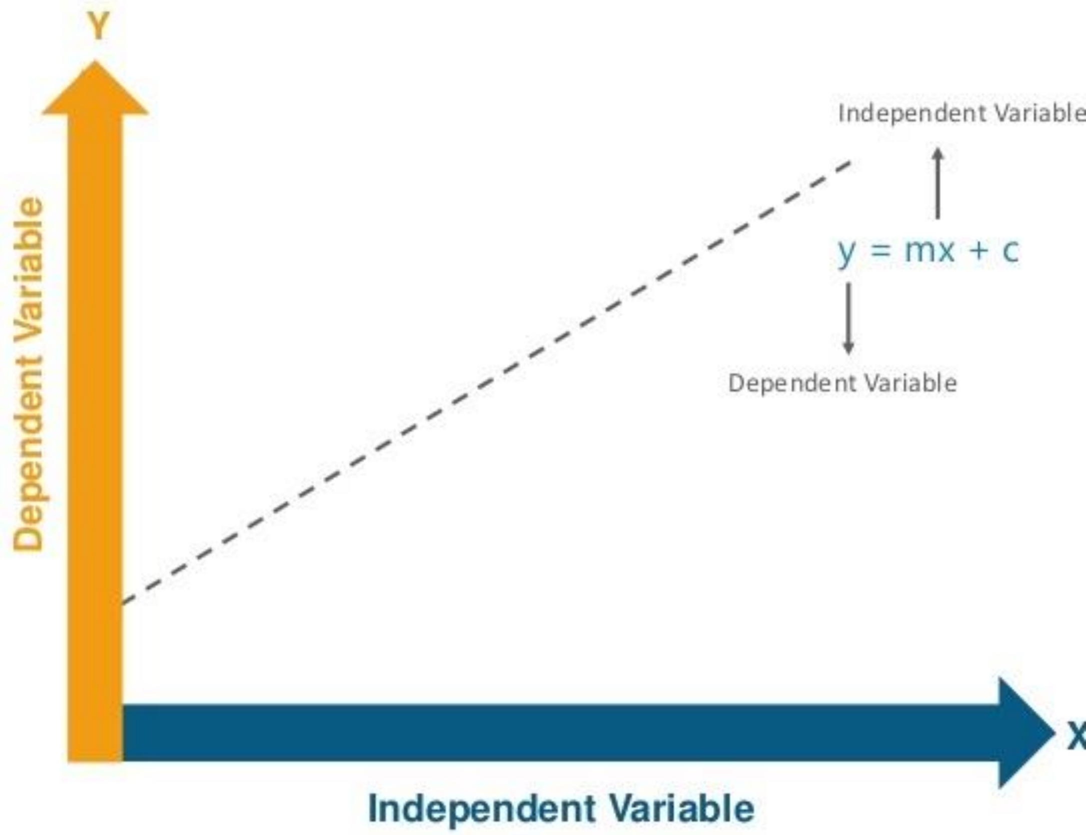

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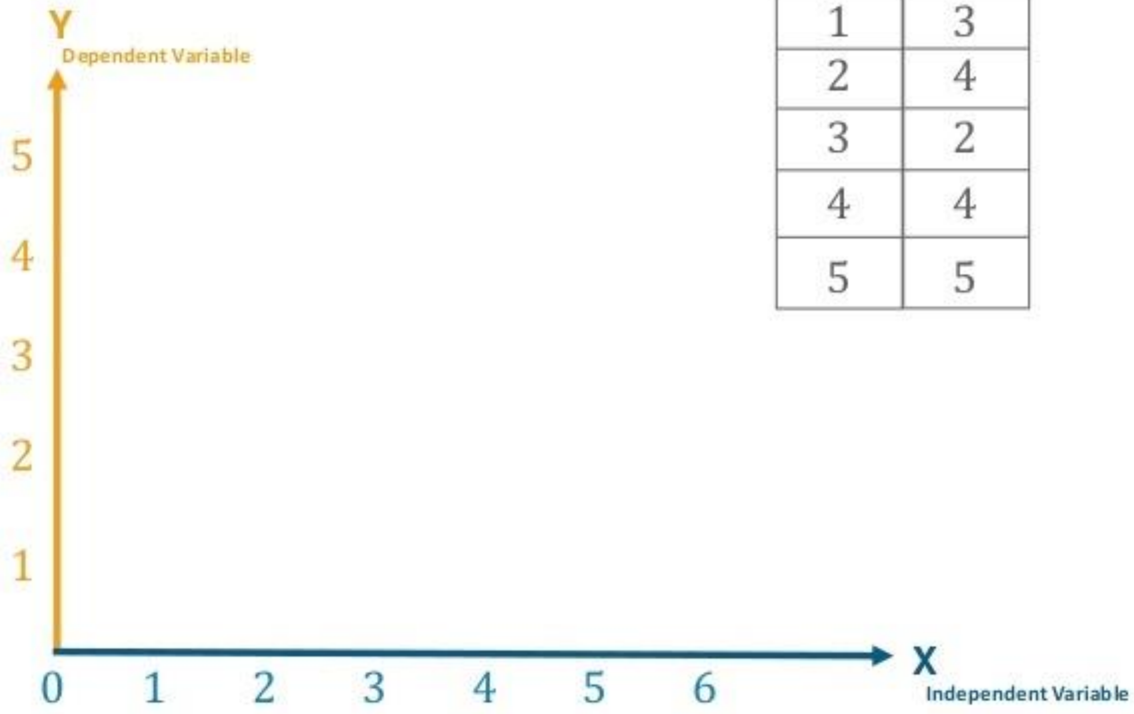
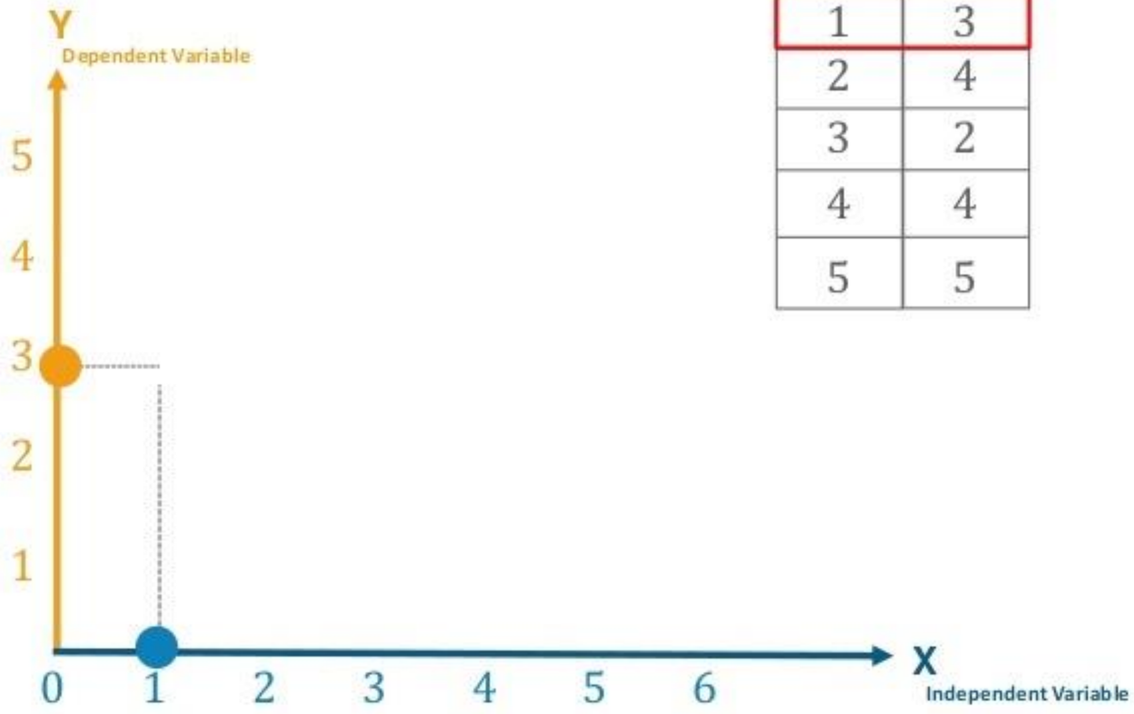


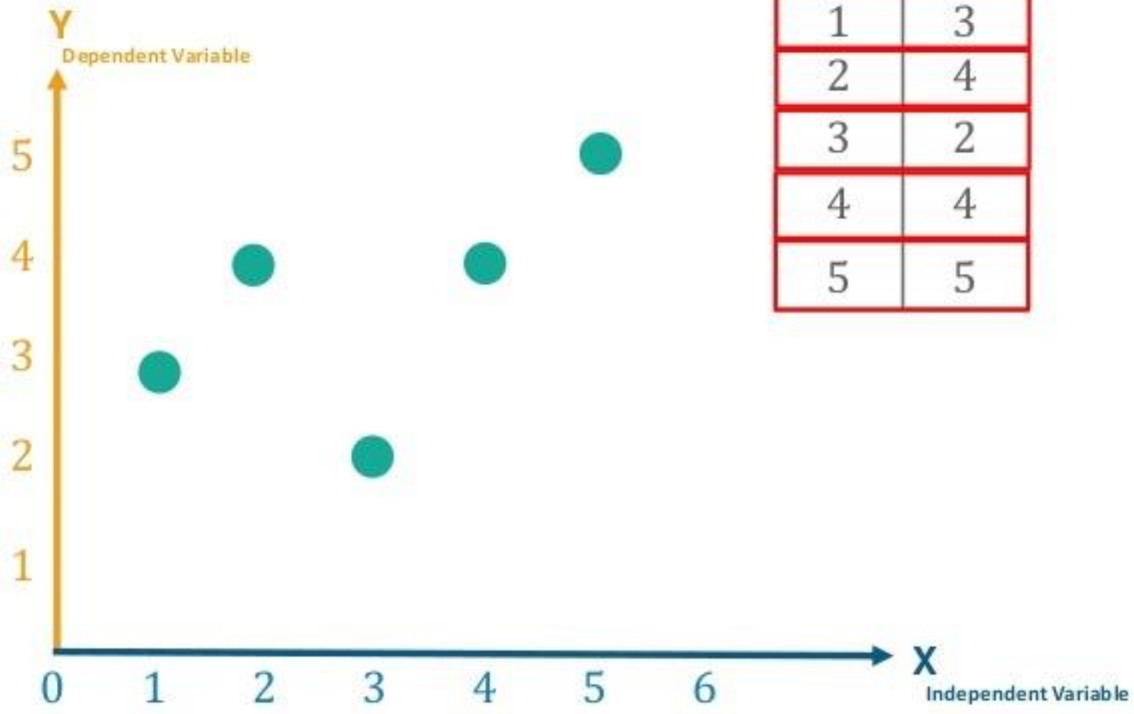
x	y
1	3
2	4
3	2
4	4
5	5

Understanding Linear Regression Algorithm



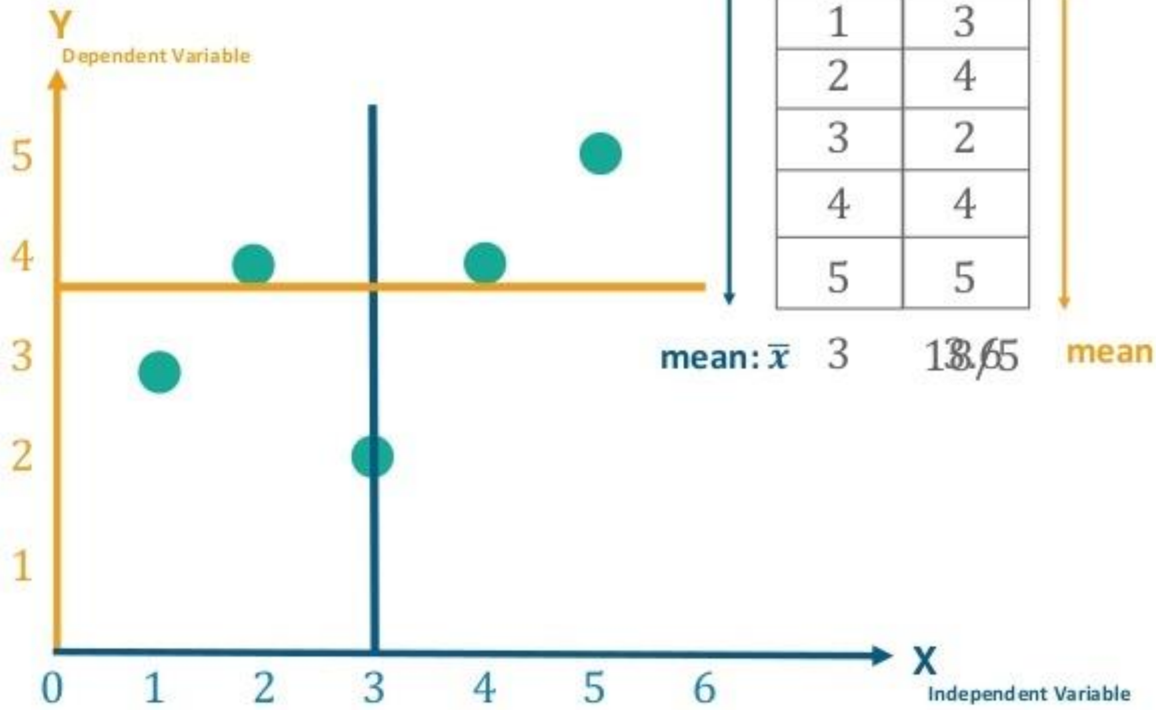
x	y
1	3
2	4
3	2
4	4
5	5

Understanding Linear Regression Algorithm



x	y
1	3
2	4
3	2
4	4
5	5

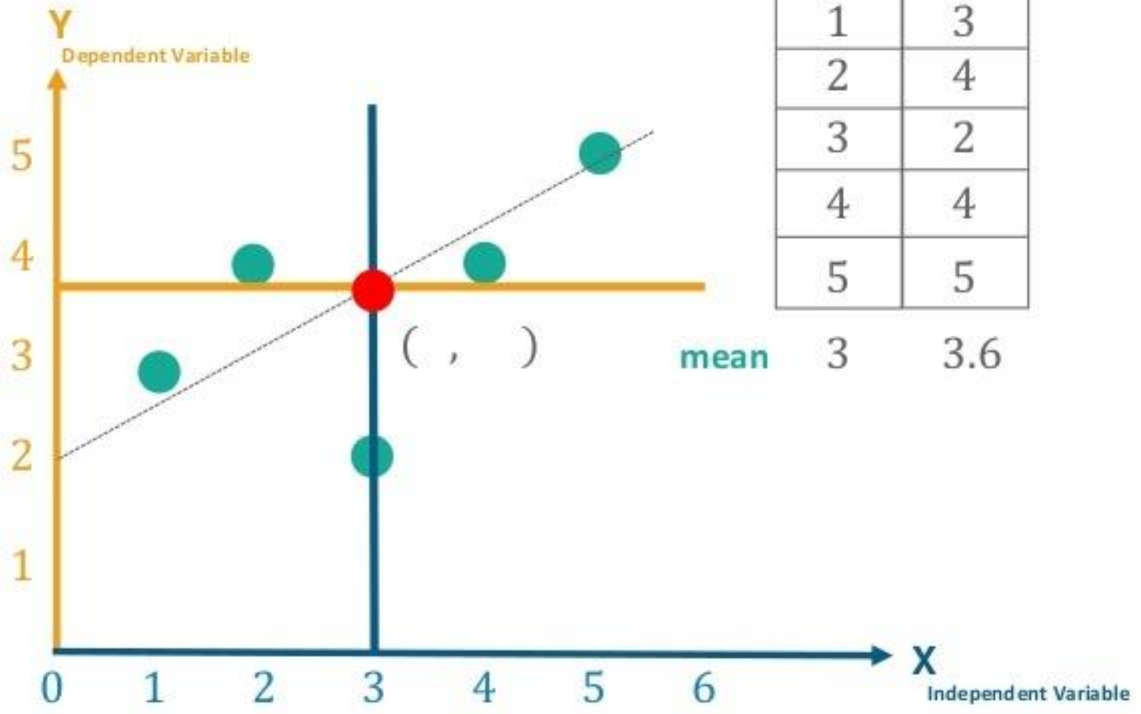
Understanding Linear Regression Algorithm



x	y
1	3
2	4
3	2
4	4
5	5

mean: $\overline{x}$ 3   18/5 3.6 mean : $\overline{y}$

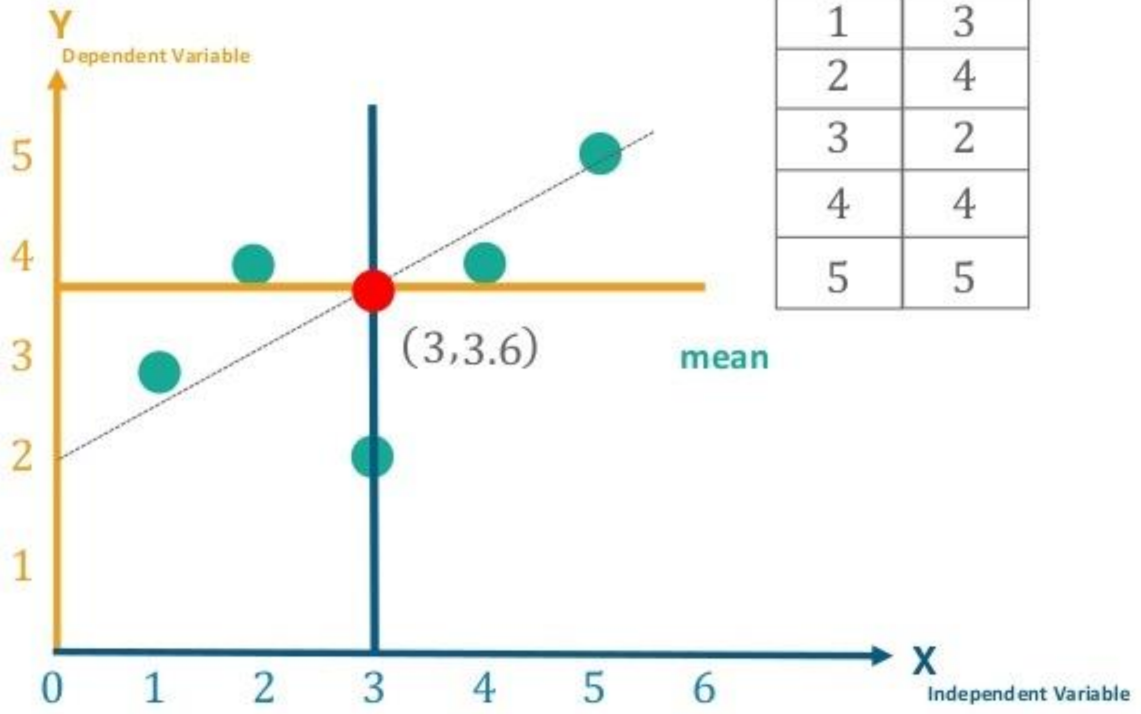
Understanding Linear Regression Algorithm



x	y
1	3
2	4
3	2
4	4
5	5
3	3.6

mean 3 3.6

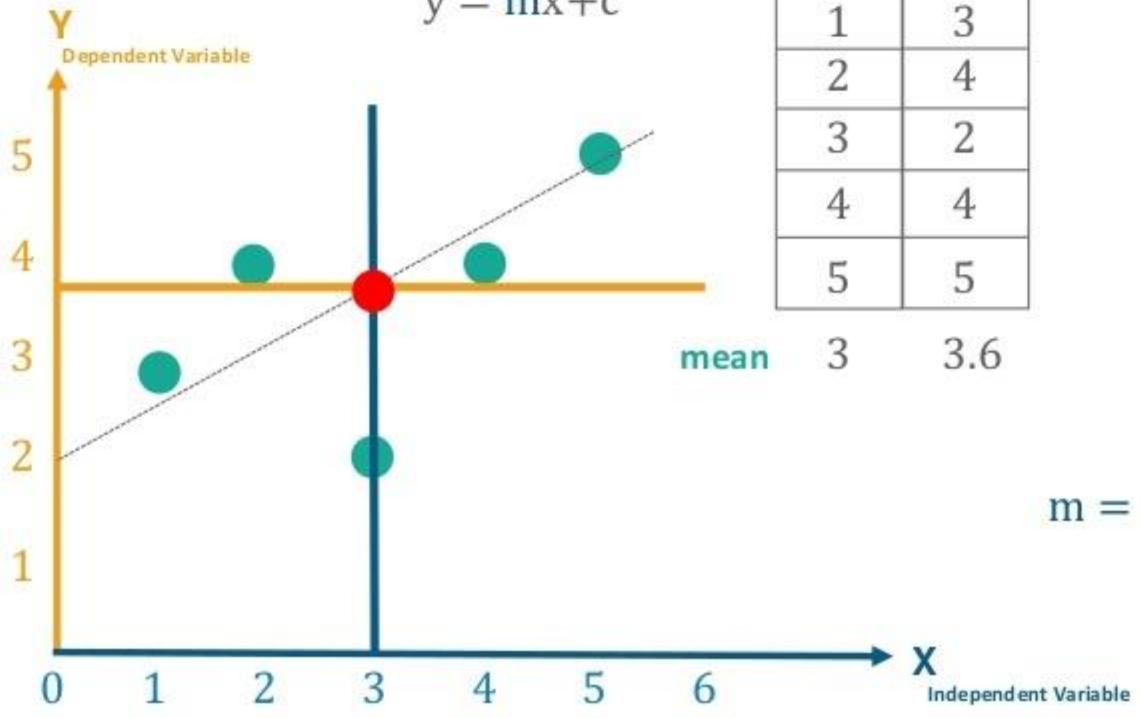
Understanding Linear Regression Algorithm



x	y
1	3
2	4
3	2
4	4
5	5

Understanding Linear Regression Algorithm

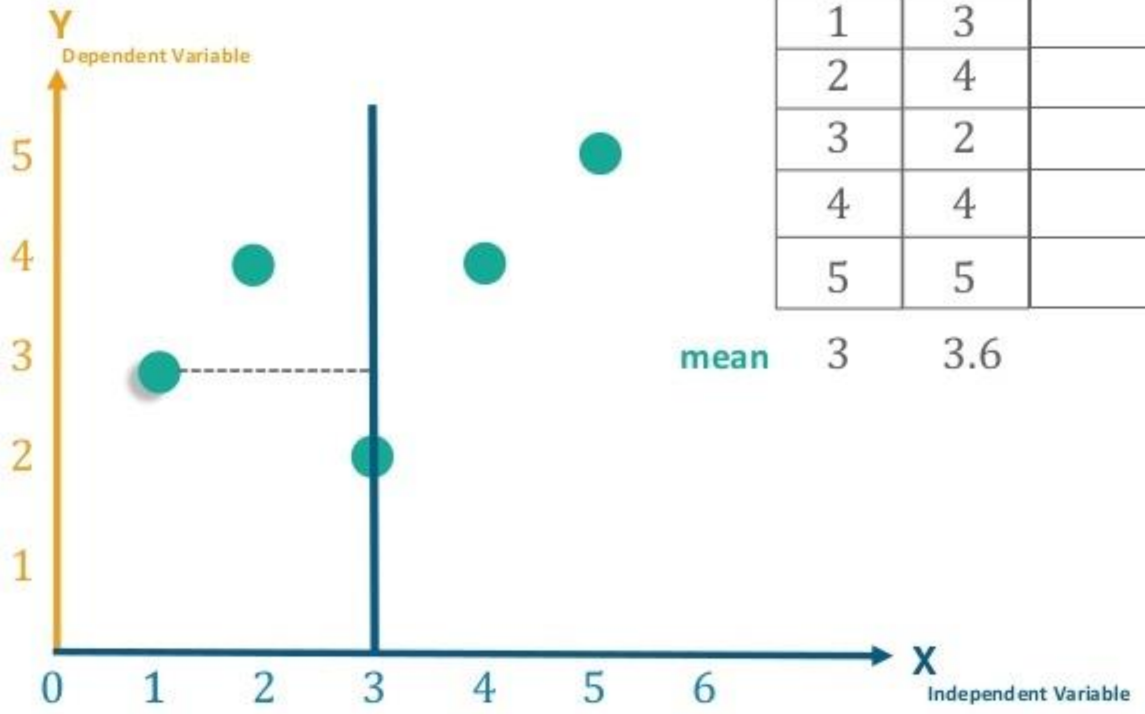
$y = mx+c$



x	y
1	3
2	4
3	2
4	4
5	5
mean 3	3.6

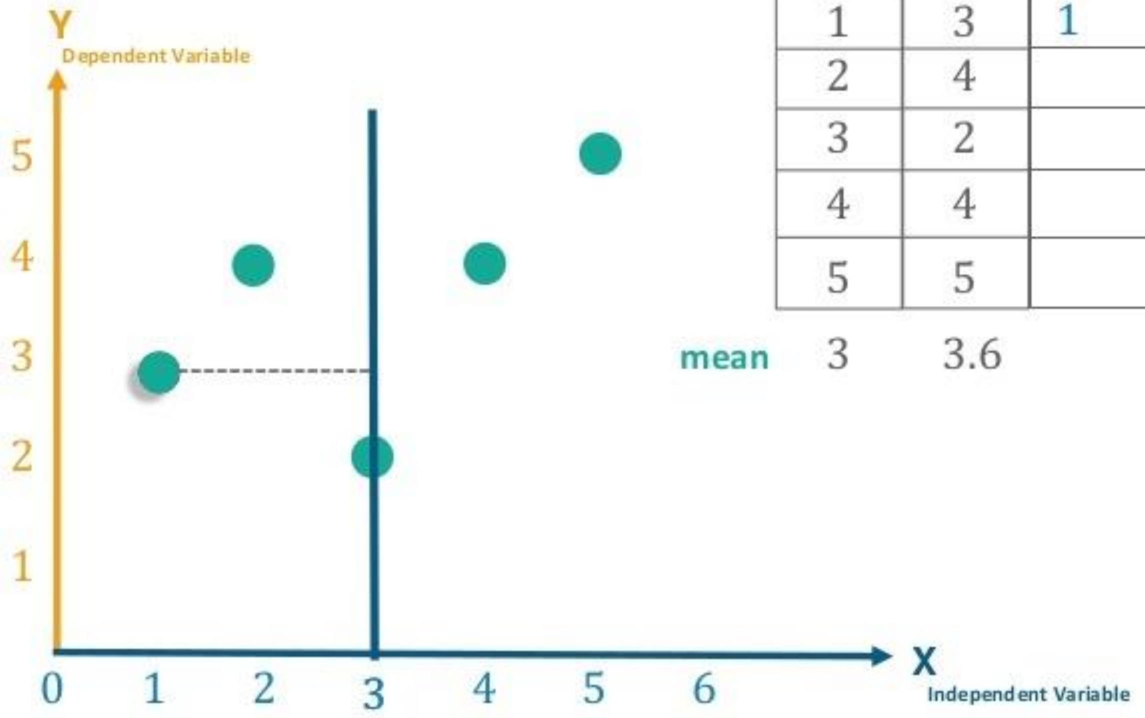
$$m = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2}$$

Understanding Linear Regression Algorithm



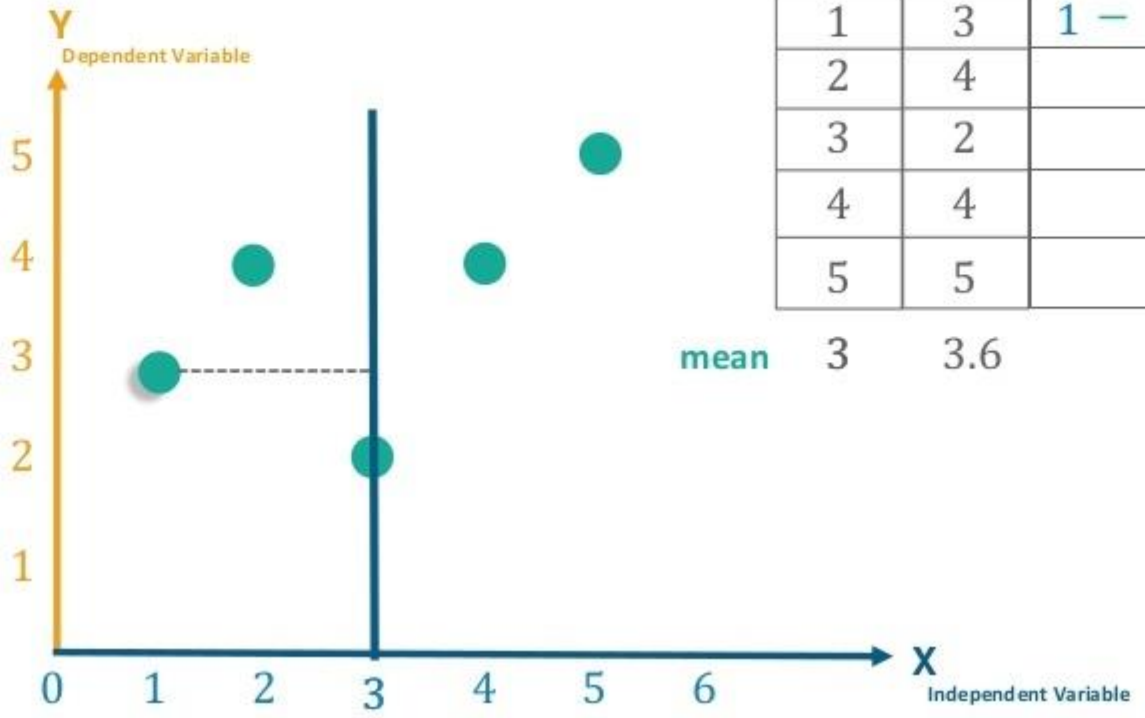
x	y	$x - \bar{x}$
1	3	
2	4	
3	2	
4	4	
5	5	
mean 3	3.6	

Understanding Linear Regression Algorithm



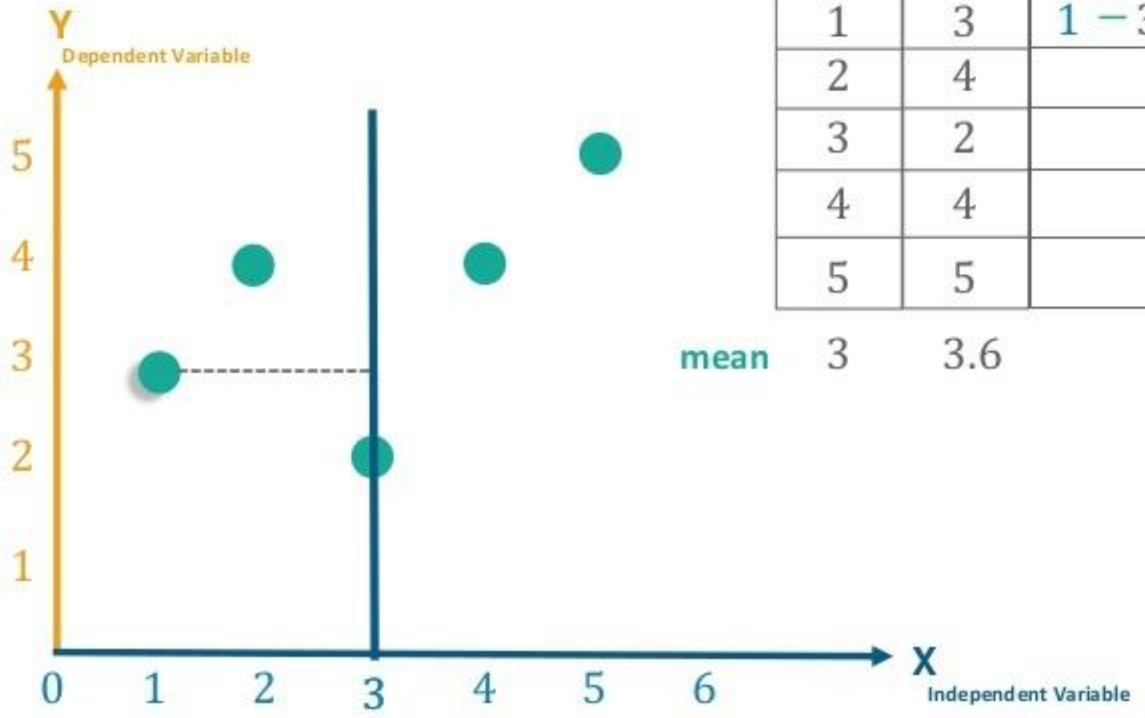
x	y	$x - \bar{x}$
1	3	1
2	4	
3	2	
4	4	
5	5	
mean 3	3.6	

Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	1 −
2	4	
3	2	
4	4	
5	5	
mean 3	3.6	

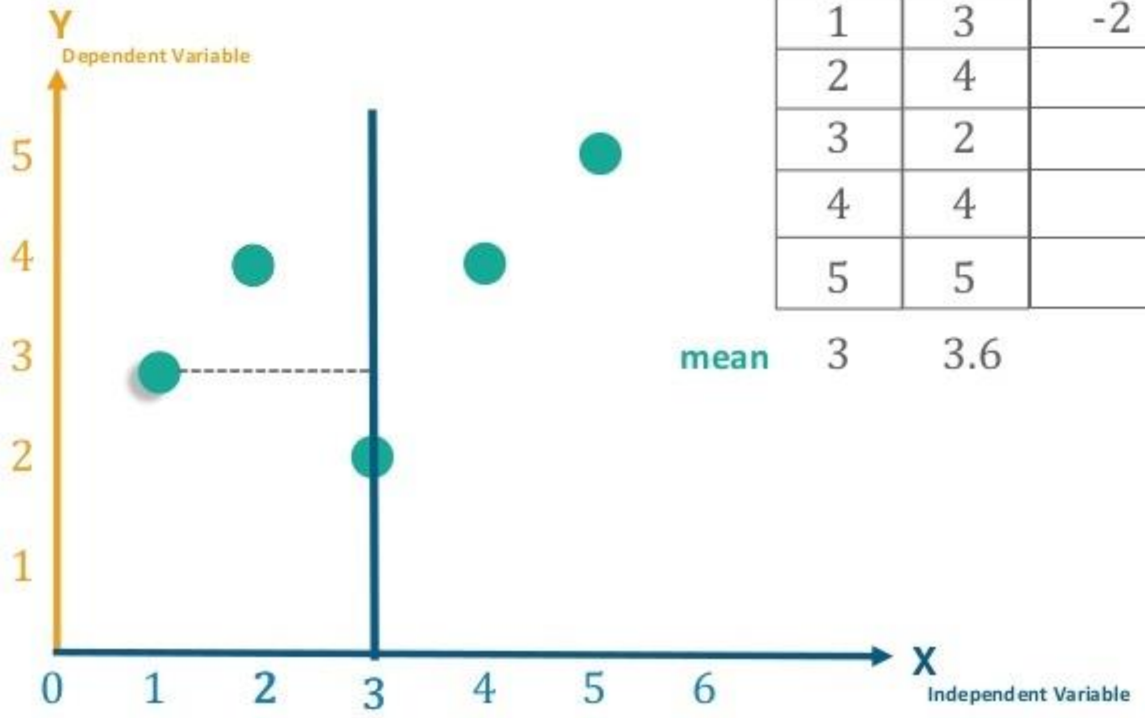
Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	$1 - 3$
2	4	
3	2	
4	4	
5	5	

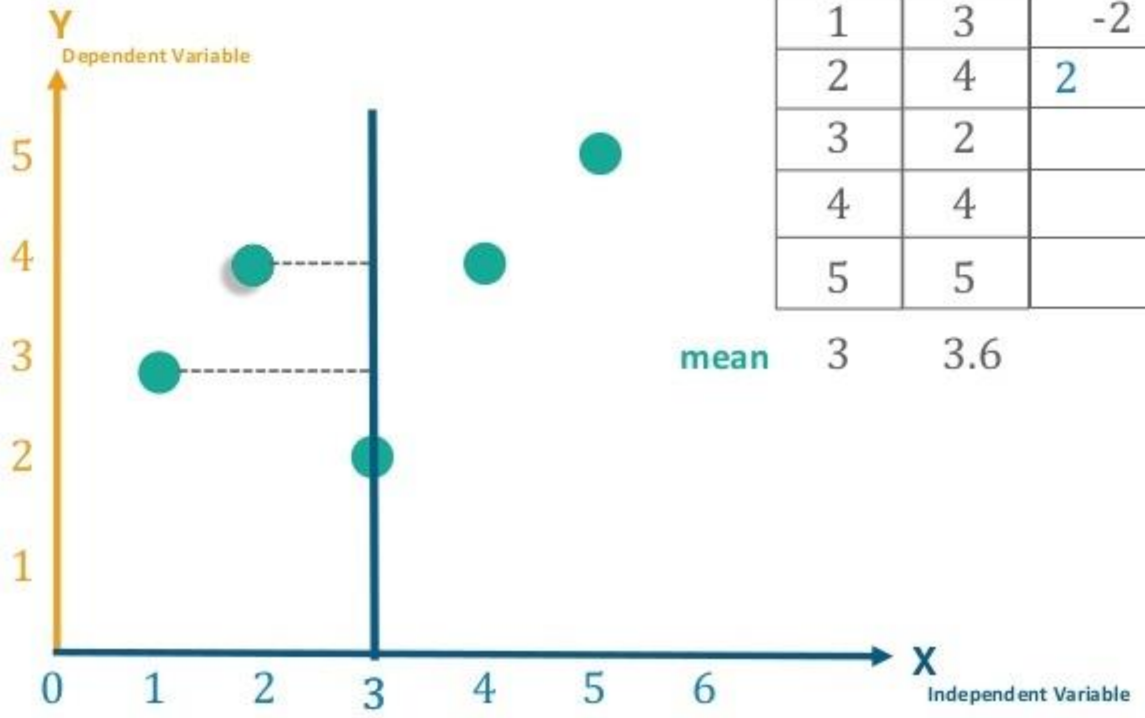
mean	3	3.6

Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	-2
2	4	
3	2	
4	4	
5	5	
mean 3	3.6	

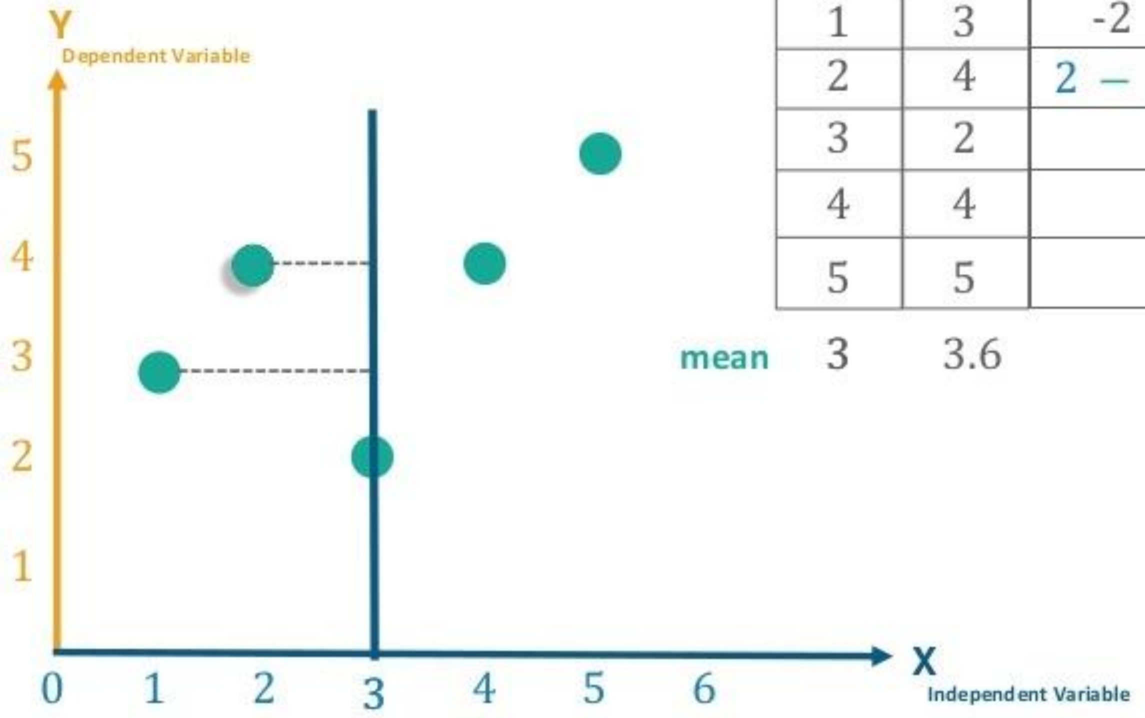
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$
1	3	-2
2	4	2
3	2	
4	4	
5	5	

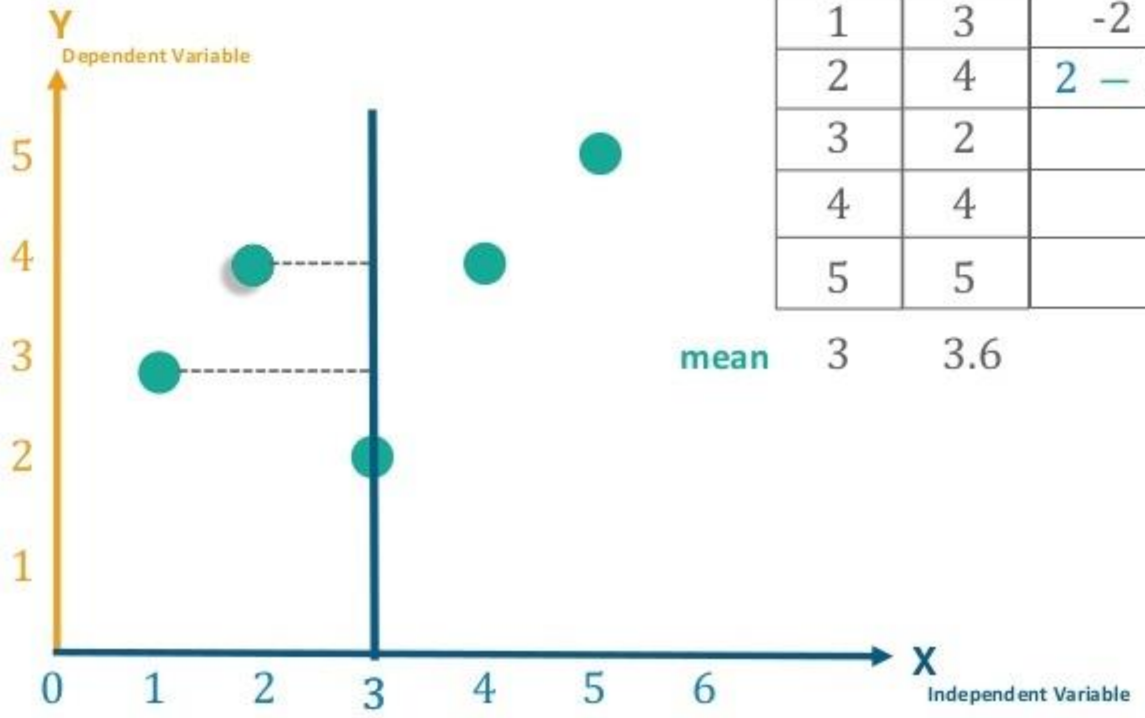
mean 3 3.6

Understanding Linear Regression Algorithm



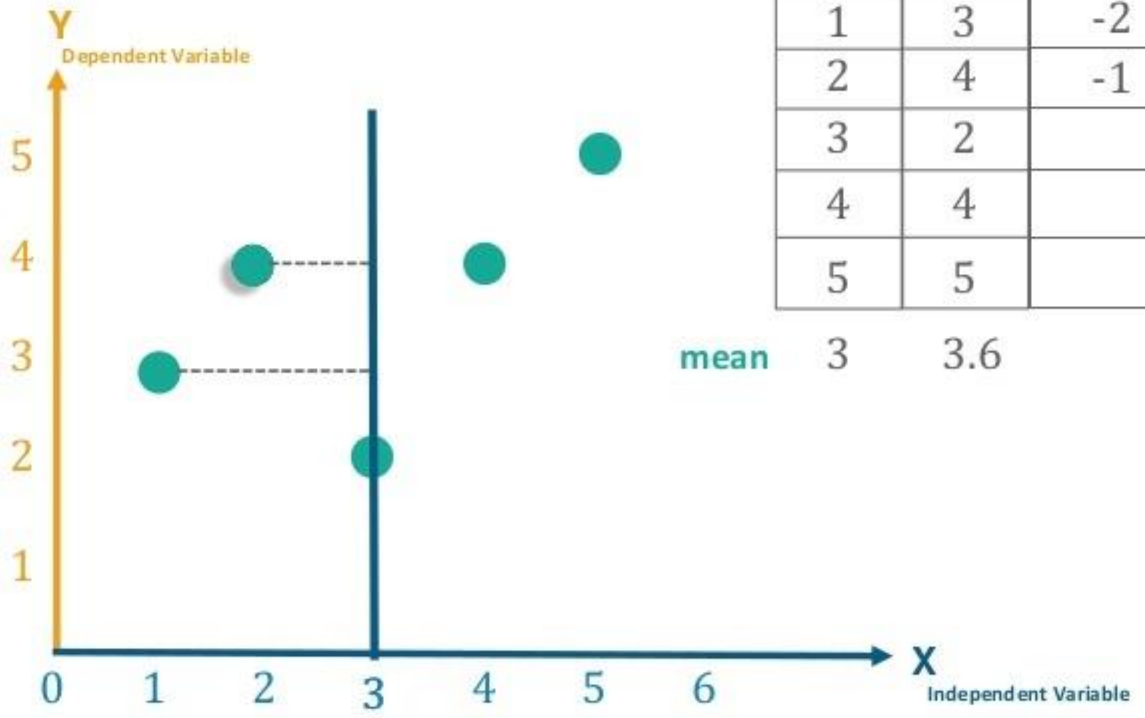
x	y	$x - \bar{x}$
1	3	-2
2	4	2 −
3	2	
4	4	
5	5	
mean 3	3.6	

Understanding Linear Regression Algorithm



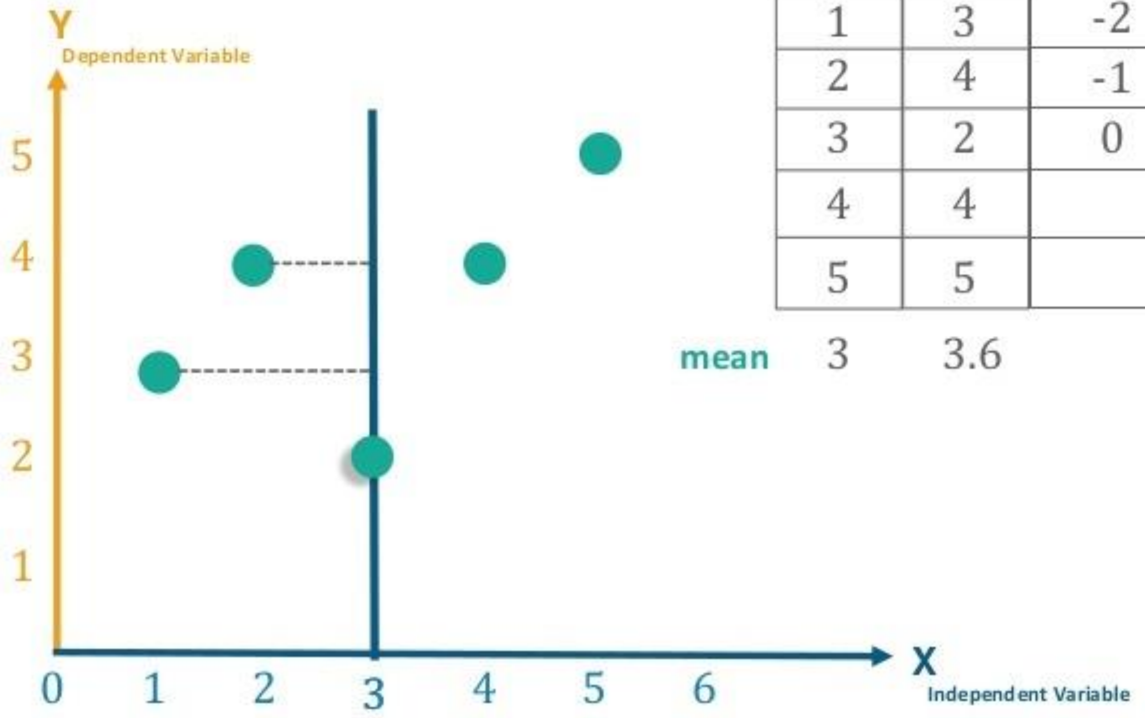
x	y	$x - \bar{x}$
1	3	-2
2	4	$2 - 3$
3	2	
4	4	
5	5	
mean 3	3.6	

Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	-2
2	4	-1
3	2	
4	4	
5	5	
mean 3	3.6	

Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	-2
2	4	-1
3	2	0
4	4	
5	5	
mean 3	3.6	

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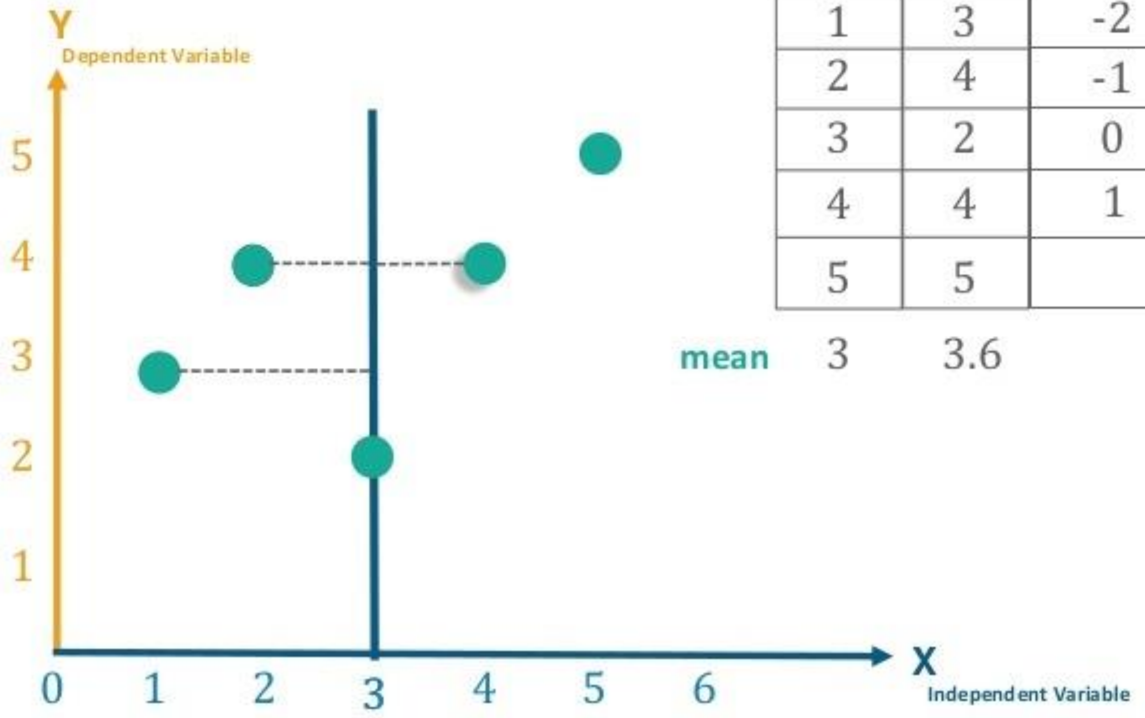
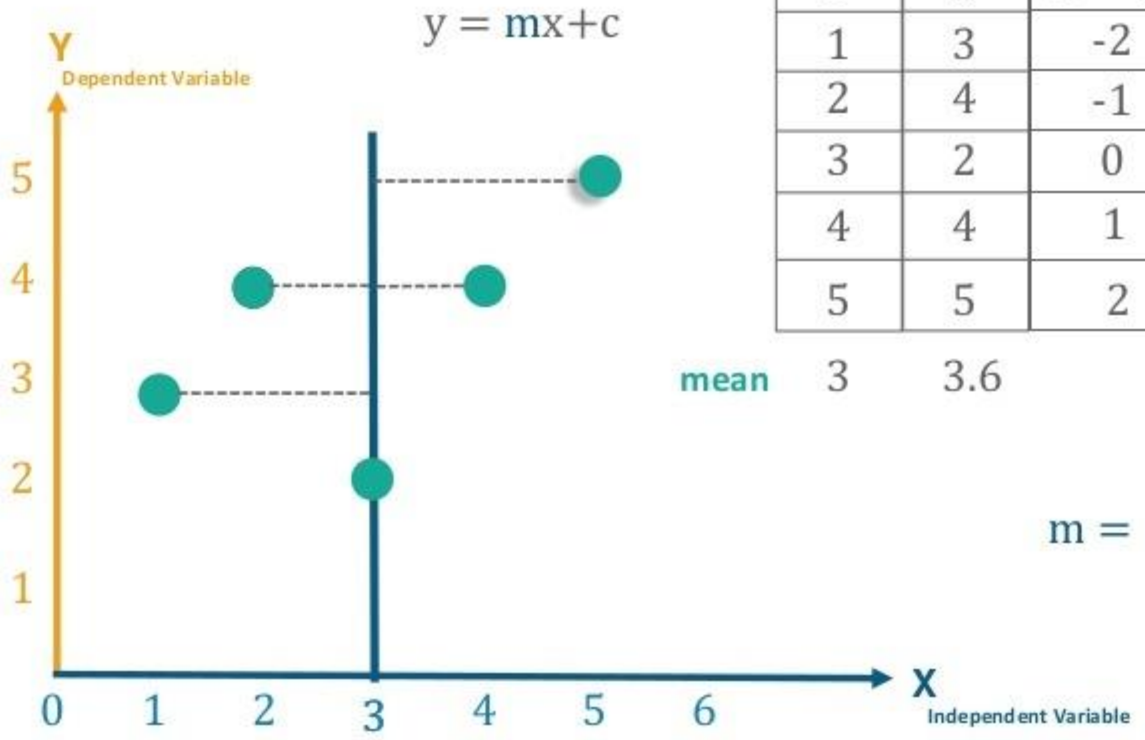


x	y	$x - \bar{x}$
1	3	-2
2	4	-1
3	2	0
4	4	1
5	5	

mean 3 3.6

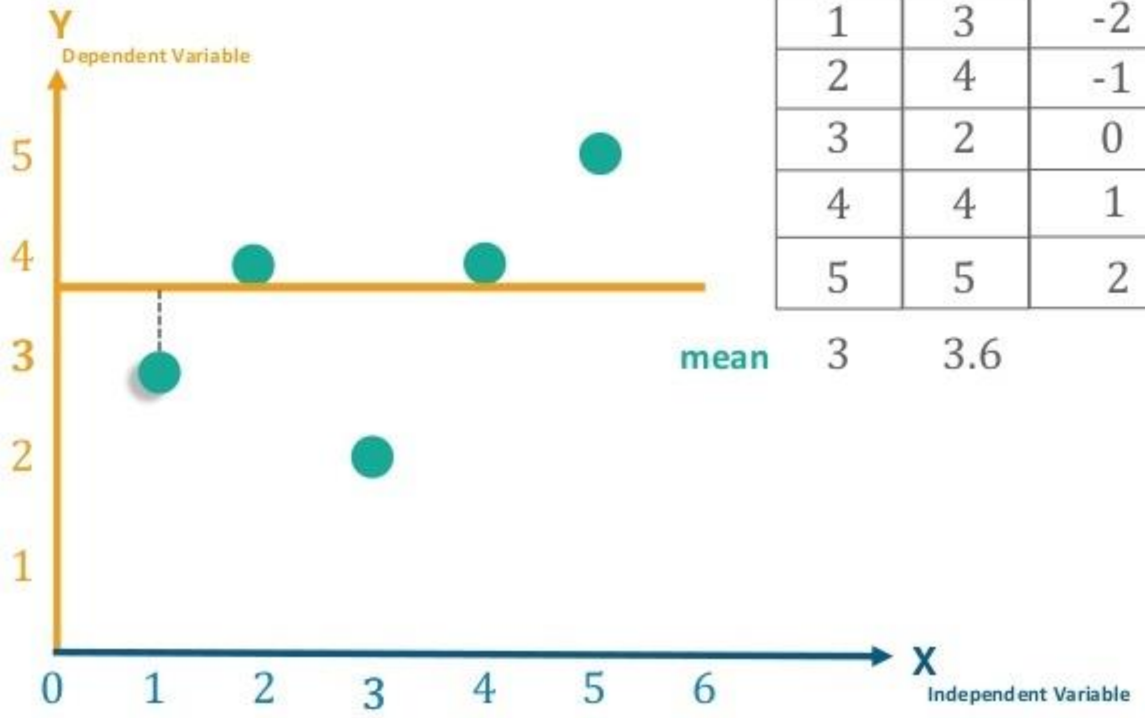
Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$
1	3	-2
2	4	-1
3	2	0
4	4	1
5	5	2
mean 3	3.6	

$$m = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sum (x-\bar{x})^2}$$

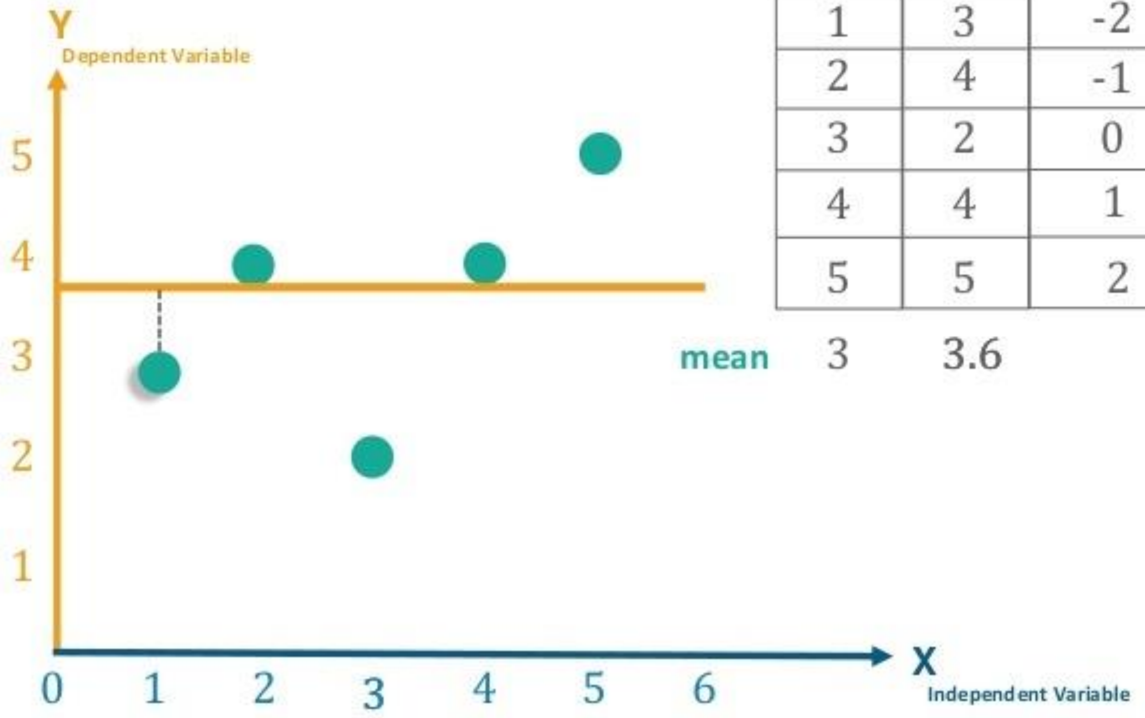
Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	
2	4	-1	
3	2	0	
4	4	1	
5	5	2	

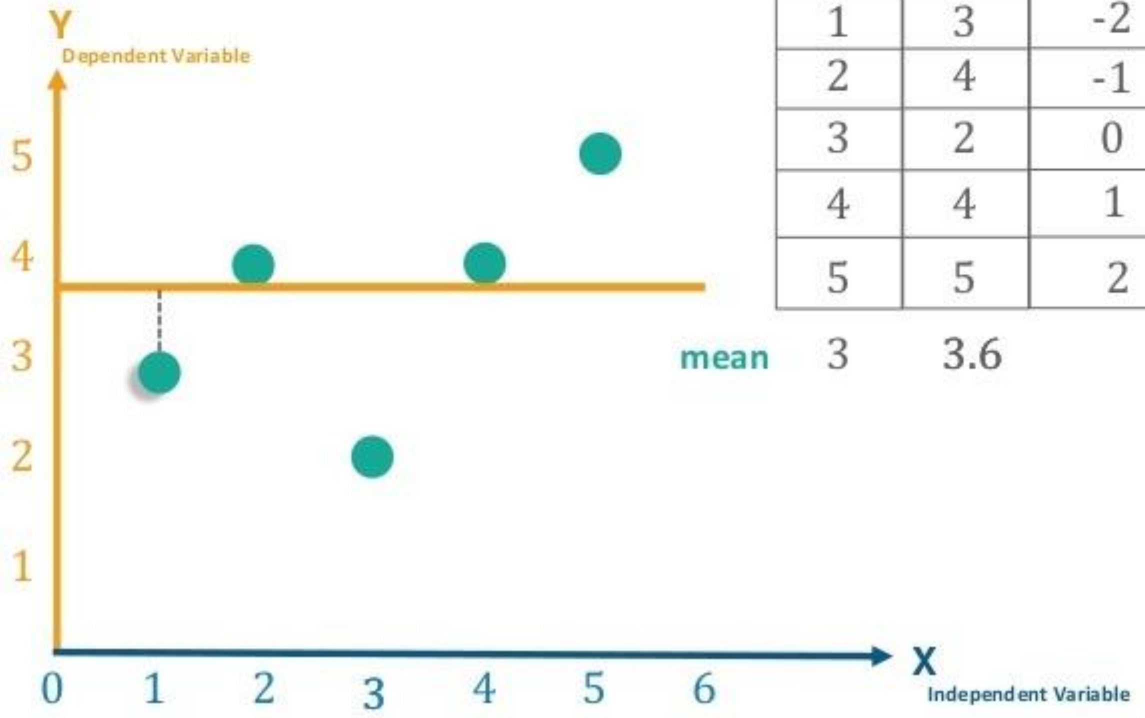
mean 3 3.6

Understanding Linear Regression Algorithm



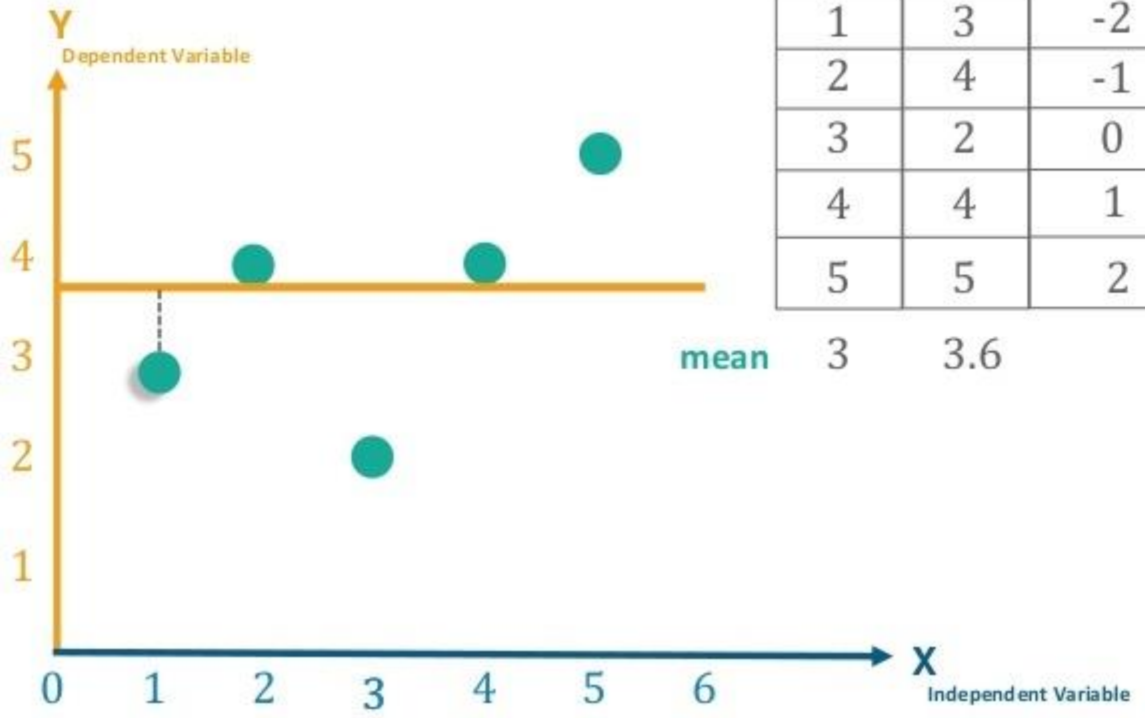
x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	3
2	4	-1	
3	2	0	
4	4	1	
5	5	2	
mean 3	3.6		

Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	3 −
2	4	-1	
3	2	0	
4	4	1	
5	5	2	
mean 3	3.6		

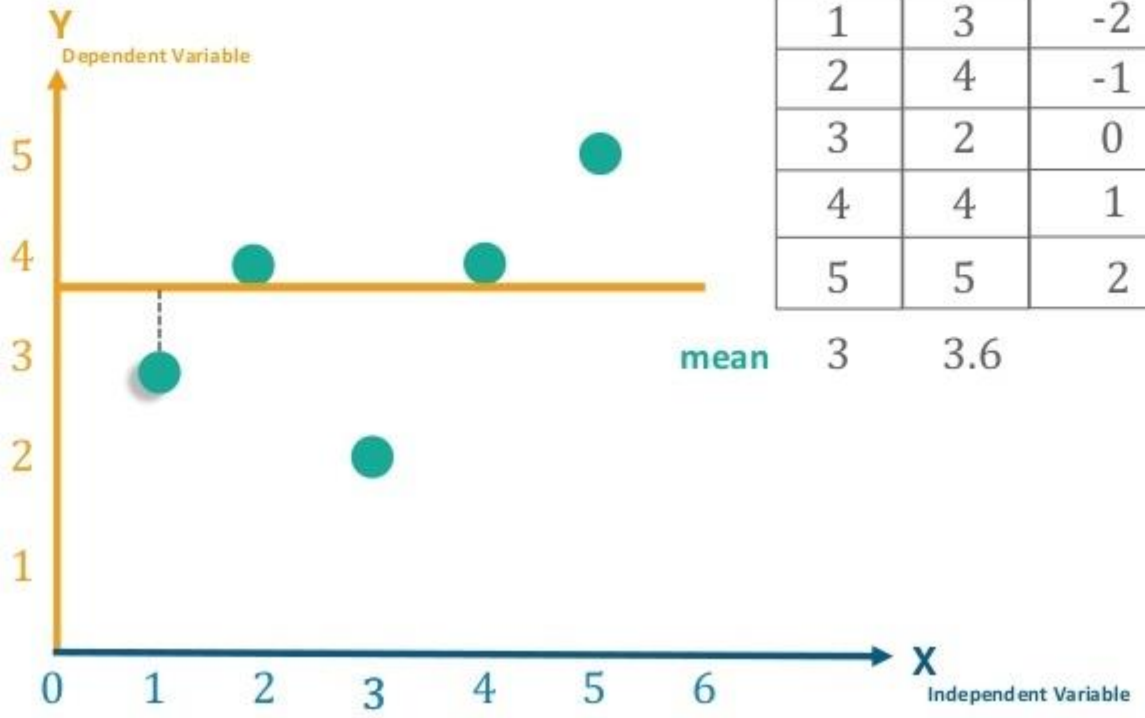
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$
1	3	-2	$3-3.6$
2	4	-1	
3	2	0	
4	4	1	
5	5	2	

mean 3 3.6

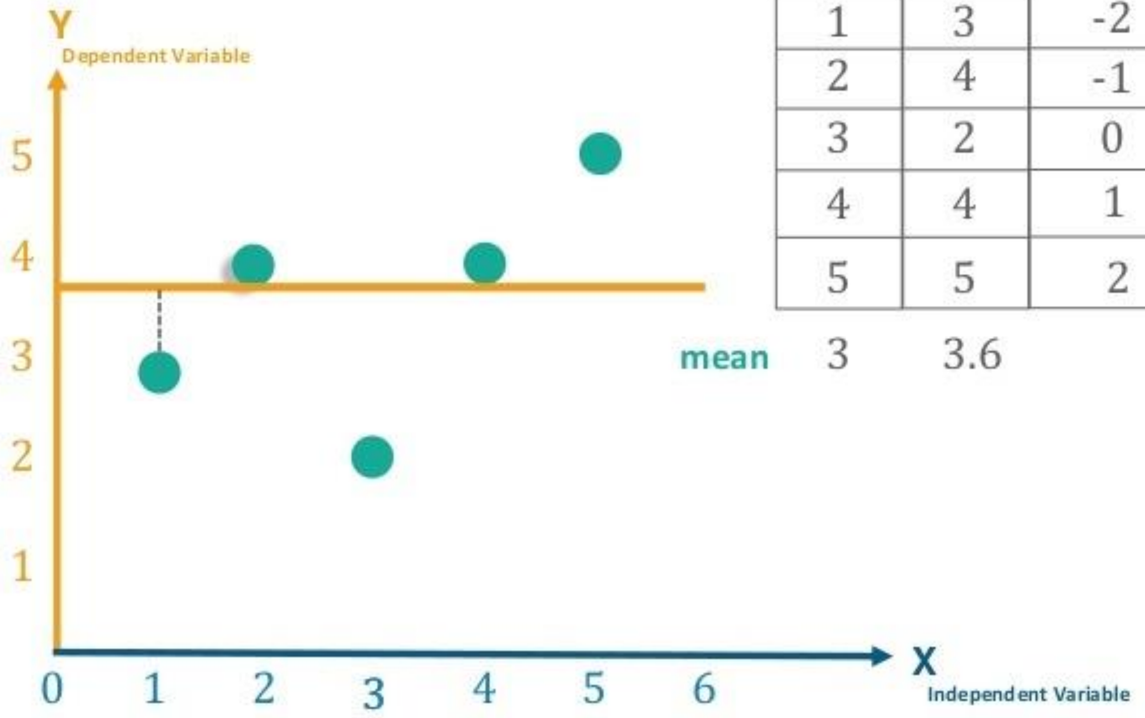
Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	-0.6
2	4	-1	
3	2	0	
4	4	1	
5	5	2	

mean 3 3.6

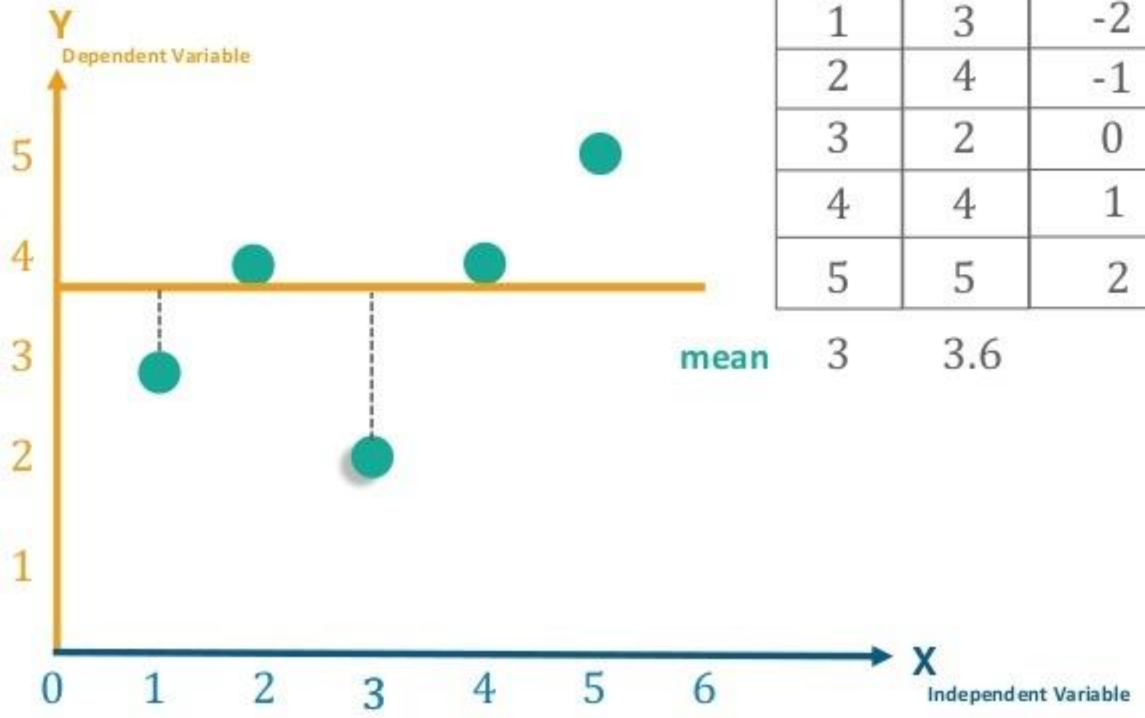
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$
1	3	-2	-0.6
2	4	-1	0.4
3	2	0	
4	4	1	
5	5	2	

mean 3 3.6

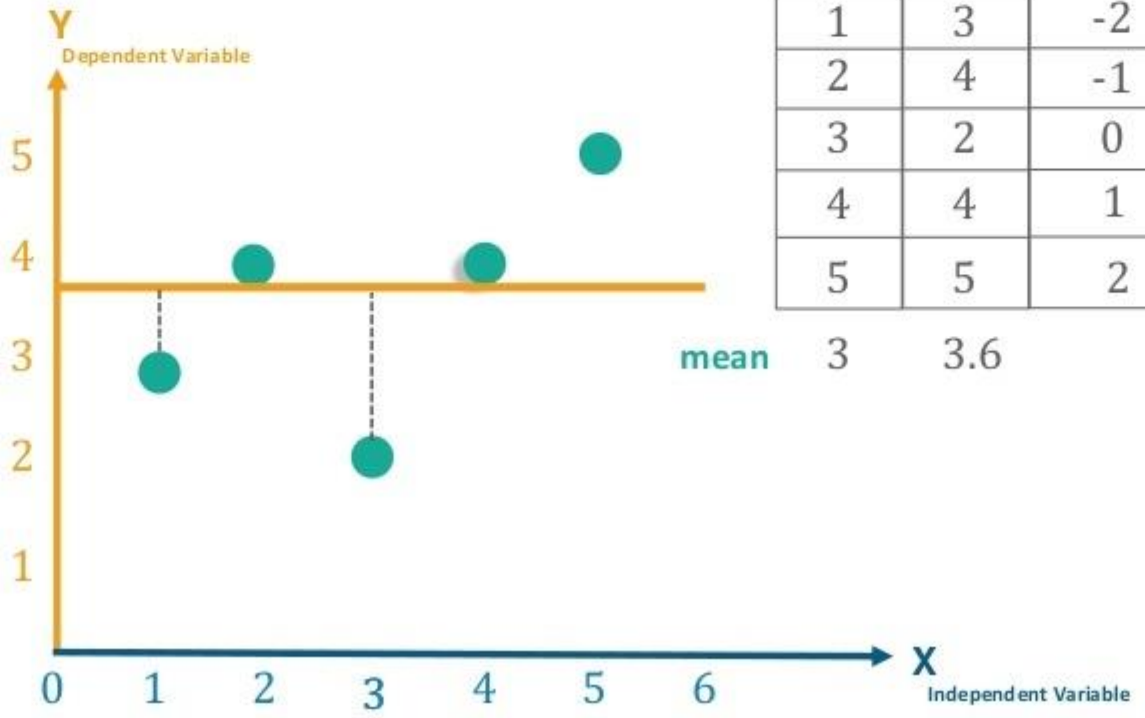
Understanding Linear Regression Algorithm



x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	-0.6
2	4	-1	0.4
3	2	0	-1.6
4	4	1	
5	5	2	

mean 3 3.6

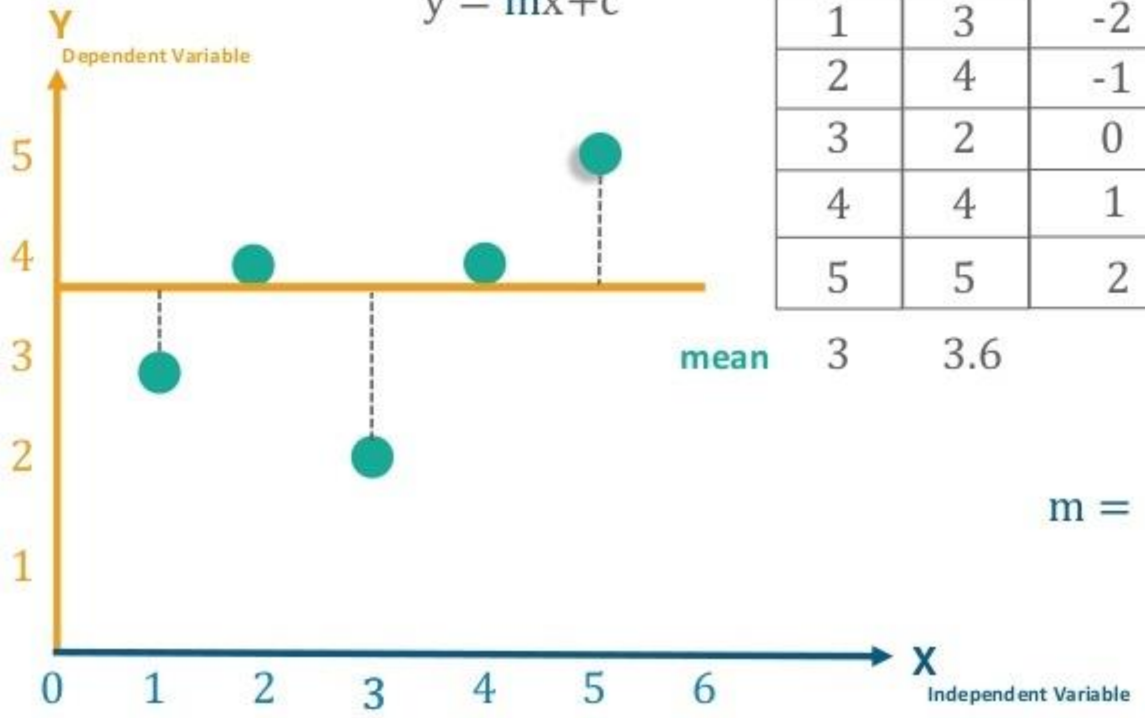
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$
1	3	-2	-0.6
2	4	-1	0.4
3	2	0	-1.6
4	4	1	0.4
5	5	2	

mean 3 3.6

Understanding Linear Regression Algorithm

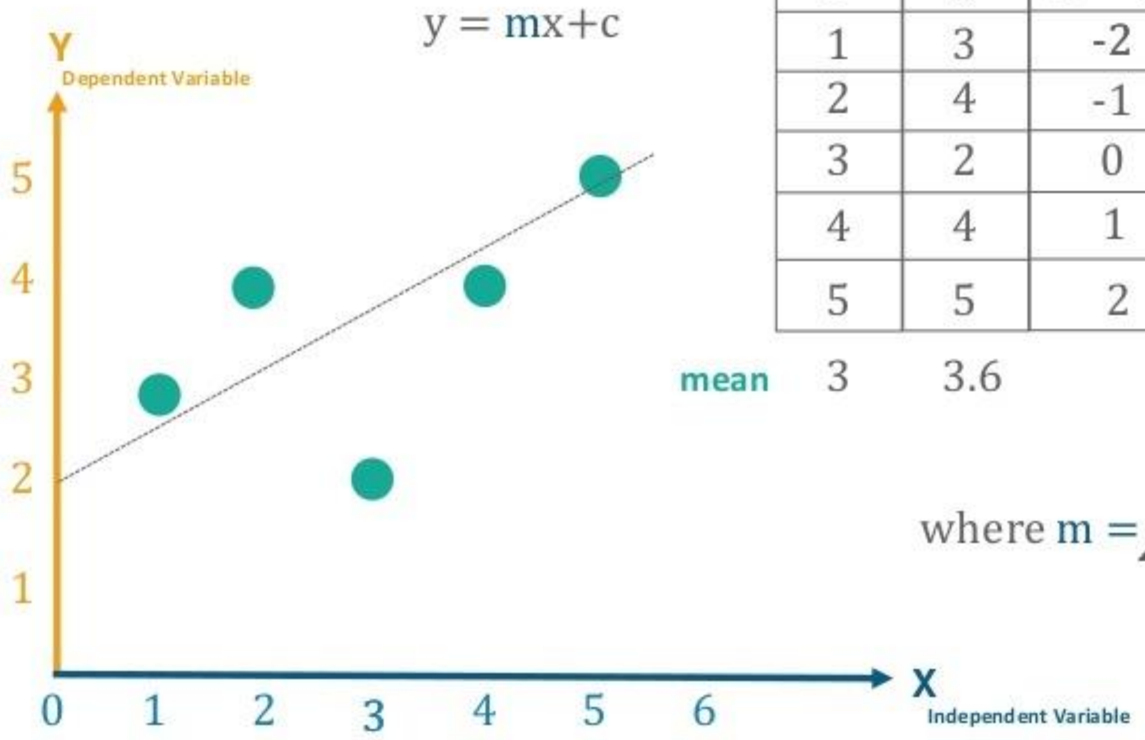


$$y = mx + c$$

x	y	$x - \bar{x}$	$y - \bar{y}$
1	3	-2	-0.6
2	4	-1	0.4
3	2	0	-1.6
4	4	1	0.4
5	5	2	1.4
mean 3	3.6		

$$m = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

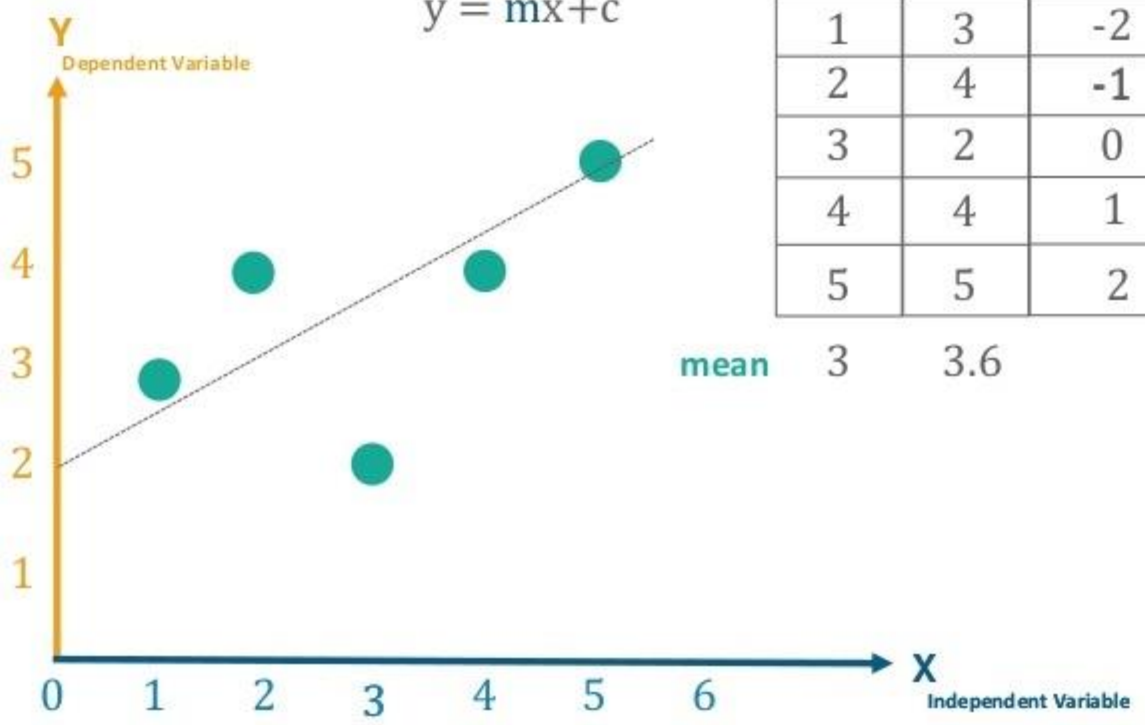
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	
2	4	-1	0.4	
3	2	0	-1.6	
4	4	1	0.4	
5	5	2	1.4	
mean 3	3.6			

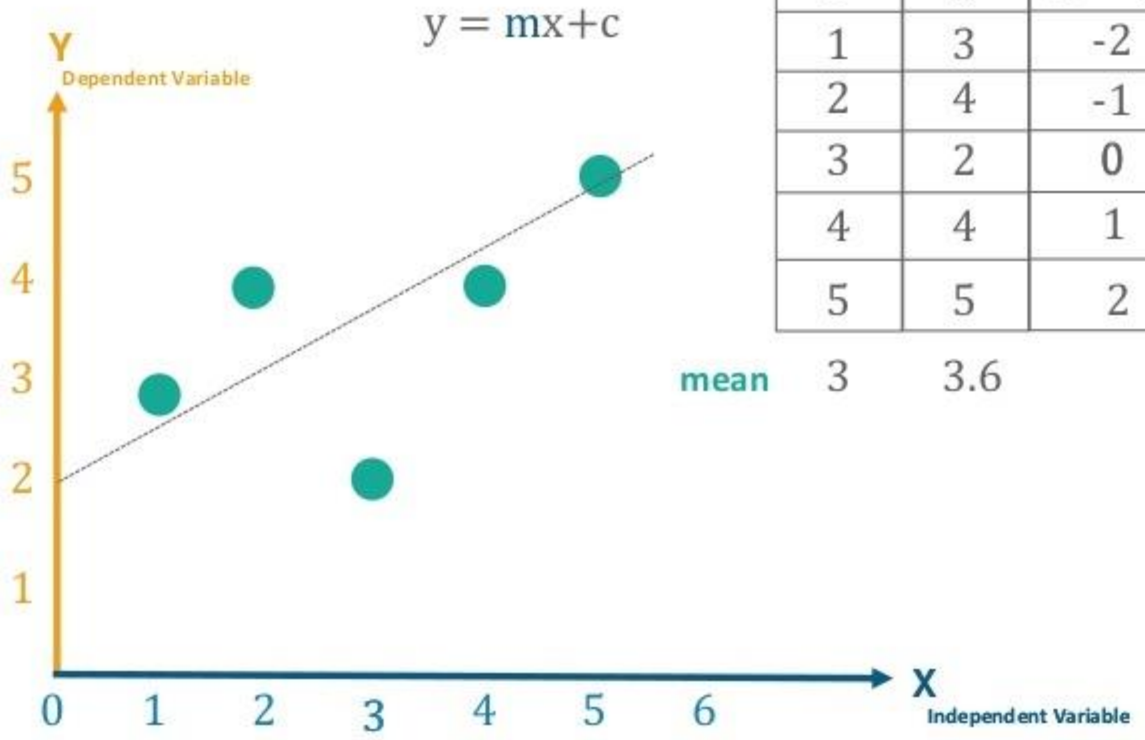
$$\text{where } m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2}$$

Understanding Linear Regression Algorithm



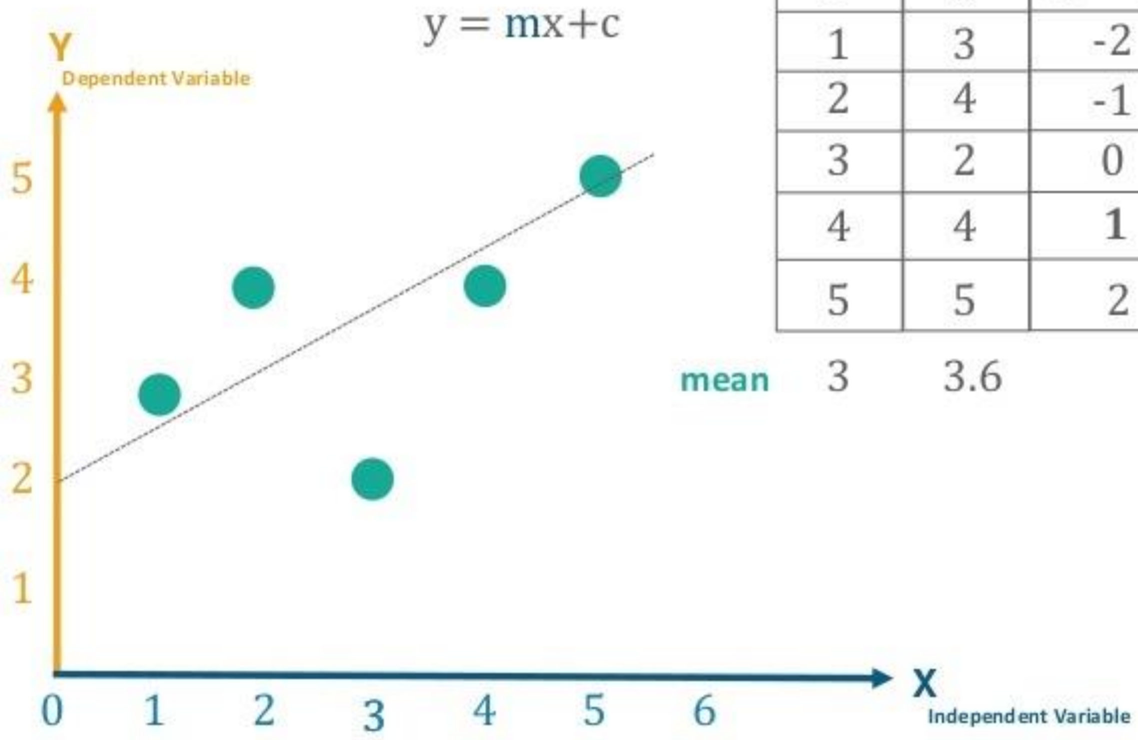
x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	
3	2	0	-1.6	
4	4	1	0.4	
5	5	2	1.4	
mean 3	3.6			

Understanding Linear Regression Algorithm



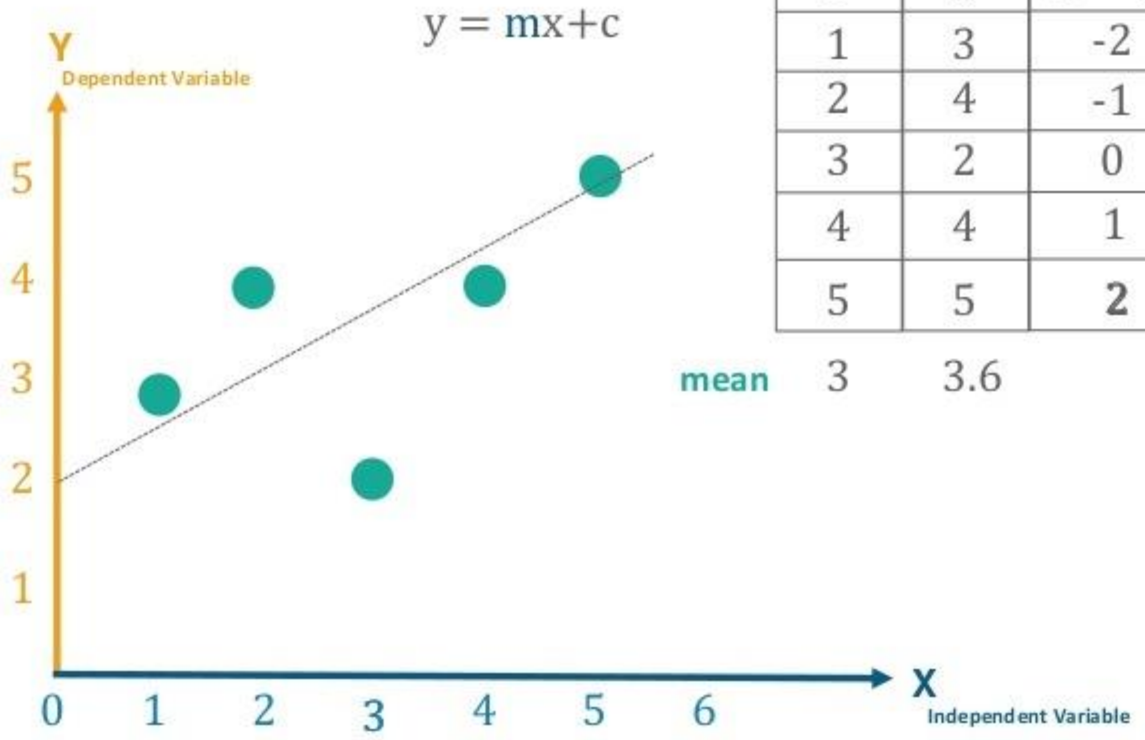
x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	1
3	2	0	-1.6	
4	4	1	0.4	
5	5	2	1.4	
mean	3	3.6		

Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	1
3	2	0	-1.6	0
4	4	1	0.4	
5	5	2	1.4	
mean 3	3.6			

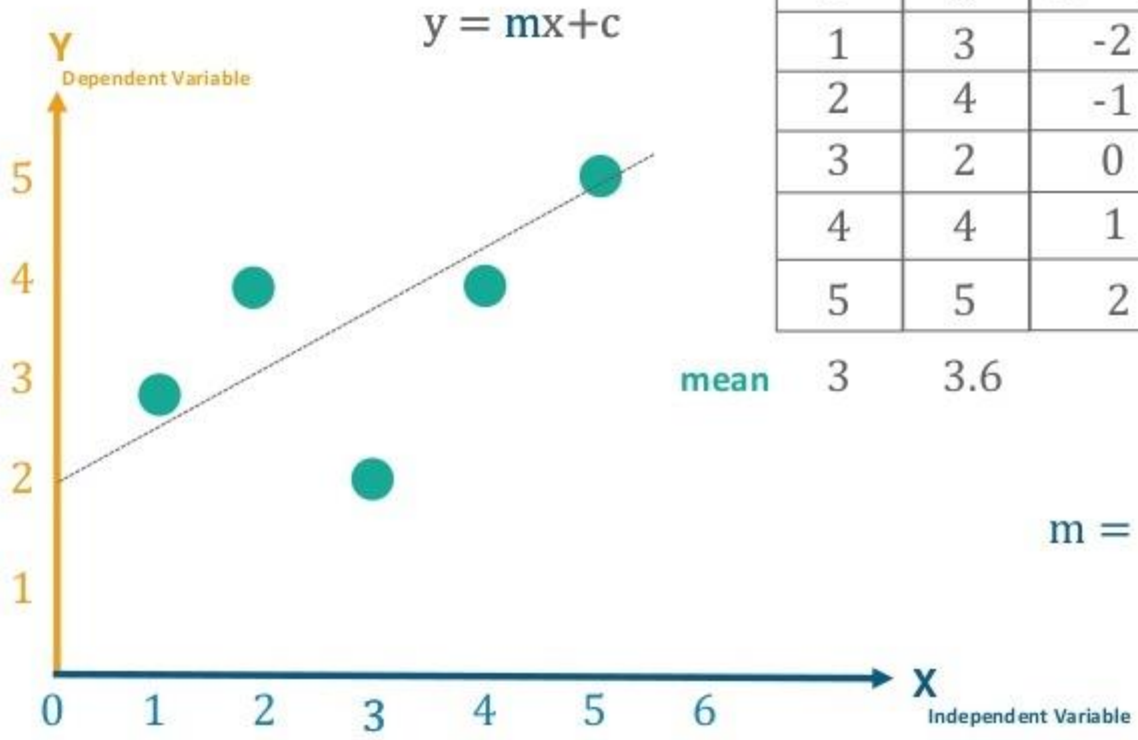
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	1
3	2	0	-1.6	0
4	4	1	0.4	1
5	5	2	1.4	

mean 3 3.6

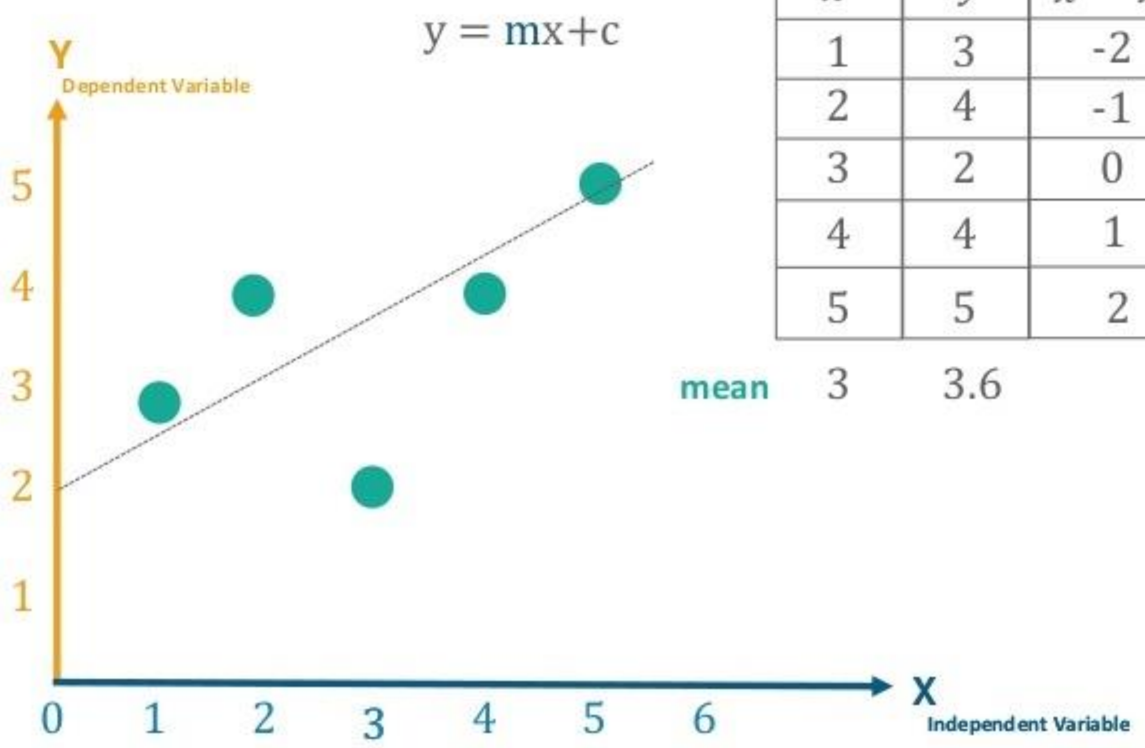
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	1
3	2	0	-1.6	0
4	4	1	0.4	1
5	5	2	1.4	4
mean 3	3.6			

$$m = \frac{\Sigma\,(x-\bar{x})(y-\bar{y})}{\Sigma\,(x-\bar{x})^2}$$

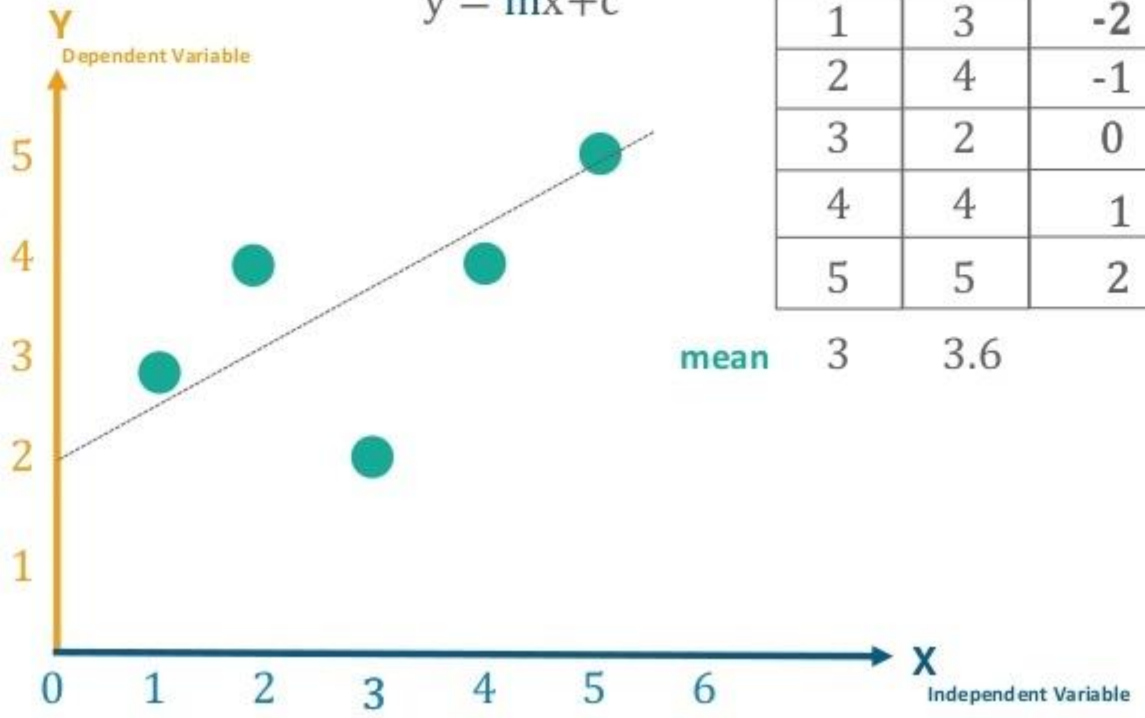
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$
1	3	-2	-0.6	4
2	4	-1	0.4	1
3	2	0	-1.6	0
4	4	1	0.4	1
5	5	2	1.4	4
mean 3	3.6			

Understanding Linear Regression Algorithm

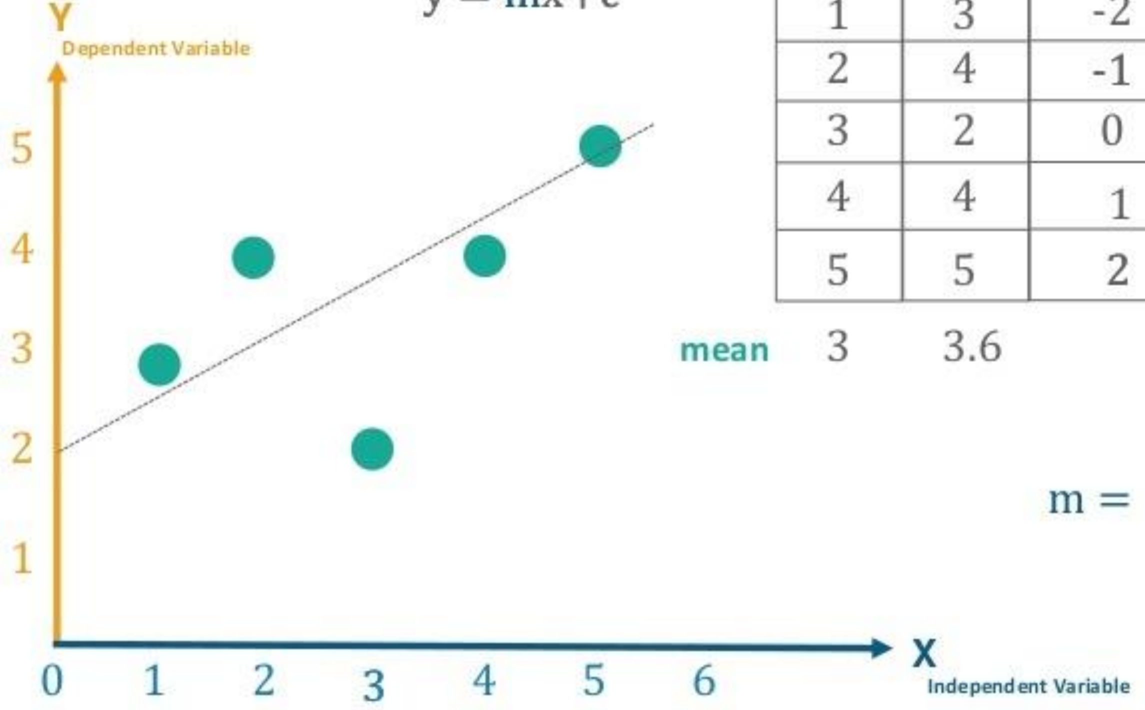
$y = mx+c$



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	
2	4	-1	0.4	1	
3	2	0	-1.6	0	
4	4	1	0.4	1	
5	5	2	1.4	4	
mean: 3	3.6				

Understanding Linear Regression Algorithm

$y = mx + c$

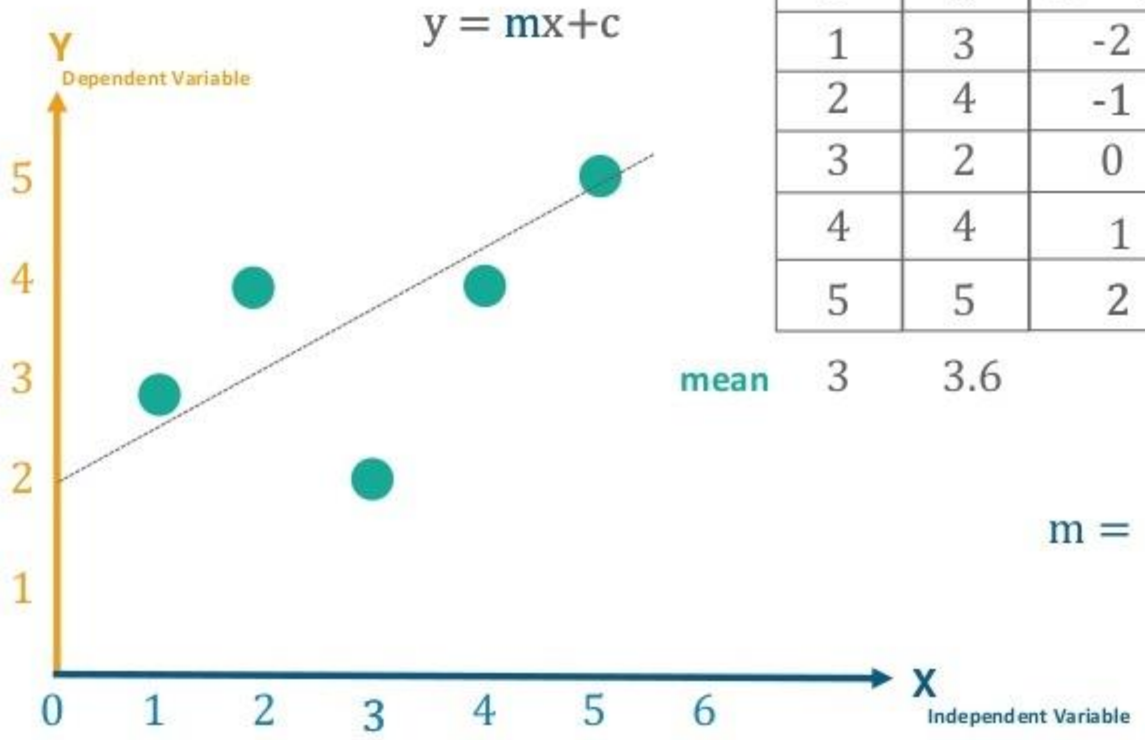


x	y	$x - \bar{x}$	$y - \bar{y}$	$(x - \bar{x})^2$	$(x - \bar{x})(y - \bar{y}$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8

mean 3 3.6

$$m = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

Understanding Linear Regression Algorithm

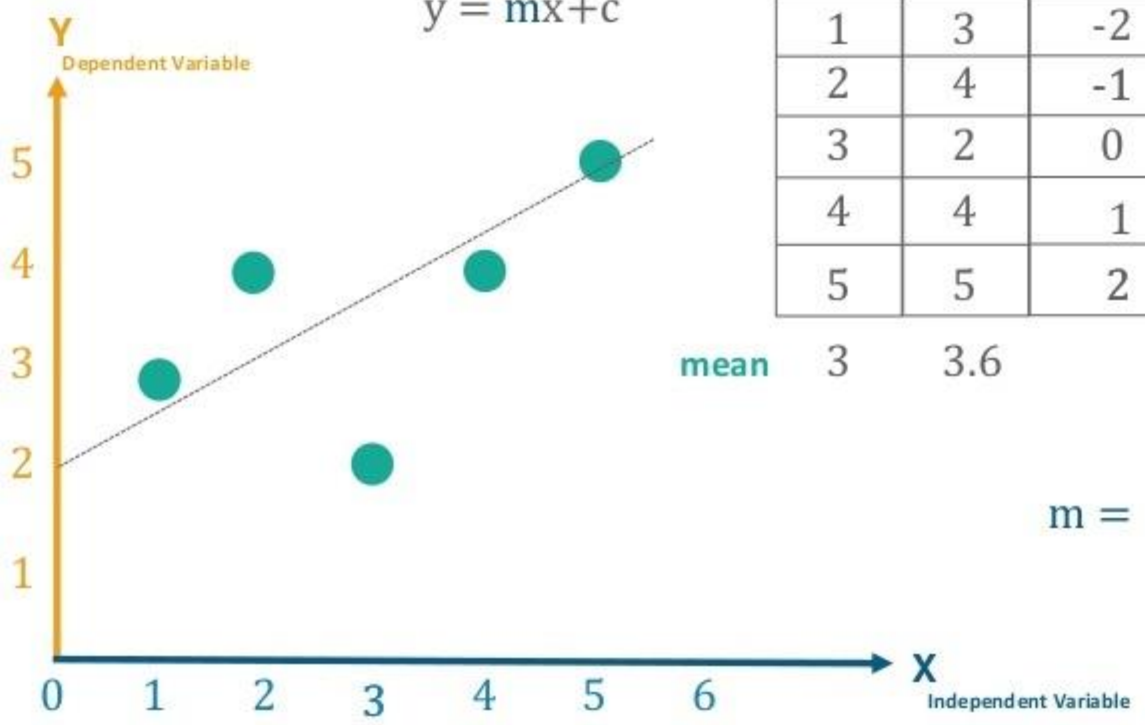


	x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y}$
	1	3	-2	-0.6	4	1.2
	2	4	-1	0.4	1	-0.4
	3	2	0	-1.6	0	0
	4	4	1	0.4	1	0.4
	5	5	2	1.4	4	2.8
mean	3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \frac{\Sigma\,(x-\bar{x})(y-\bar{y})}{\Sigma\,(x-\bar{x})^2}$$

Understanding Linear Regression Algorithm

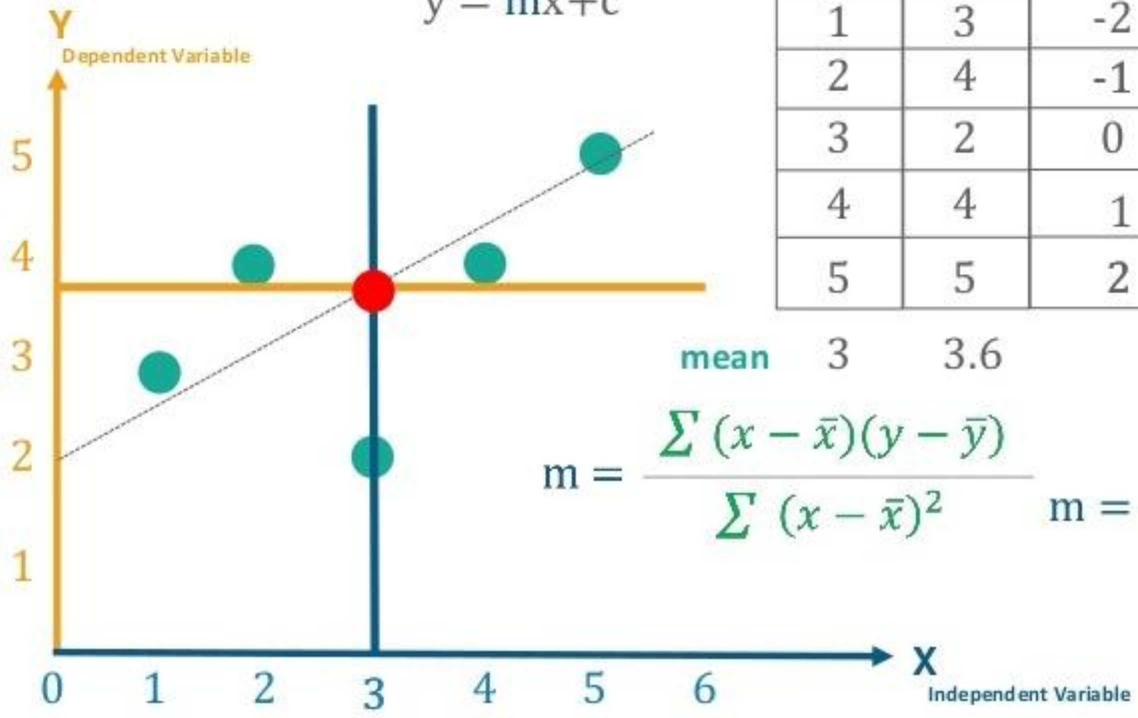
$y = mx + c$



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \frac{\Sigma\,(x-\bar{x})(y-\bar{y})}{\Sigma\,(x-\bar{x})^2} = \frac{4}{10}$$

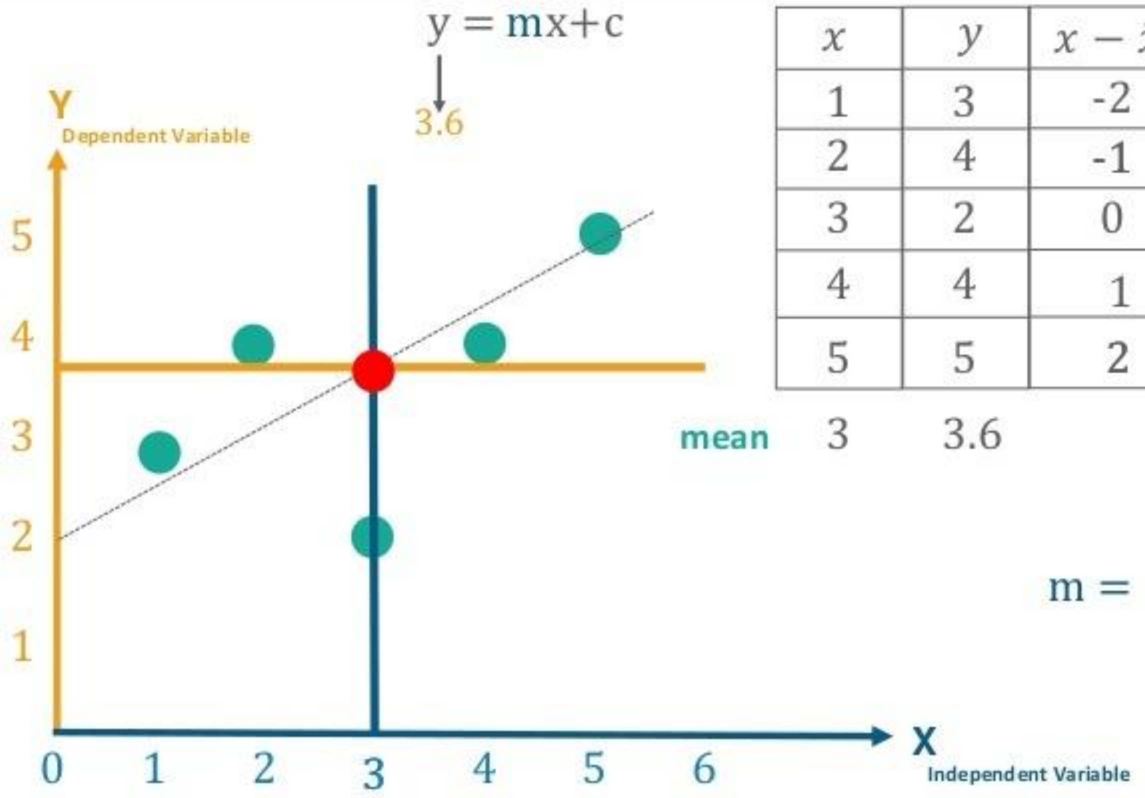
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y}$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{\Sigma (x-\bar{x})^2} \quad m = \frac{\Sigma (x-\bar{x})(y-\bar{y})}{\Sigma (x-\bar{x})^2} = \frac{4}{10}$$

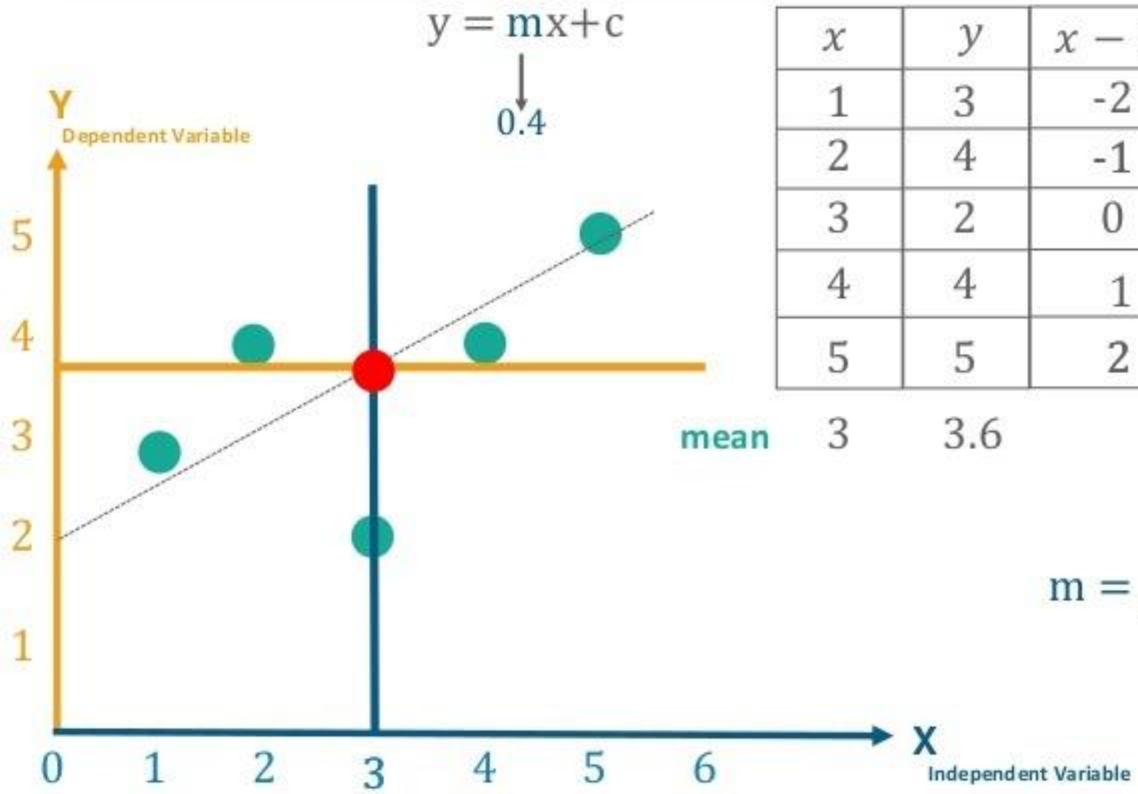
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y}$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \frac{\Sigma\,(x-\bar{x})(y-\bar{y})}{\Sigma\,(x-\bar{x})^2} = \frac{4}{10}$$

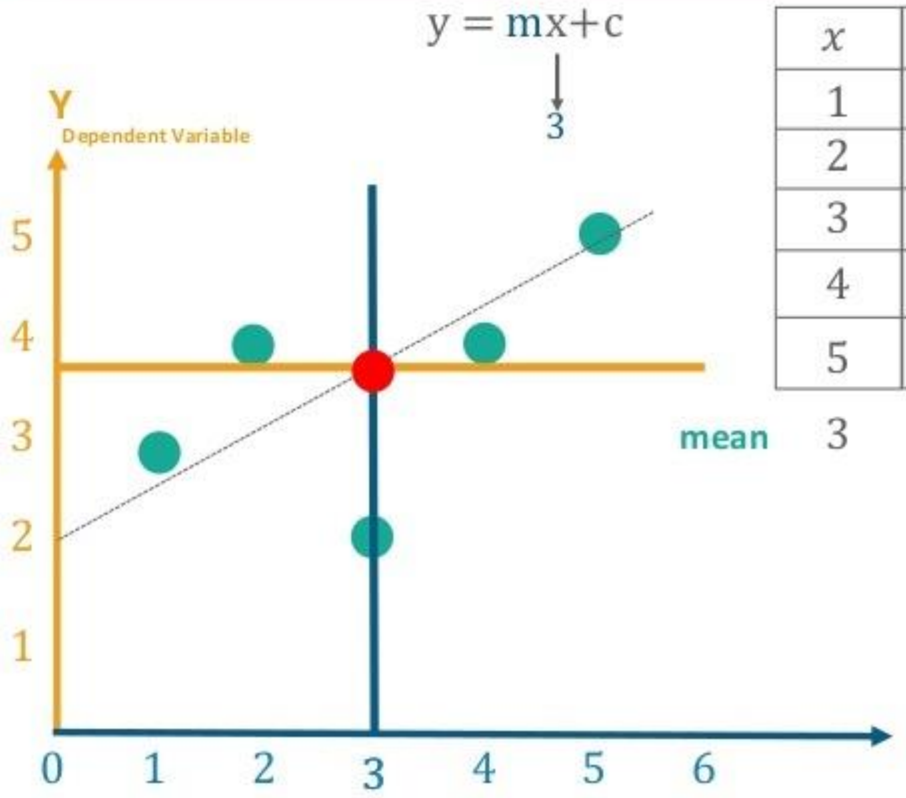
Understanding Linear Regression Algorithm



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm



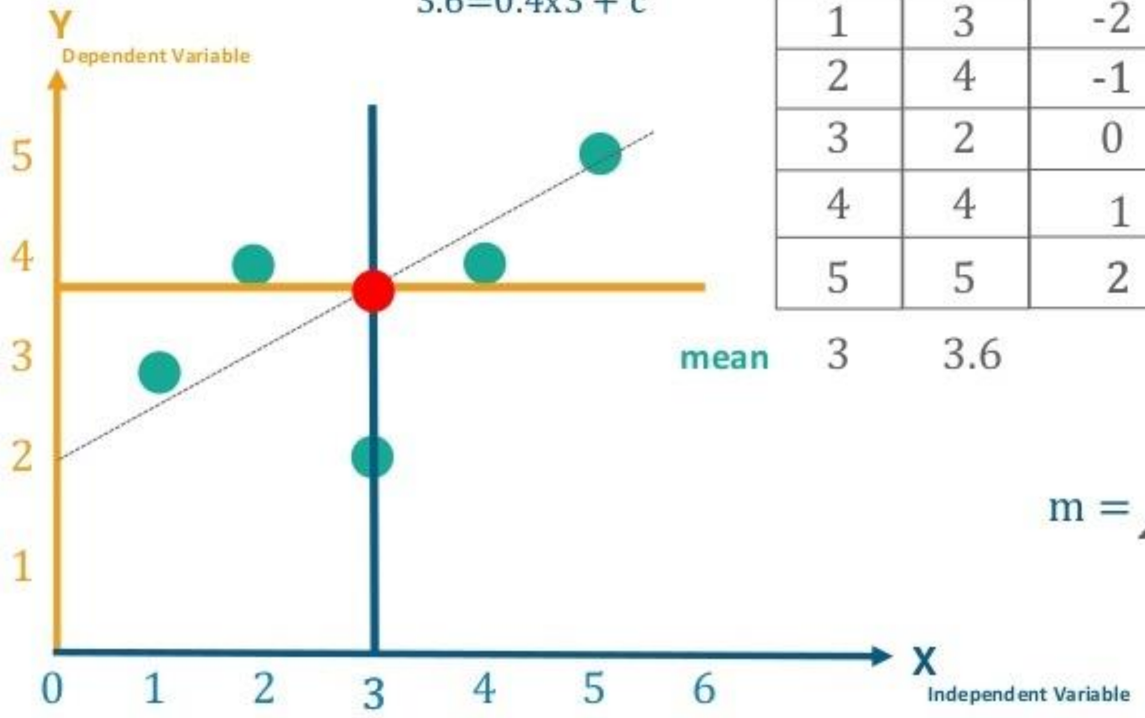
x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y}$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm

$y = mx + c$

$3.6 = 0.4x3 + c$

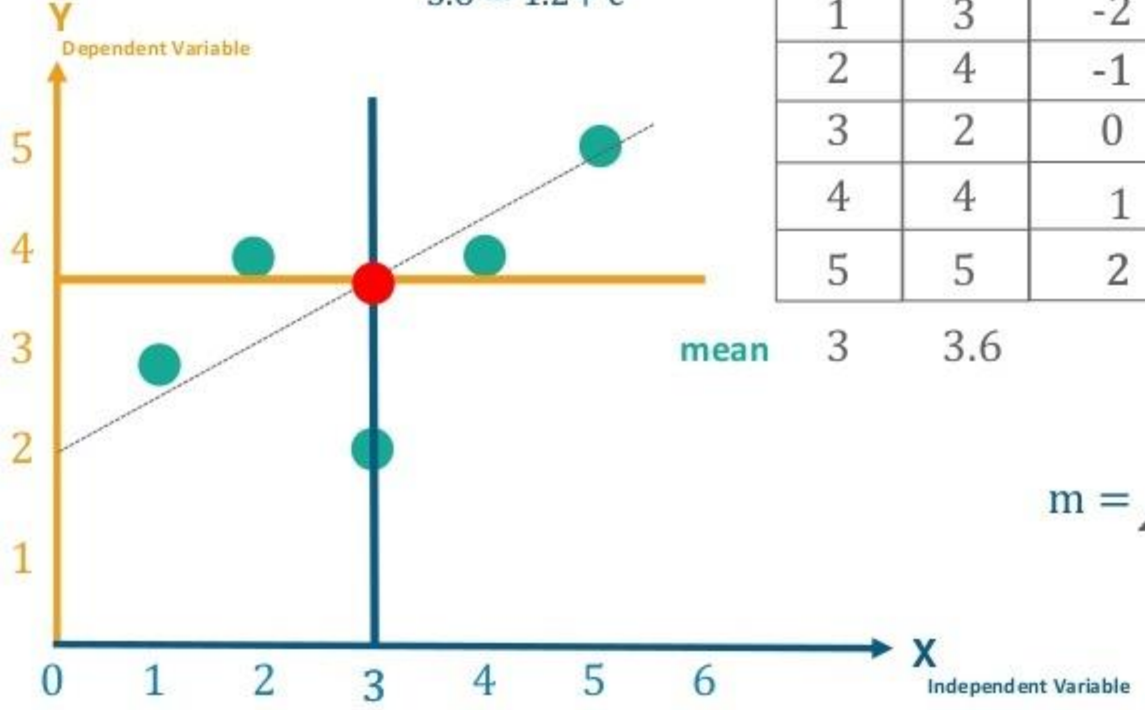


x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm

$$y = mx + c$$
$$3.6 = 1.2 + c$$



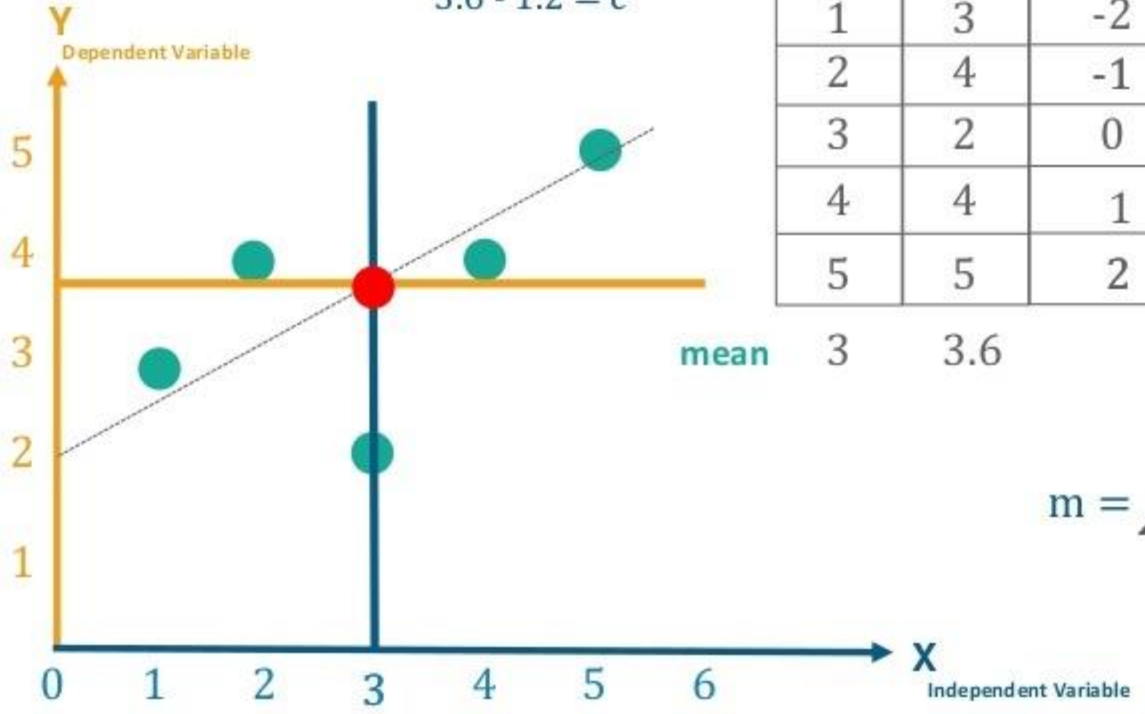
x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm

$$y = mx + c$$

$$3.6 - 1.2 = c$$



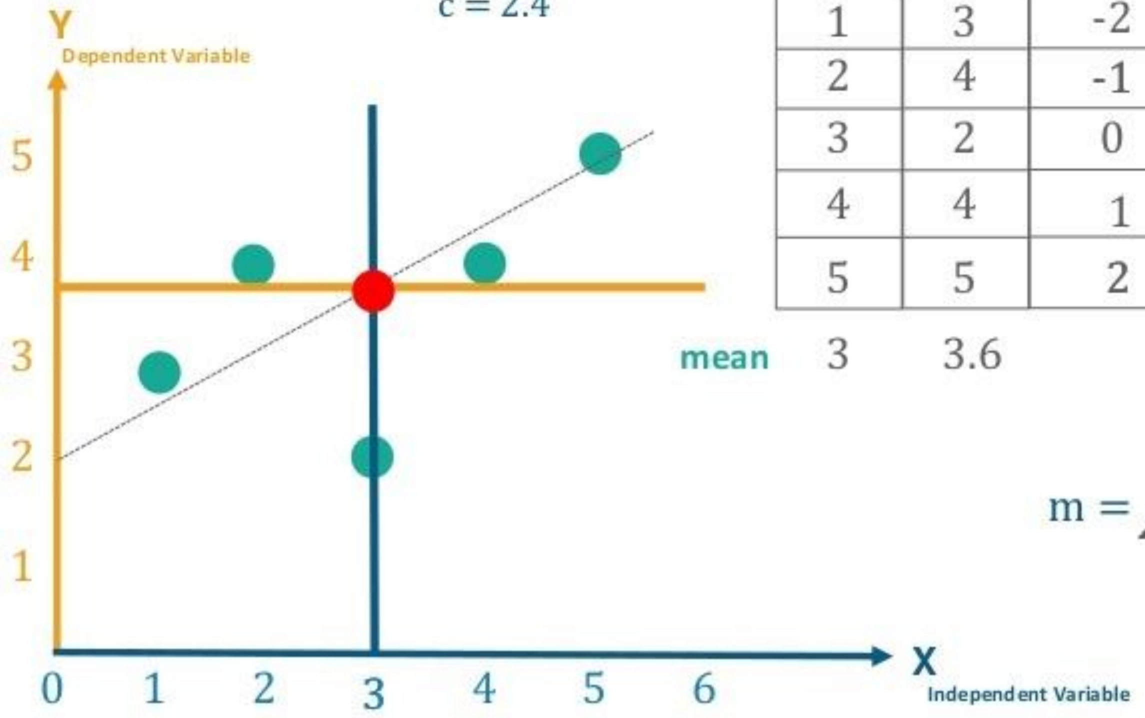
	x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y}$
	1	3	-2	-0.6	4	1.2
	2	4	-1	0.4	1	-0.4
	3	2	0	-1.6	0	0
	4	4	1	0.4	1	0.4
	5	5	2	1.4	4	2.8
mean	3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm

$y = mx + c$

$c = 2.4$



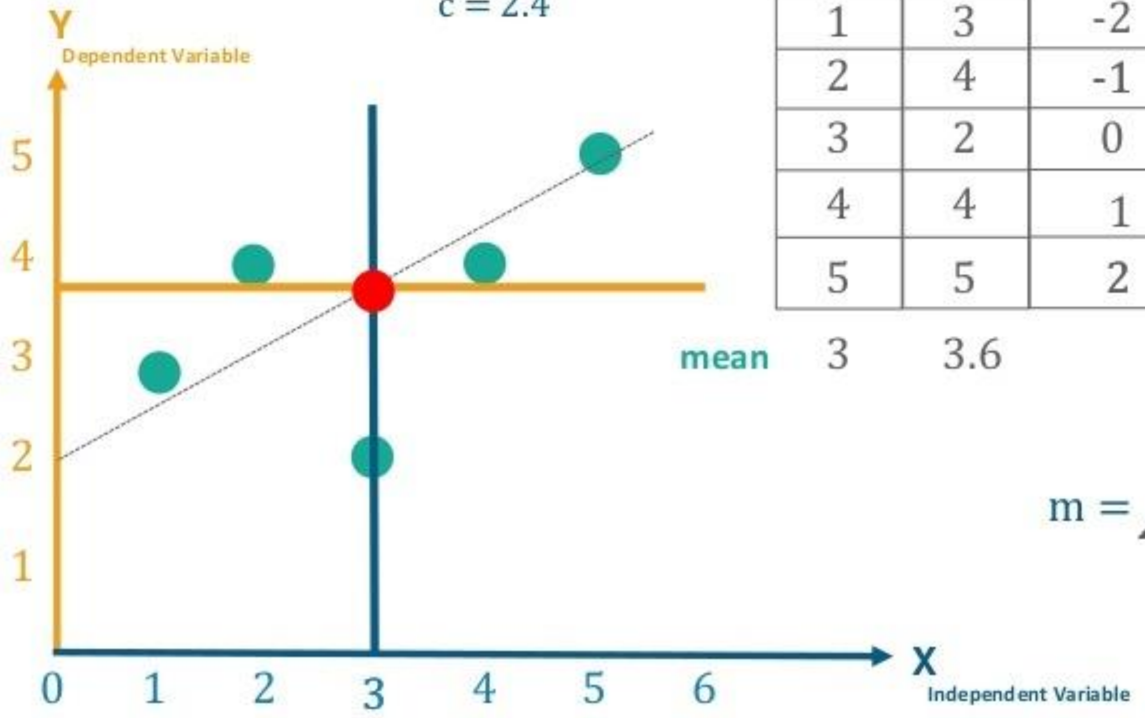
x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

Understanding Linear Regression Algorithm

$y = mx + c$

$c = 2.4$



x	y	$x-\bar{x}$	$y-\bar{y}$	$(x-\bar{x})^2$	$(x-\bar{x})(y-\bar{y})$
1	3	-2	-0.6	4	1.2
2	4	-1	0.4	1	-0.4
3	2	0	-1.6	0	0
4	4	1	0.4	1	0.4
5	5	2	1.4	4	2.8
mean 3	3.6			$\Sigma = 10$	$\Sigma = 4$

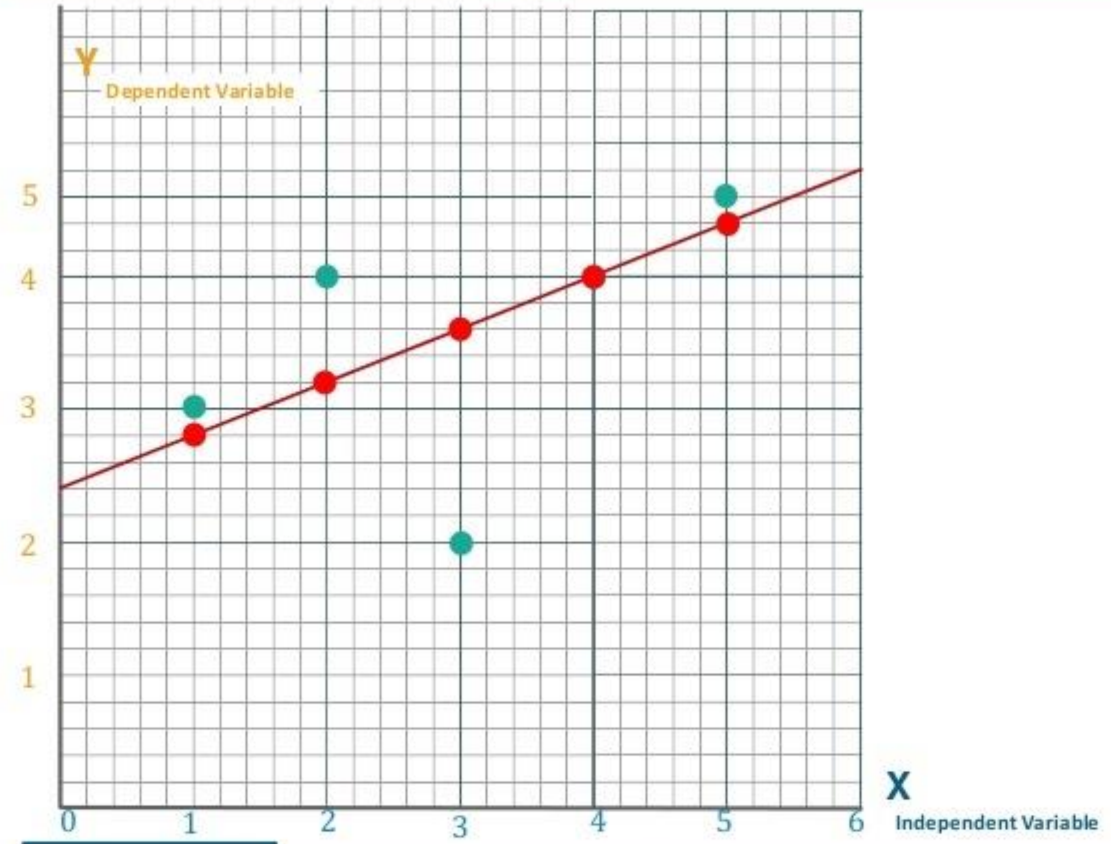
$$m = \sum \frac{(x-\bar{x})(y-\bar{y})}{(x-\bar{x})^2} = \frac{4}{10}$$

$m = 0.4$

$c = 2.4$

$y = 0.4x + 2.4$

Mean Square Error



$m = 0.4$

$c = 2.4$

$y = 0.4x + 2.4$

For given $m = 0.4$ & $c = 2.4$, lets predict values for y for $x = \{1,2,3,4,5\}$

$y = 0.4 \times 1 + 2.4 = 2.8$

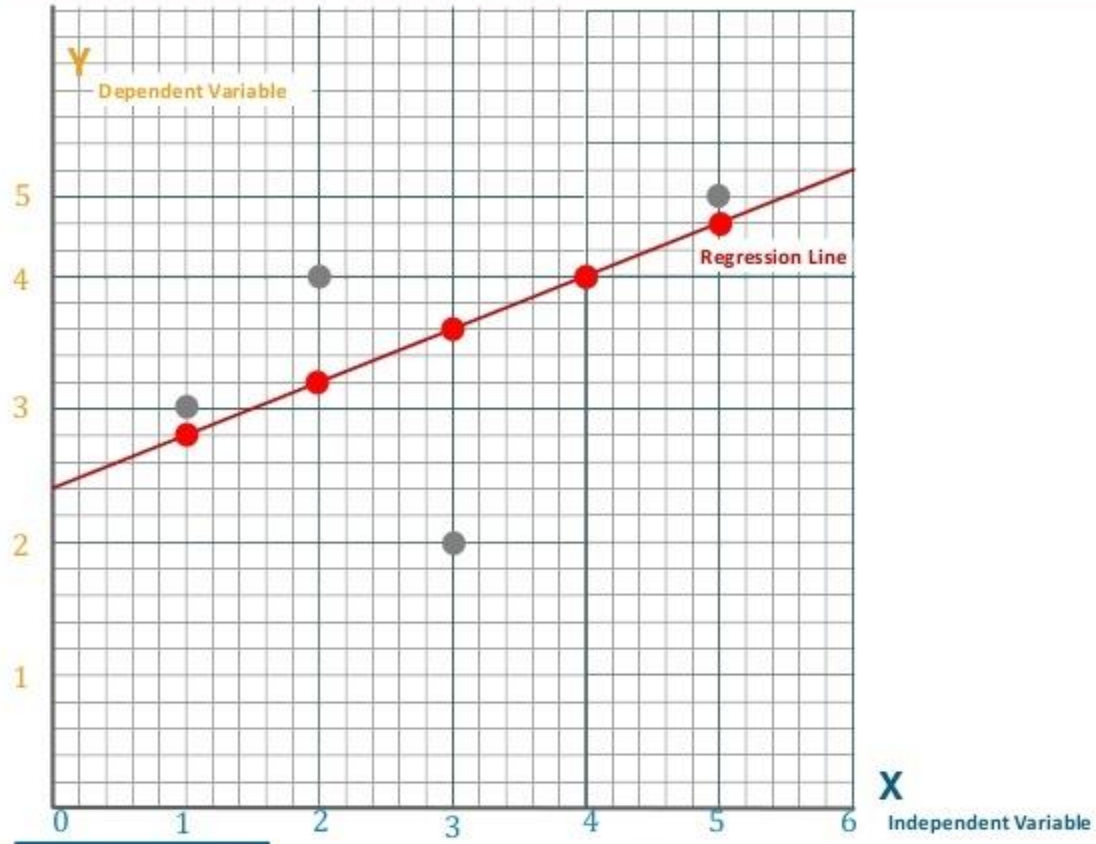
$y = 0.4 \times 2 + 2.4 = 3.2$

$y = 0.4 \times 3 + 2.4 = 3.6$

$y = 0.4 \times 4 + 2.4 = 4.0$

$y = 0.4 \times 5 + 2.4 = 4.4$

Mean Square Error



$m = 0.4$

$c = 2.4$

$y = 0.4x + 2.4$

For given $m = 0.4$ & $c = 2.4$, lets predict values for y for $x = \{1,2,3,4,5\}$

$y = 0.4 \times 1 + 2.4 = 2.8$

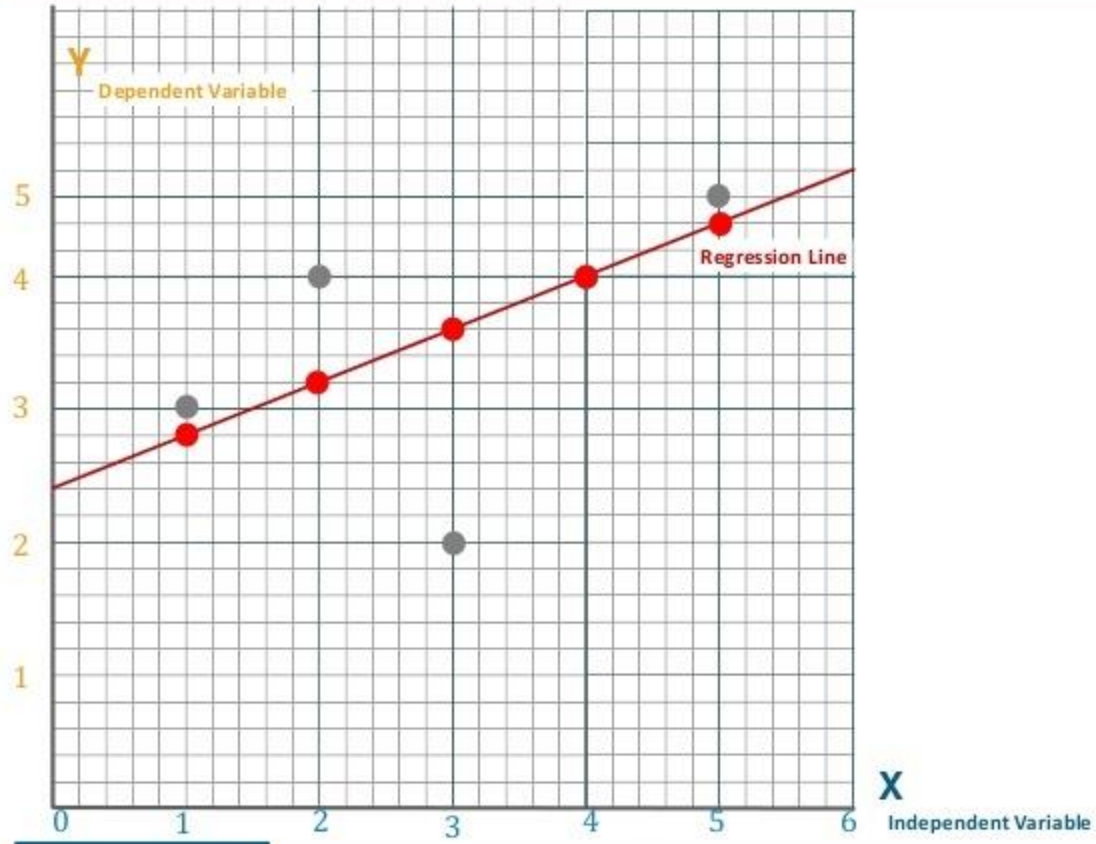
$y = 0.4 \times 2 + 2.4 = 3.2$

$y = 0.4 \times 3 + 2.4 = 3.6$

$y = 0.4 \times 4 + 2.4 = 4.0$

$y = 0.4 \times 5 + 2.4 = 4.4$

Mean Square Error

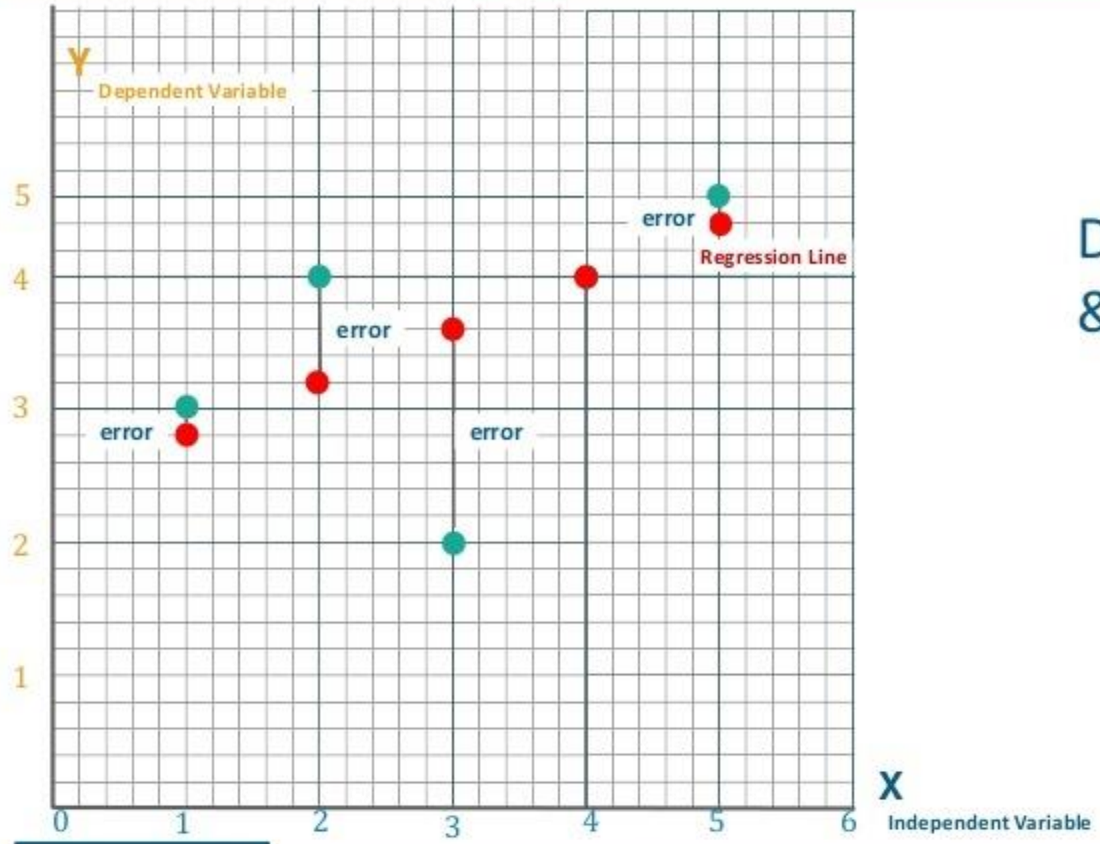


$m = 0.4$
$c = 2.4$
$y = 0.4x + 2.4$

For given $m = 0.4$ & $c = 2.4$, lets predict values for y for $x = \{1,2,3,4,5\}$

$y = 0.4 \times 1 + 2.4 = 2.8$
$y = 0.4 \times 2 + 2.4 = 3.2$
$y = 0.4 \times 3 + 2.4 = 3.6$
$y = 0.4 \times 4 + 2.4 = 4.0$
$y = 0.4 \times 5 + 2.4 = 4.4$

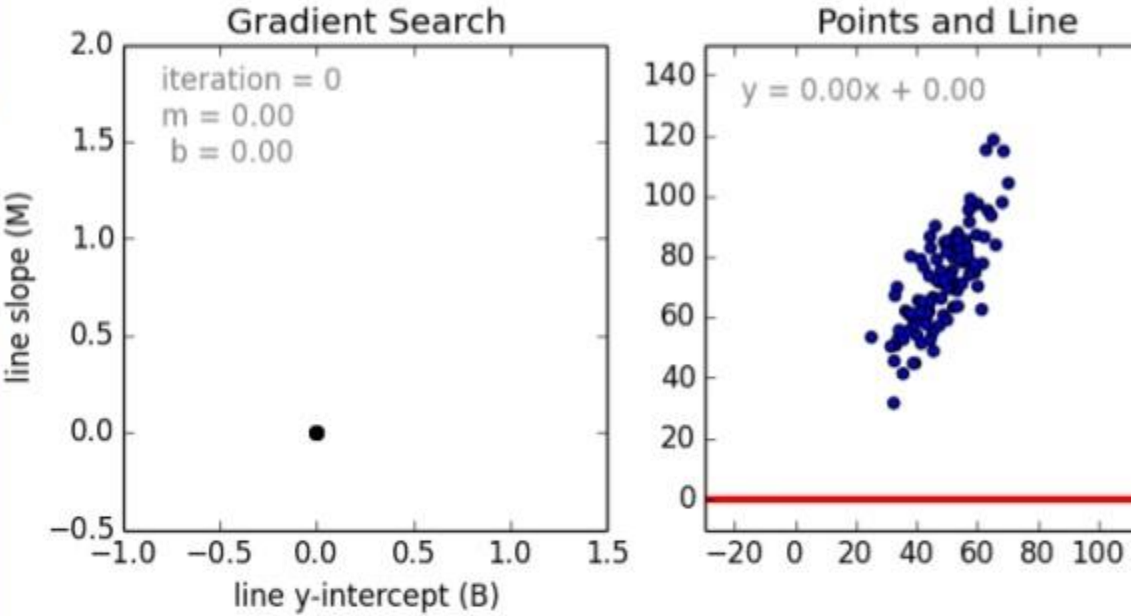
Mean Square Error



Distance between actual & predicted value

edureka!

Finding the best fit line



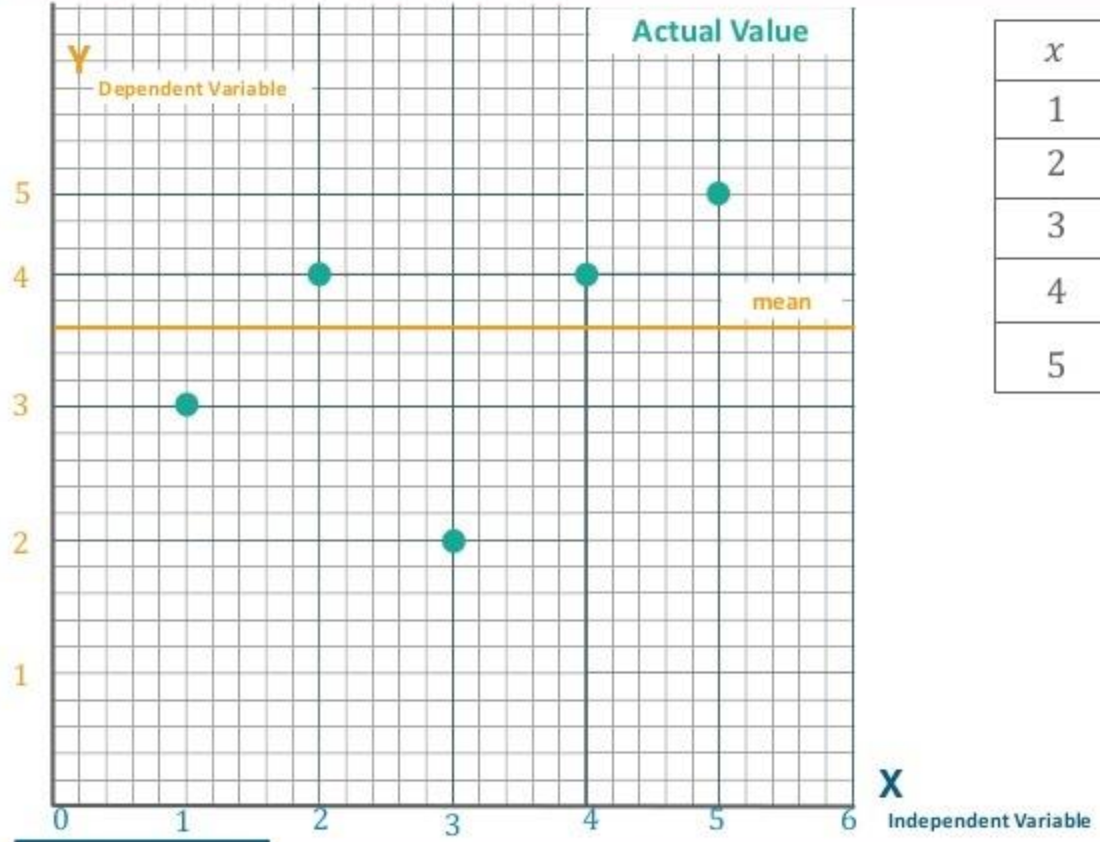
Let’s check the Goodness of fit

edureka!

What is R-Square?

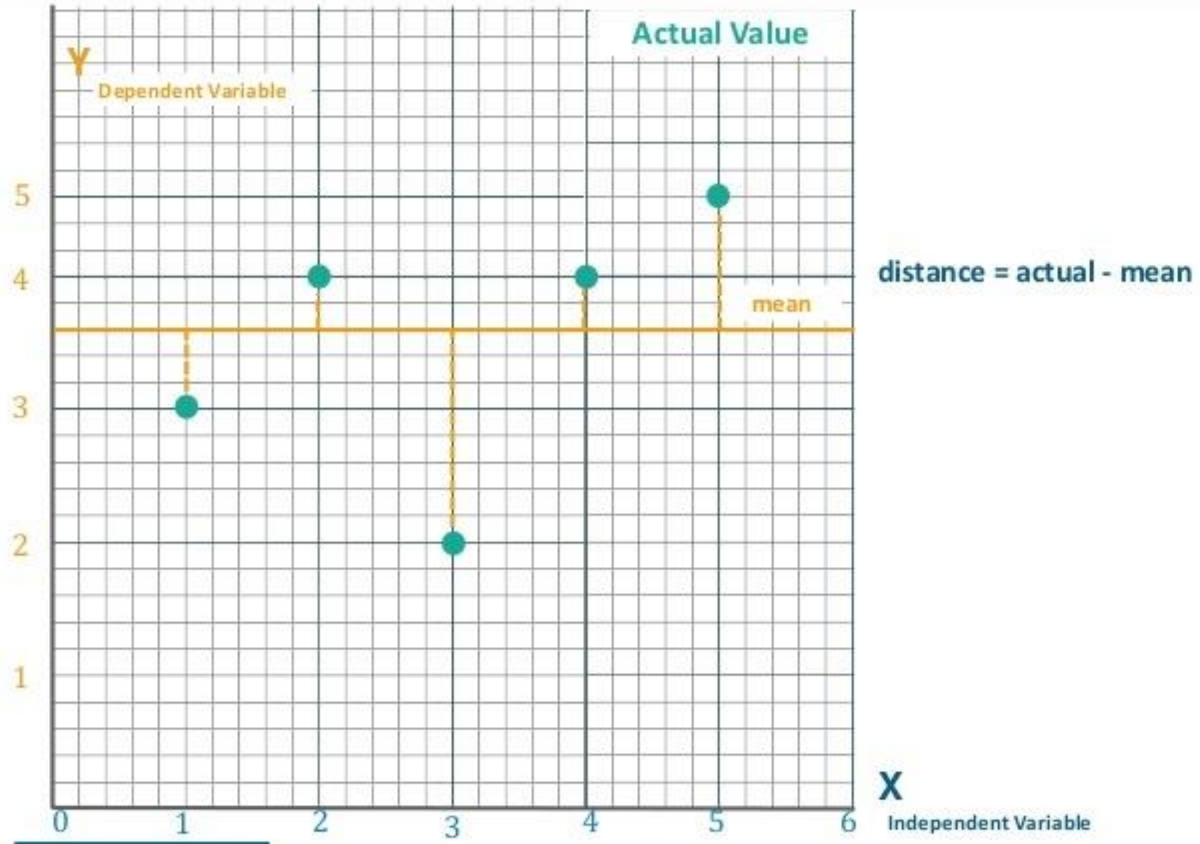
- **R-squared** value is a statistical measure of how close the data are to the fitted regression line
- It is also known as **coefficient of determination**, or the **coefficient of multiple determination**

Calculation of R^2

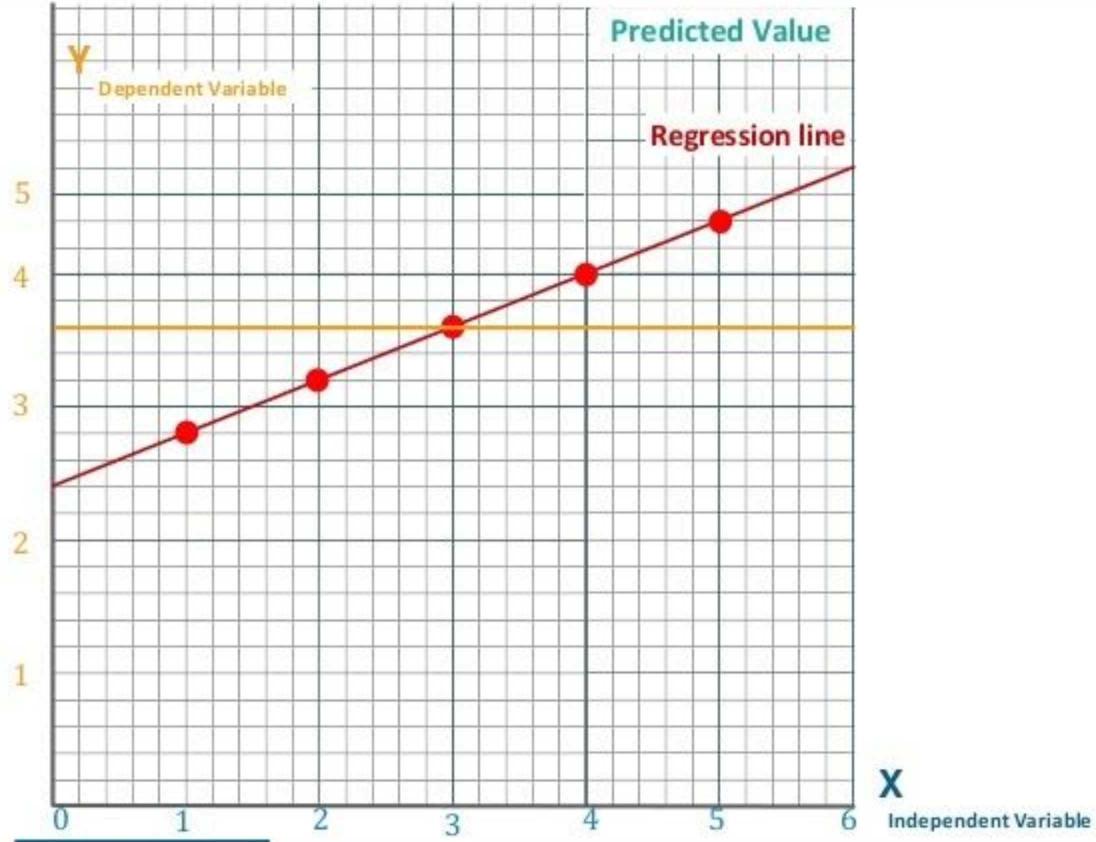


x	y
1	3
2	4
3	2
4	4
5	5

Calculation of R^2

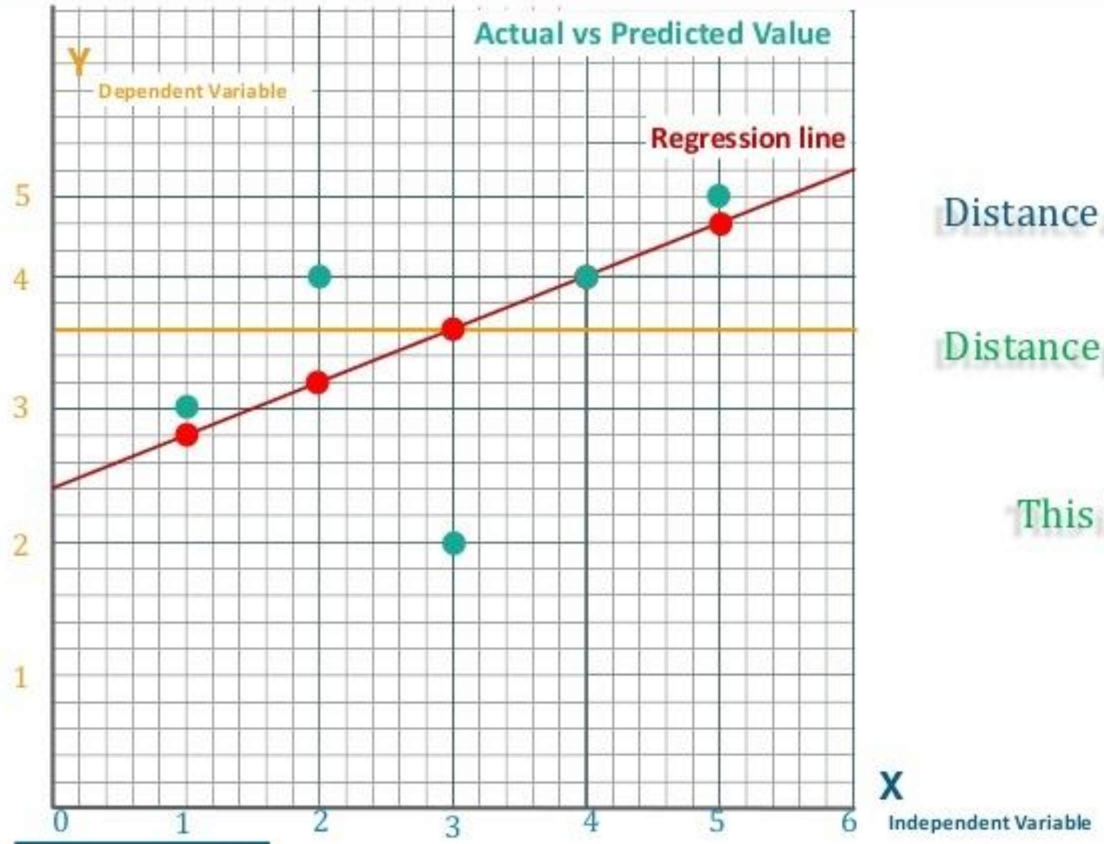


Calculation of R^2



x	y_p
1	2.8
2	3.2
3	3.6
4	4.0
5	4.4

Calculation of R^2



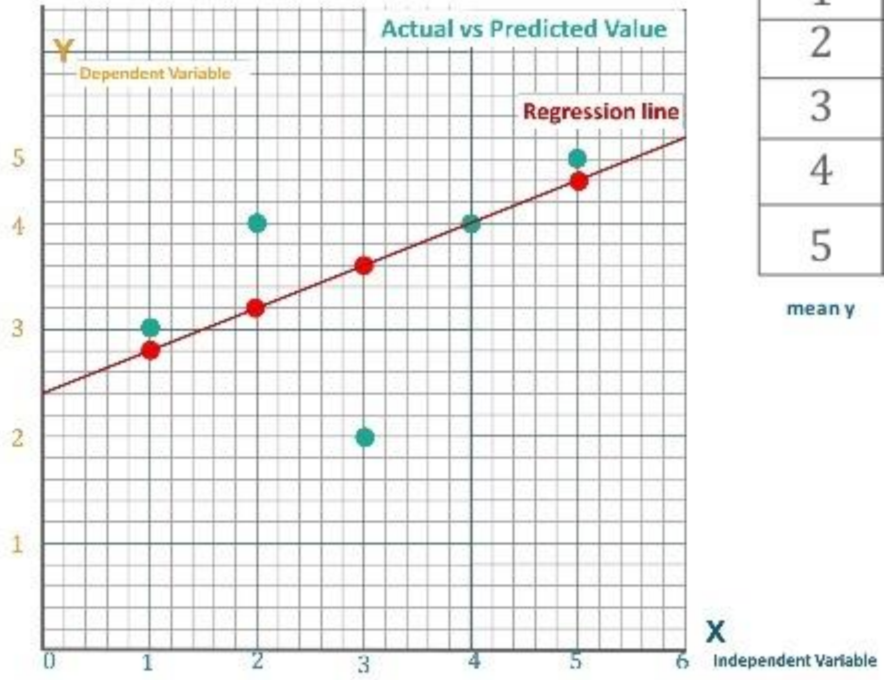
Distance actual - mean

vs

Distance predicted - mean

This is nothing but $R^2 = \dfrac{\sum (y_p - \bar{y})^2}{\sum (y - \bar{y})^2}$

Calculation of R^2

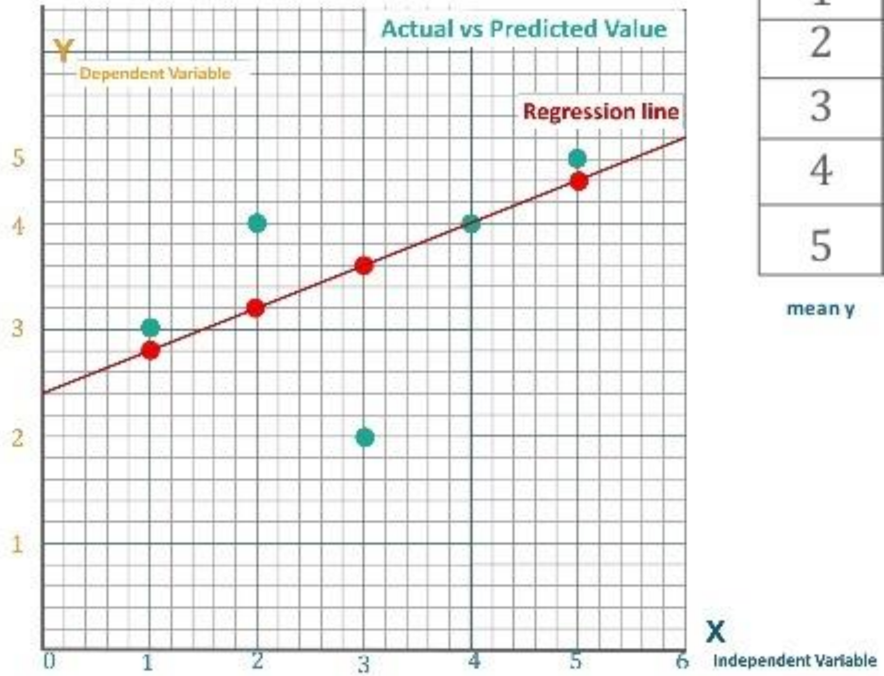


x	y	$y - \bar{y}$
1	3	– 0.6
2	4	0.4
3	2	–1.6
4	4	0.4
5	5	1.4

mean y 3.6

$$R^2 = \frac{\sum (y_p - \bar{y})^2}{\sum (y - \bar{y})^2}$$

Calculation of R^2

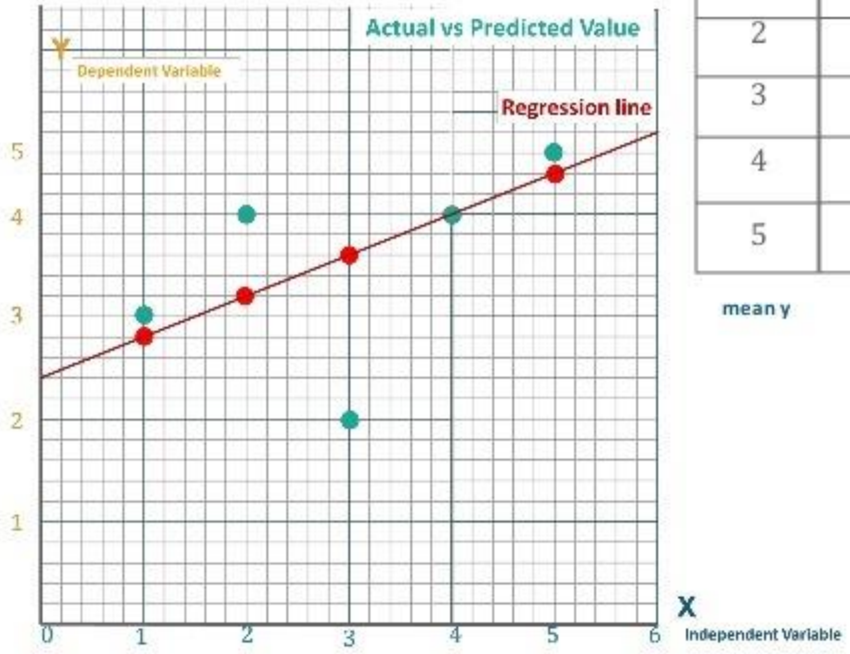


x	y	$y-\bar{y}$	$(y-\bar{y})^2$	y_p	$(y_p - \bar{y})$
1	3	– 0.6	3.6	2.8	-0.8
2	4	0.4	1.6	3.2	-0.4
3	2	−1.6	2.56	3.6	0
4	4	0.4	1.6	4.0	0.4
5	5	1.4	1.96	4.4	0.8

mean y 3.6

$$R^2 = \frac{\sum (y_p - \bar{y})^2}{\sum (y - \bar{y})^2}$$

Calculation of R^2

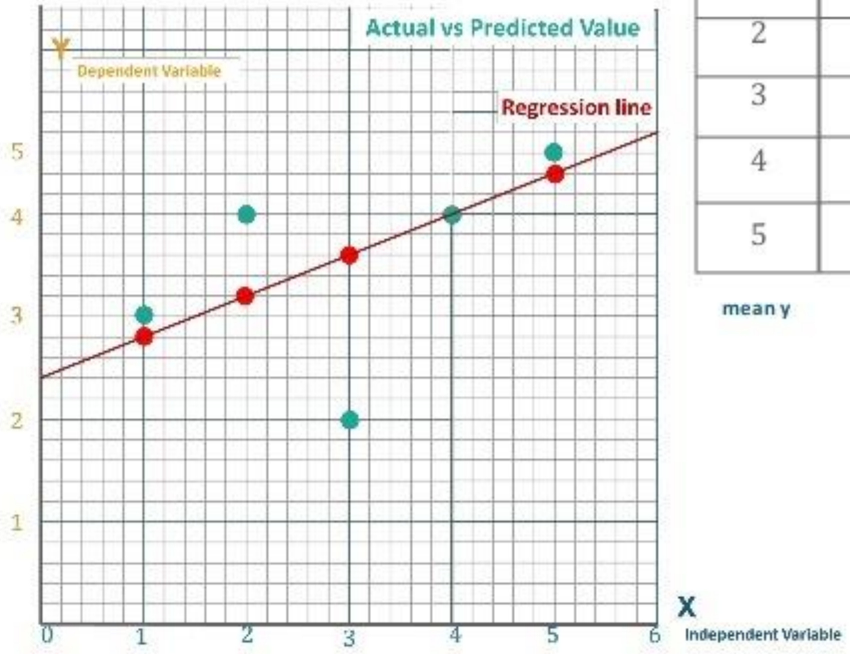


x	y	$y-\bar{y}$	$(y-\bar{y})^2$	y_p	$(y_p - \bar{y})$	$(y_p - \bar{y}$
1	3	- 0.6	3.6	2.8	-0.8	6.4
2	4	0.4	1.6	3.2	-0.4	1.6
3	2	−1.6	2.56	3.6	0	0
4	4	0.4	1.6	4.0	0.4	1.6
5	5	1.4	1.96	4.4	0.8	6.4

mean y 3.6

$$R^2 = \frac{\sum (y_p - \bar{y})^2}{\sum (y-\bar{y})^2}$$

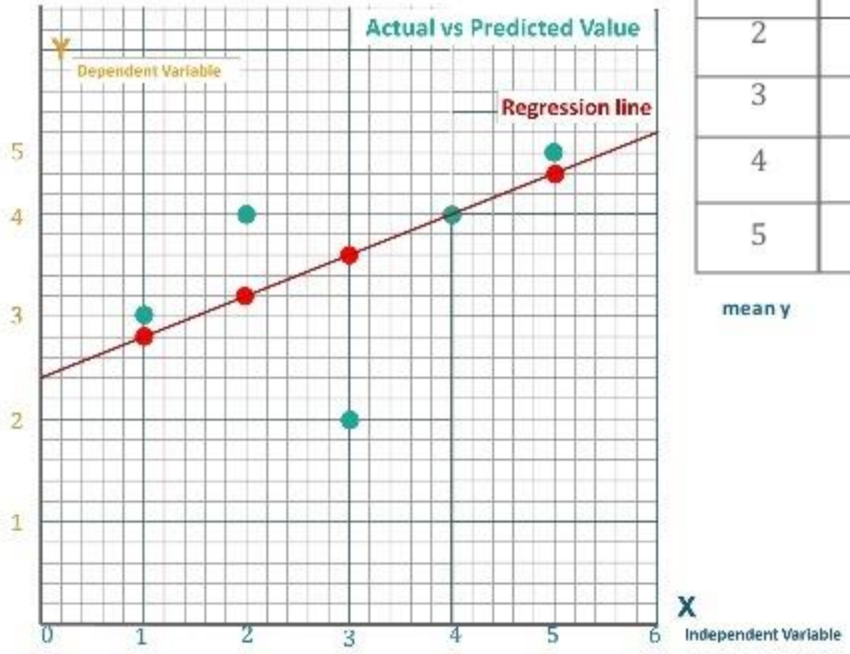
Calculation of R^2



x	y	$y-\bar{y}$	$(y-\bar{y})^2$	y_p	$(y_p - \bar{y})$	$(y_p - \bar{y}$
1	3	– 0.6	0.36	2.8	-0.8	0.64
2	4	0.4	0.16	3.2	-0.4	0.16
3	2	–1.6	2.56	3.6	0	0
4	4	0.4	0.16	4.0	0.4	0.16
5	5	1.4	1.96	4.4	0.8	0.64
mean y	3.6		Σ 5.2			Σ 1.6

$$R^2 = \frac{1.6}{5.2} = \frac{\Sigma\left((y_p - \bar{y}\right)^2}{\Sigma\,(y-\bar{y})^2}$$

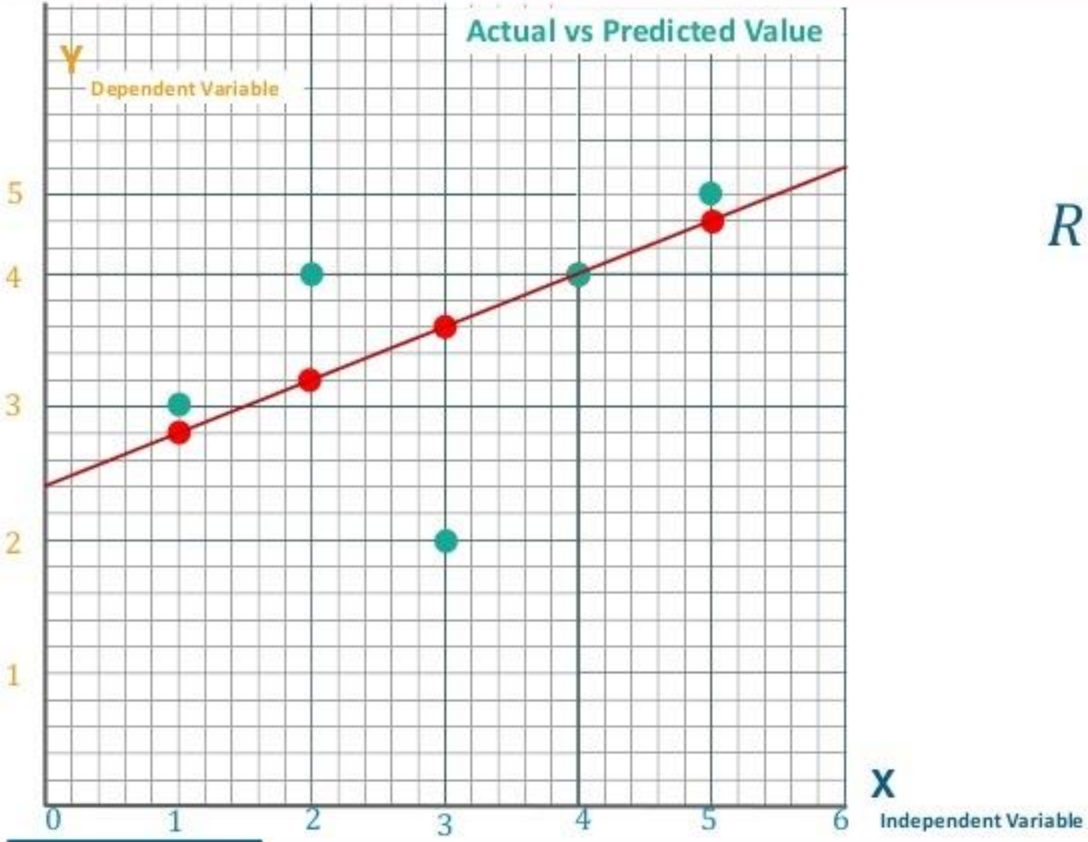
Calculation of R^2



x	y	$y-\bar{y}$	$(y-\bar{y})^2$	y_p	$(y_p - \bar{y})$	$((y_p -$
1	3	- 0.6	3.6	2.8	-0.8	6.4
2	4	0.4	1.6	3.2	-0.4	1.6
3	2	−1.6	2.56	3.6	0	0
4	4	0.4	1.6	4.0	0.4	1.6
5	5	1.4	1.96	4.4	0.8	6.4
mean y	3.6		11.32			16

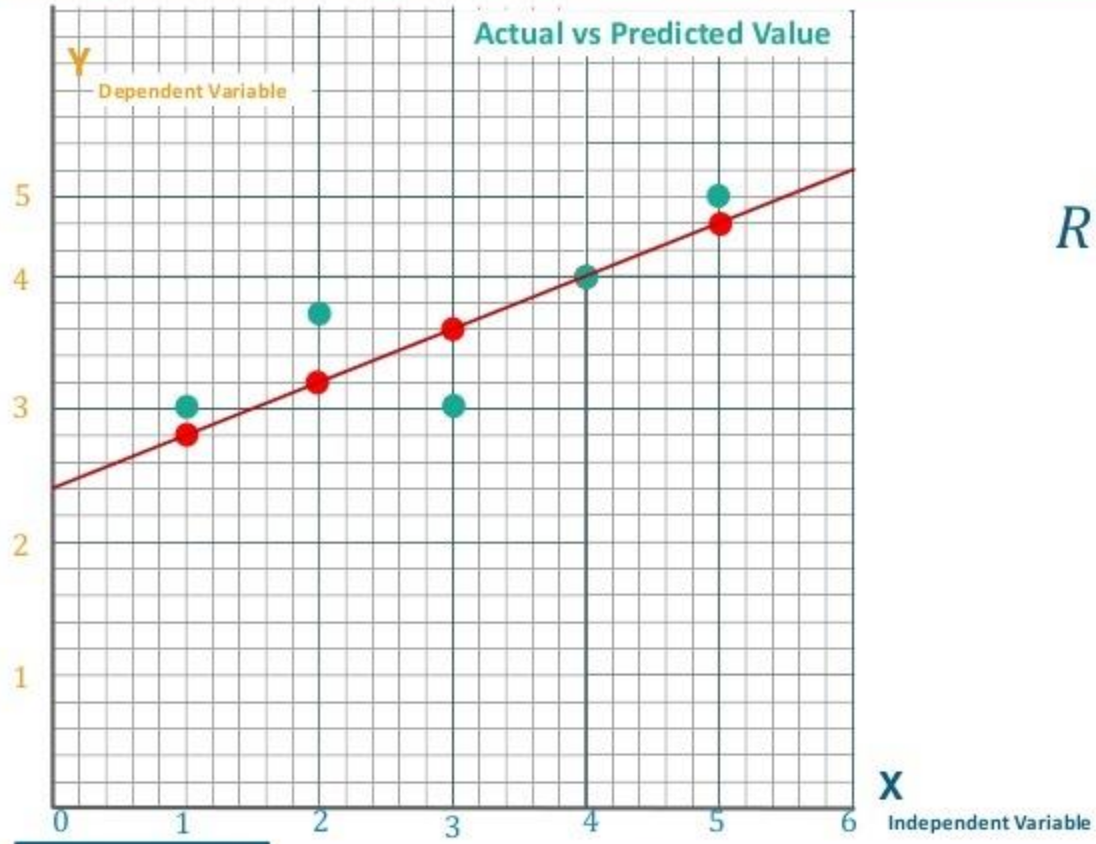
$$R^2 \approx 0.3$$

Calculation of R^2



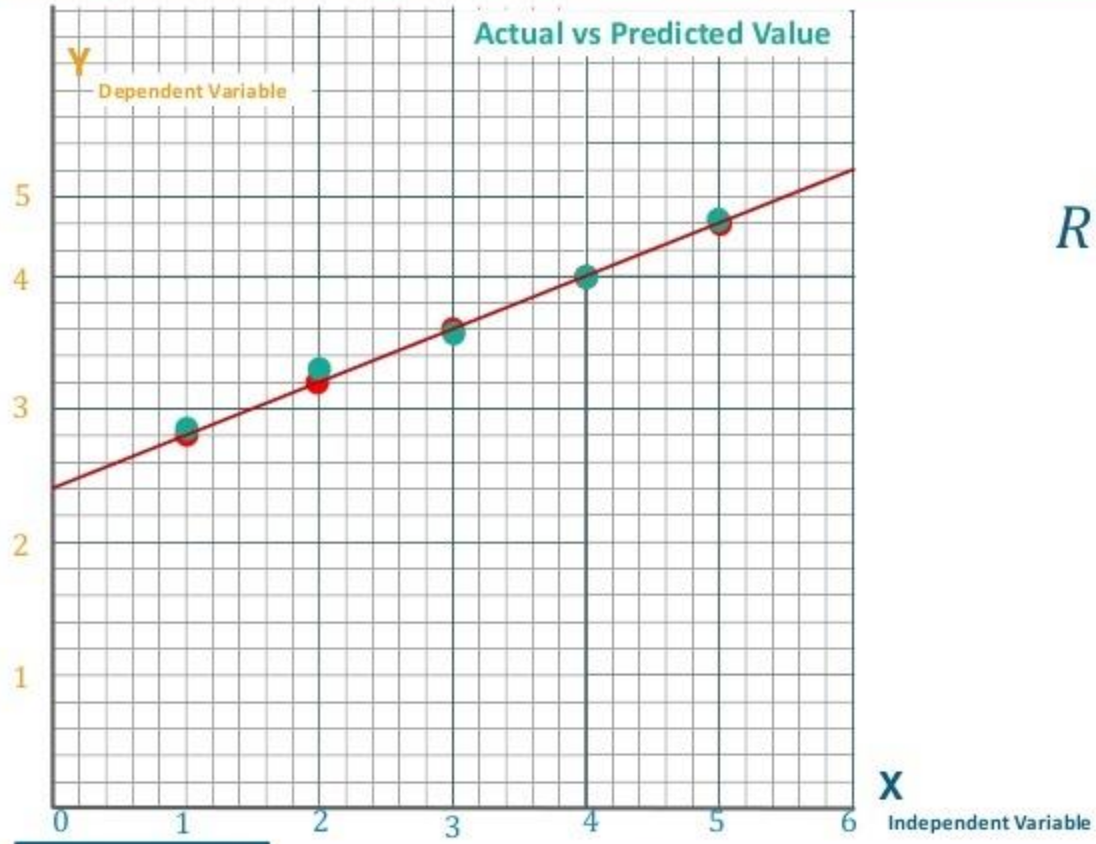
$$R^2 \approx 0.3$$

Calculation of R^2



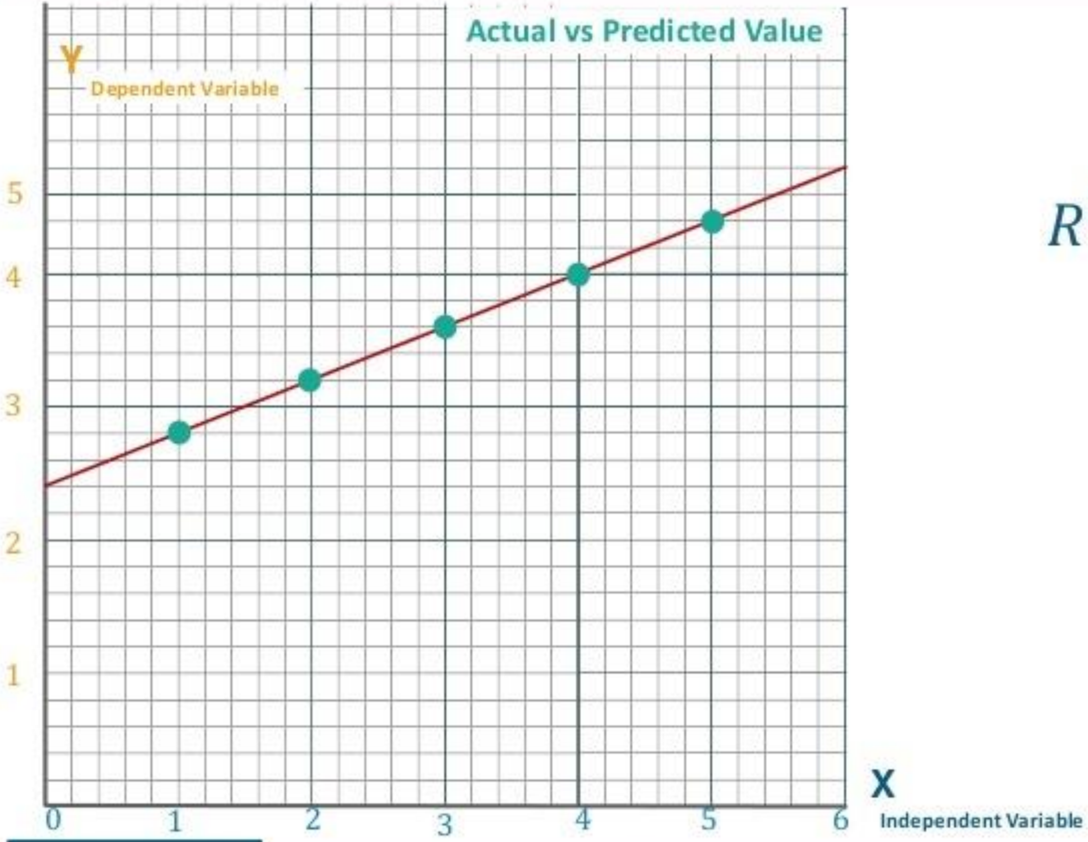
$$R^2 \approx 0.7$$

Calculation of R^2



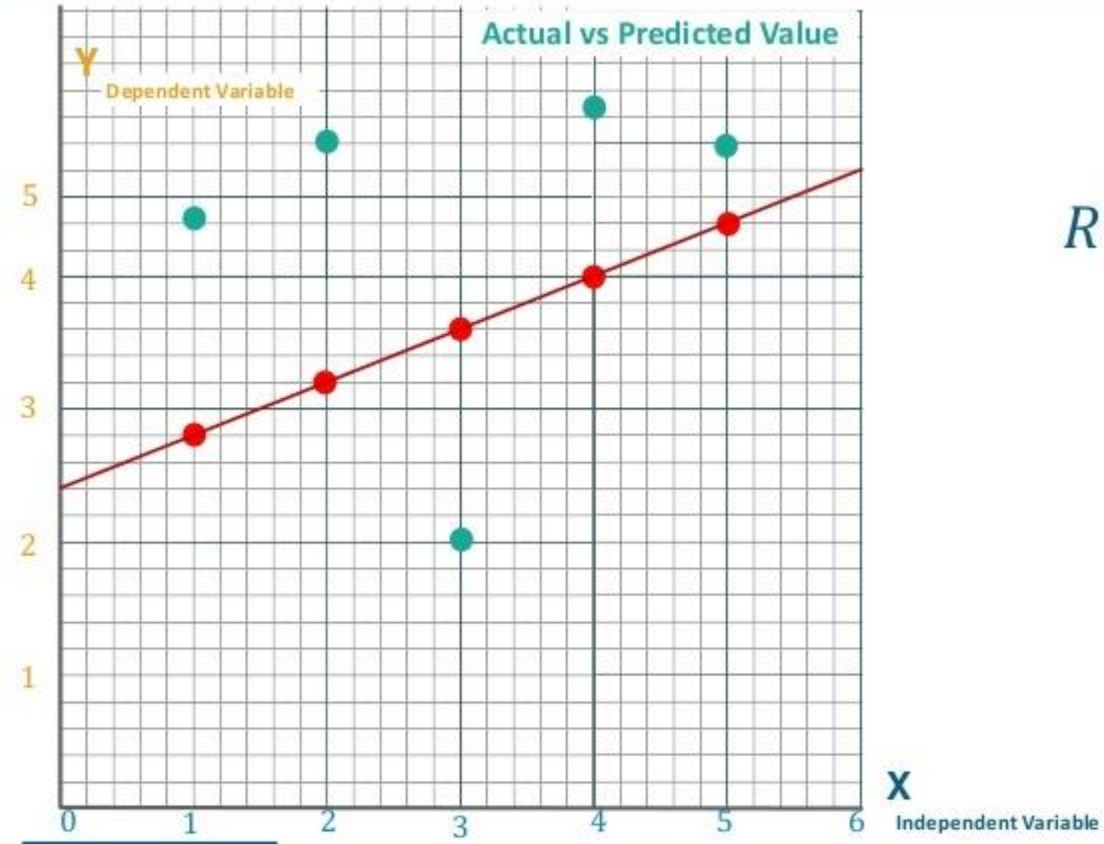
$$R^2 \approx 0.9$$

Calculation of R^2



$$R^2 \approx 1$$

Calculation of R^2



$$R^2 \approx 0.02$$

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