## ASSIGNMENT #2

We want to predict a student's Exam Score $(y)$ based on the number of Hours studied $(x)$

## DATA

| STUDENT | HOURS STUDIED $(x)$ | EXAM SCORE $(y)$ |
|---------|---------------------|------------------|
| 1 | 1 | 52 |
| 2 | 2 | 57 |
| 3 | 3 | 61 |
| 4 | 4 | 65 |
| 5 | 5 | 70 |

## TASK

We want to fit linear regression line of the form:

$$y = mx + b$$

A new student studied 6 hours. We want to predict the Exam Score using the regression equation.

## FILL IN THE TABLE

- Compute $x^2$ for each student.
- Compute $xy$ for each student.
- Find the totals: $\sum x, \sum y,$ $\sum x^2,$ and $\sum xy.$

| STUDENT | $x$ | $y$ | $xy$ | $x^2$ |
|---------|-----|-----|------|-------|
| 1 | 1 | 52 | 52 | 1 |
| 2 | 2 | 57 | 114 | 4 |
| 3 | 3 | 61 | 183 | 9 |
| 4 | 4 | 65 | 260 | 16 |
| 5 | 5 | 70 | 350 | 25 |
| | $\sum x = 15$ | $\sum y = 305$ | $\sum xy = 959$ | $\sum x^2 = 55$ |

## COMPUTE THE SLOPE M

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

$$m = \frac{5(959) - (15)(305)}{5(55) - (15)^2}$$

$$m = 4.4$$

## COMPUTE THE INTERCEPT B

$$b = \frac{\sum y - m(\sum x)}{n}$$

$$b = \frac{305 - 4.4(15)}{5}$$
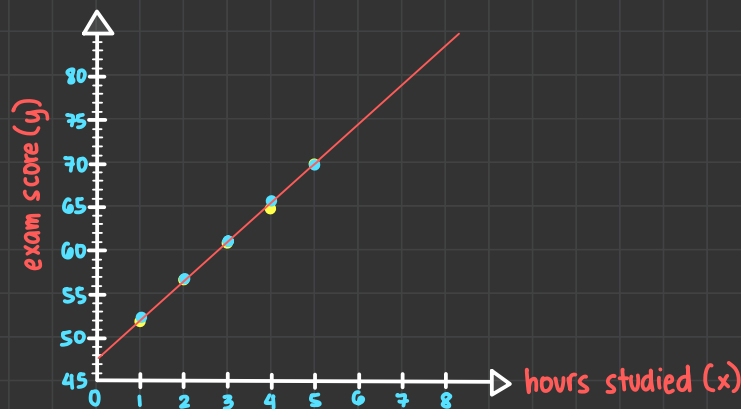
$$b = 47.8$$

## REGRESSION EQUATION

$$y = m(x) + b$$
$$y = 4.4(6) + 47.8$$
$$y = 74.2$$

# DRAW THE REGRESSION LINE USING A SCATTER PLOT

- Calculate the $y_{predict}$ for each data points
- Draw a regression line using $y_{predict}$
- Use a circle for all data points
- Use a red line for the regression line

| STUDENT | x | y | y predict |
|---|---|---|---|
| 1 | 1 | 52 | 52.2 |
| 2 | 2 | 57 | 56.6 |
| 3 | 3 | 61 | 61 |
| 4 | 4 | 65 | 65.4 |
| 5 | 5 | 70 | 69.8 |



# CALCULATE THE SUM OF SQUARED ERRORS

| STUDENT | x | y | y predict | $y_i - y_{predict}$ | $(y_i - y_{predict})^2$ |
|---|---|---|---|---|---|
| 1 | 1 | 52 | 52.2 | -0.2 | 0.04 |
| 2 | 2 | 57 | 56.6 | 0.4 | 0.16 |
| 3 | 3 | 61 | 61 | 0 | 0 |
| 4 | 4 | 65 | 65.4 | -0.4 | 0.16 |
| 5 | 5 | 70 | 69.8 | 0.2 | 0.04 |
| | | | | | SSE = 0.4 |

# CALCULATE THE SUM OF SQUARED TOTAL

| STUDENT | x | y | MEAN($\bar{y}$) | $y_i - \bar{y}$ | $(y_i - \bar{y})^2$ |
|---|---|---|---|---|---|
| 1 | 1 | 52 | 61 | -9 | 81 |
| 2 | 2 | 57 | 61 | -4 | 16 |
| 3 | 3 | 61 | 61 | 0 | 0 |
| 4 | 4 | 65 | 61 | 4 | 16 |
| 5 | 5 | 70 | 61 | 9 | 81 |
| | | | | | SST = 194 |

## COMPUTE $R^2$

$$R^2 = 1 - \frac{SSE}{SST}$$

$R^2 = 0.998$

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## PREDICTION

Use your equation to predict the exam score for a student who studied for 6 hours.

$y = m(6) + b$

$y = 4.4(6) + 47.8$

$y = 74.2$