TOPIC: LINEAR REGRESSION USING THE LEAST SQUARES METHOD

Introduction to Least Squares Regression

◆ **Linear Regression** is a way to model the relationship between 2 variables with an equation of a _____.

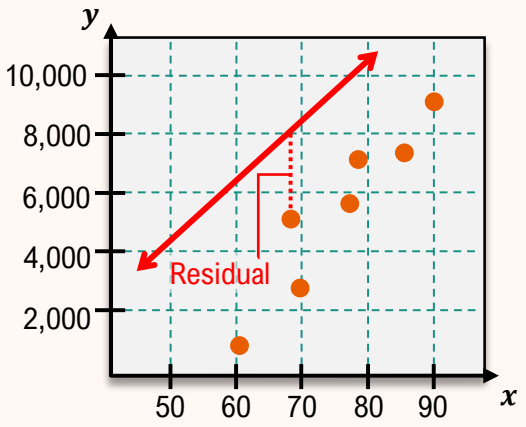
► **Residual:** vertical _____ from a pt. to the line. **Least Squares Regression** minimizes residuals (*"best fit"*).

EXAMPLE

The data below shows ice cream sales (y) in dollars from a local ice cream stand & the daily high temperature (x) in °F for 1 week. Find and plot the least squares regression line for the data. Does your line fit the data better than the red line on the graph? Explain.

New **Least Squares Regression**

High Temp (x)	83	61	69	79	77	70	90
Sales (y)	7462	914	4793	6712	5423	2854	9327



Recall

$y = mx + b$

$\hat{y} = ax + b$ *(Calculator)*

$\hat{y} = b_1 x + b_0$ *(Textbook)*

HOW TO: Find Least Squares Regression Line on TI-84

1) 2ND 0, v to **DiagnosticOn**
(Only needed once)

2) STAT, **1:Edit…**

Enter data in **L1** (x) & **L2** (y)

3) STAT > to **CALC**

4:LinReg(ax+b)

XList: L_1 ; YList: L_2

Write **a** & **b**

4) y= to plot line

Y_1 = __x + __
(slope) *(y-int)*

5) WINDOW, **Xmin=** , **Xmax=** , etc.

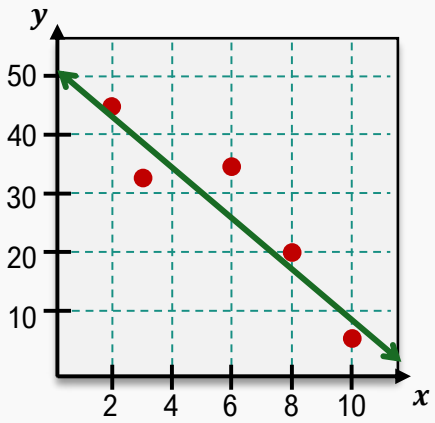
6) GRAPH

TOPIC: LINEAR REGRESSION USING THE LEAST SQUARES METHOD

PRACTICE

The scatterplot below shows a set of data and its least-squares regression line. Based on the graph, which of the following is most likely the equation of the regression line?

A) $\hat{y} = 4.1x + 50.9$
B) $\hat{y} = -10.2x + 50.9$
C) $\hat{y} = -4.1x + 50.9$
D) $\hat{y} = -4.1x - 50.9$



EXAMPLE

A business analyst tracks how the number of weekly training hours affects the sales performance of new employees during their first month. The data for 7 employees is shown below. Use a calculator to compute and plot the least-squares regression line. Is a linear model appropriate for this data?

Hours (x)	1	7	4	2	6	3	5
Sales (y)	9	19	25	14	22	20	23

HOW TO: Find Least Squares Regression Line on TI-84

1) 2ND 0, v to `DiagnosticOn` *(Only needed once)*
2) STAT, `1:Edit…`
   Enter data in `L1` (x) & `L2` (y)
3) STAT > to `CALC`
   `4:LinReg(ax+b)`
   `XList: L1 ; YList: L2`
   Write `a` & `b`
4) y= to plot line `Y1 = ax + b`
5) WINDOW, `Xmin=` , `Xmax=` , etc.
6) GRAPH

TOPIC: LINEAR REGRESSION USING THE LEAST SQUARES METHOD

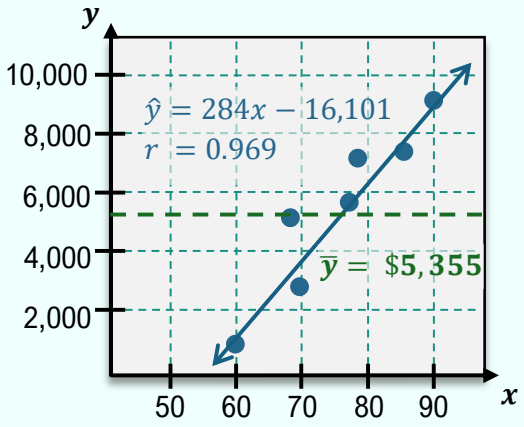
Predicting Values with Regression Line

◆ If correlation is **strong** AND x-value is **close/within** range of data, _____ x into regression eqn to predict y-value.

► If correlation is **weak** OR x-value is **far outside** the range of data, use the _____ ($\bar{y}$) as best estimate.

EXAMPLE The data below shows ice cream sales (y) in dollars from a local ice cream stand & the daily high temperature (x) in °F for 1 week. Use the given regresson line to predict sales when:

High Temp (x)	83	61	69	79	77	70	90
Sales (y)	7462	914	4793	6712	5423	2854	9327



($\boldsymbol{A}$) $x_1 = 86$ °F

Strong Correlation? ☐

AND

x-value **inside** range? ☐

Use **[REG. LINE | $\bar{y}$]**

($\boldsymbol{B}$) $x_2 = 32$ °F

Strong Correlation? ☐

AND

x-value **inside** range? ☐

Use **[REG. LINE | $\bar{y}$]**

TOPIC: LINEAR REGRESSION USING THE LEAST SQUARES METHOD

PRACTICE

A regional sales manager records data on the number of clients a salesperson contacts in a week (x) and the total sales generated that week (y). The data from 10 salespeople is shown below. Find the equation of the regression line and use it to predict sales if the salesperson contacts **(a)** 6 clients; **(b)** 40 clients

Clients (x)	4	1	3	9	5	7	2	8	10	11
Sales (y)	2100	700	1600	4500	2700	3300	900	3900	5000	5300