III. Cont.

eg Pointing a laser at aircraft, which can temporarily blind pilots, is a serious offense with a maximum punishment of 20 years in prison and a $250,000 fine. The numbers of laser incidents involving aircraft are shown in the Table on the next slide for various years. Let y be the number of laser incidents involving aircraft in the year that is x years since 2000. ← starting year

Table Numbers of Laser Incidents Involving Aircraft

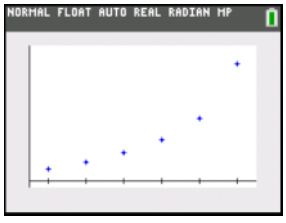
Year	Number
2005	283
2006	446
2007	675
2008	988
2009	1527
2010	2836

Source: *Federal Aviation Administration*

x → y →

1. Construct a scatterplot.
2. Find a regression equation to describe the data. How well does the model fit the data points?
3. What is the y-intercept? What does it mean in this situation?
4. Estimate the percentage increase in laser incidents per year.

S:

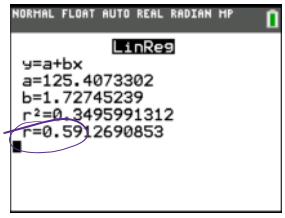


Eg. Below is the sample collect from 5 people shoes print length and height:

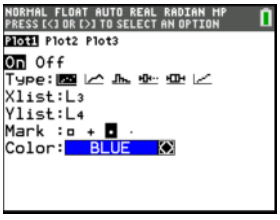
Shoe Print lengths and Heights	
X (Shoe Print)	Y (Height)
29.7	175.3
29.7	177.8
31.4	185.4
31.8	175.3
27.6	172.7

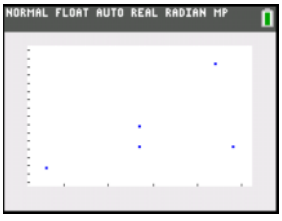
Find the linear correlation coefficient and determine if there is a correlation between the two variables. Plot the data values into a scatterplot.

S:



r = 0.59 ✓ going up





IV. Regression Line

The regression line is the best-fit straight line for all the data points in a scatterplot. It is also called the line of best fit.

Properties:

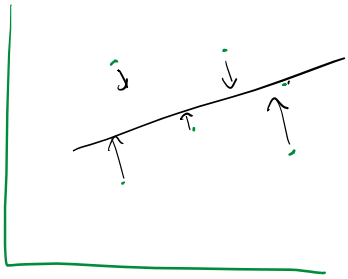
- $y = b_0 + b_1 x$ (TI-84: $y = a + bx$), where b_0 is the initial y-intercept and b_1 is the slope.

– it is a stright line from the computer.

– it is the line of best fit, due to technology.

Long time ago:

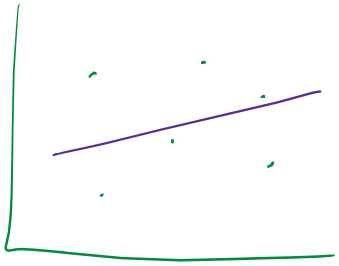
→



← not good

Now

TI-84 →



← line of best fit

Overall, $\hat{y} = b_0 + b_1 x$, where we have the formulas that we do not use at all, $b_1 = r\frac{S_y}{S_x}$, where S_y is the slope of y.
S_x is the slope of x.

eg

Pointing a laser at aircraft, which can temporarily blind pilots, is a serious offense with a maximum punishment of 20 years in prison and a $250,000 fine. The numbers of laser incidents involving aircraft are shown in the Table on the next slide for various years. Let y be the number of laser incidents involving aircraft in the year that is x years since 2000.

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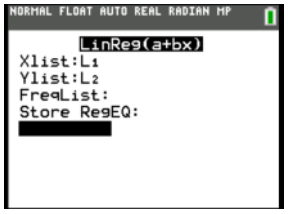
~~**1.** Construct a scatterplot.~~

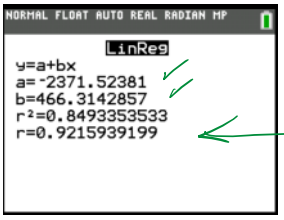
2. Find a regression equation to describe the data. How well does the model fit the data points?

3. What is the y-intercept? What does it mean in this situation?

~~**4.** Estimate the percentage increase in laser incidents per year.~~

S: 2.





$y = -2371 + 466x$ It fits very well, because $r = 0.92$, which is close to 1.

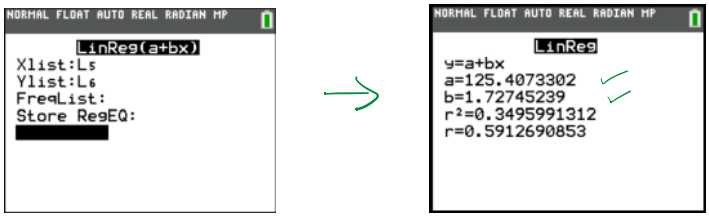
3. y-intercept is $(0, -2371)$. -2371 is negative, it does not make sense at year 2000. But as years go by, the y-values become valid.

Eg. Consider this example, as we would like to use the explanatory variable, x, shoe print length, to predict the response variable, y, height. The data are listed below:

Table 10-1 Shoe Print Lengths and Heights of Males					
Shoe Print (cm)	29.7	29.7	31.4	31.8	27.6
Height (cm)	175.3	177.8	185.4	175.3	172.7

Find the regression line for this set of sample data.

S:



$y = 125.4 + 1.7x$

Eg. Use the 5 pairs of shoe print lengths and heights to predict the height of a person with a shoe print length of 29 cm.

S: We have $y = 125.4 + 1.7x$,

for x is 29, we have

$y = 125.4 + 1.7 \cdot 29$

≈ 174.7 cm