

Line of Best Fit (Linear Regression)

$y = mx + b$

When we have a scatterplot of data, we want to find an equation of the line that best fits our data. We can then use this equation to help predict results of additional sets of data.

A **LINEAR REGRESSION** is the calculation that finds an equation for the graph that best fits which is linear.

INTERPOLATION is when we use our line of best fit to estimate a data value that is inside the data. For instance, if we had x values from 3 to 10, predicting an x-value of 7 would be inside 3 to 10. It is interpolation.

EXTRAPOLATION is when we use our line of best fit to estimate a data value that is outside the data. For instance, if we had x values from 3 to 10, predicting an x-value of 2 would be outside 3 to 10. It is extrapolation.

Example: When you play golf, you hit a ball with a club. You want the ball to fly as far as possible. The faster you can swing the club, the farther the ball will fly. The data below explores the relationship between these two events.

Club-head speed, mph (x)	100	102	103	101	105	100	99	105
Distance, yards (y)	257	264	274	266	277	263	258	275

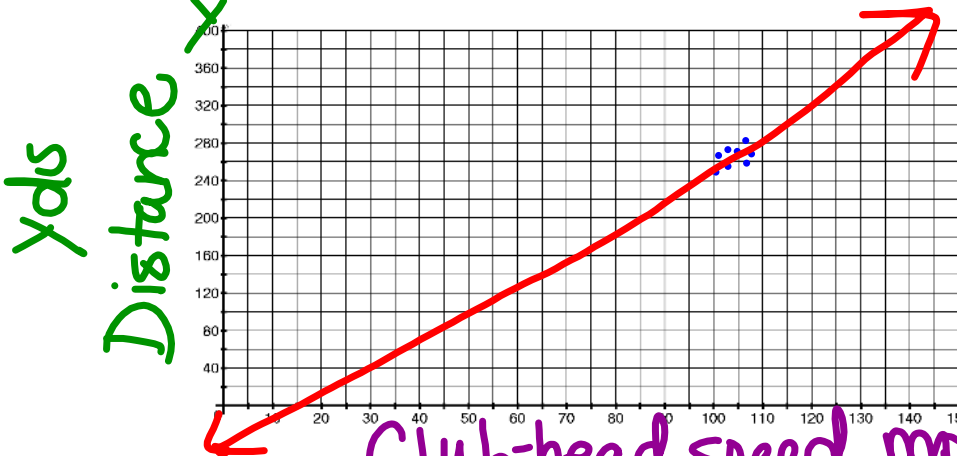
What is the independent variable?

What does the independent variable represent in your table?

What is the dependent variable?

What does the dependent variable represent in your table?

Create a scatterplot of your data. Label the axes.



positive
Correlation
causation

Calculate the equation for the line of best fit. Use the steps on the back of the paper. Graph the line of best fit.

$y = 3.17x - 55.80$

Calculate the correlation coefficient. Describe what it means about the relationship between club-head speed and the distance the golf ball goes.

r = .939 positive, very strong

Step 1: Clear your memory by pressing on and clear.

Step 2: Press the "data" button.

Step 3: Put the list of x-values in L1 by pressing enter in between each number.

Step 4: Put the list of y-values in L2 by pressing enter in between each number.

Step 5: Press "2nd" and then "data". Scroll down to highlight "4: LinReg ax+b" and press "enter".

Step 6: Pick the following pressing "enter" as you go:

xDATA: L1	
yDATA: L2	
FRQ: ONE	
RegEQ→f(x): NO	
y=ax+b	CALC

Step 7: Write down the a, b, and r.

Step 8: For the line of best fit, fill in the format $y = \frac{\quad}{a}x + \frac{\quad}{b}$

Step 9: Write the "r" near your equation and interpret what this correlation coefficient means.

Now that you have the equation for the line of best fit, we can use the equation to explain the relationship between club head speed and distance a golf ball flies and predict other values.

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$y = 3.17x - 55.80$
 $y = mx + b$

Interpret the Variables

What was the slope for your line of best fit?

3.17

What are the units for your slope?

for every mph you swing the club your ball travels 3.17 yds

$m = \frac{y-y}{x-x}$
 $\frac{y}{x} = \frac{\text{yds}}{\text{mph}}$

What does your slope mean in context?

What was the y-intercept for your line of best fit?

-55.80

What are the units for your y-intercept?

if you swing your club 0 mph your ball travels 55.80 backwards (0, -55.80)

What does your y-intercept mean in context?

Use the Equation to Make Predictions

If you swung your club-head at 101 mph, how far would you expect your ball to go?

* Is this interpolation or extrapolation?

$y = 3.17(101) - 55.80$
 $y = 264.37 \text{ yds}$

If you swung your club at 110 mph, how far would you expect your ball to go?

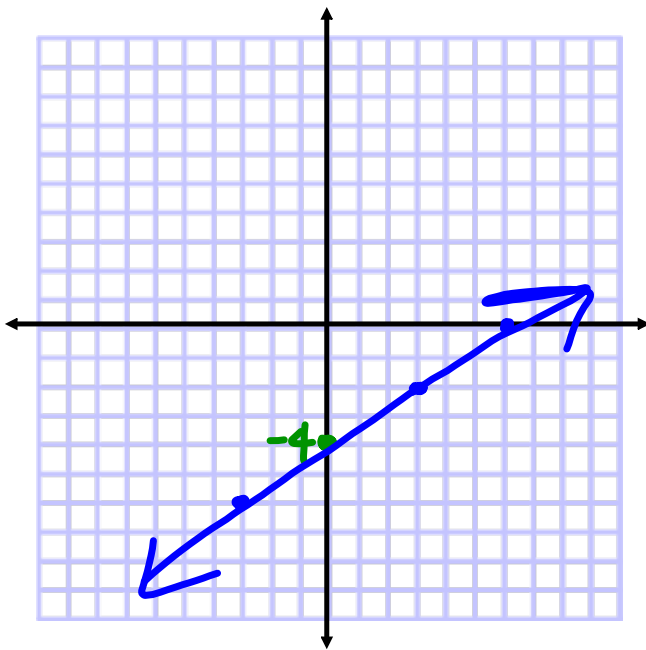
* Is this interpolation or extrapolation?

$y = 3.17(110) - 55.80$
 $y = 292.9 \text{ yds}$

If you wanted your ball to go 400 yards, how fast would you have to swing the club-head?

$400 = 3.17x - 55.80$
 $+ 55.80 \quad + 55.80$

 $455.80 = 3.17x$
 $\frac{455.80}{3.17} = \frac{3.17x}{3.17}$
 $143.79 \text{ mph} = x$



$y = mx + b$
Linear

$y = \frac{+2}{3}x - 4$

Annotations: A purple arrow points from the fraction $\frac{+2}{3}$ to the text 'm = slope'. A purple arrow points from the number 3 to the text 'run'. A purple arrow points from the number 2 to the text 'rise'. A green arrow points from the number 4 to the text 'y-int (0, -4)'.

m = slope

y-int
(0, -4)

