Curve Fitting with Linear Models

> ◆ CONNECT
> An activity which connects algebra to other strands in the math curriculum
> [View]

Who uses this?

Anthropologists can use linear models to estimate the heights of ancient people from bones that the anthropologists find.(See Example 2.)
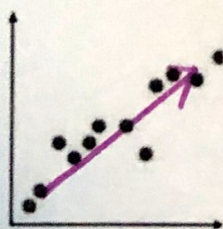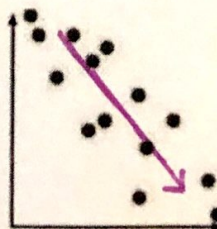
Lesson Objective(s):

- Fit scatter plot data using linear models with and without technology.
- Use linear models to make predictions.

Researchers, such as anthropologists, are often interested in how two measurements are related. The statistical study of the relationship between variables is called **regression**   4: LinReg   "linear regression"
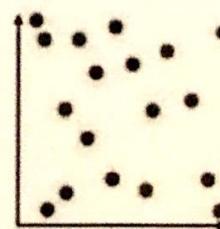
A **scatter plot** is helpful in understanding the form, direction, and strength of the relationship between two variables. **Correlation** the strength and direction of the linear relationship between the two variables.   *are the points/dots related?*

Positive correlation,
positive slope

Negative correlation,
negative slope

Relatively no
correlation

If there is a strong linear relationship between two variables **line of** *best fit* or a line that best fits the data, can be used to make predictions.

Meteorology Application

Akron, Ohio, and Wellington, New Zealand, are about the same distance from the equator. Make a scatter plot for the temperature data, identify the correlation, and then sketch a line of best fit and find its equation.

Average High Temperatures (°F)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Akron	33	37	48	59	70	78	82	80	73	61	49	38
Wellington	67	67	65	61	56	53	51	52	55	57	60	64

① STAT → 1: Edit

② Type # in L1 and L2 (then go back to home screen)

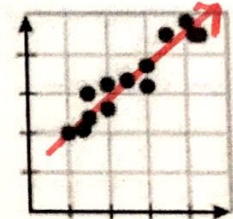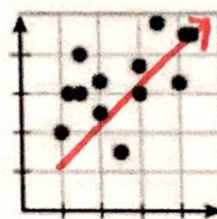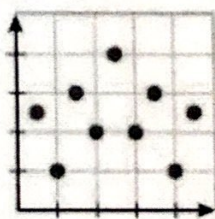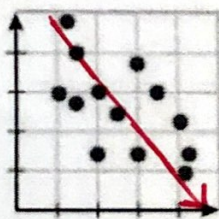③ STAT → CALC → 4: LinReg

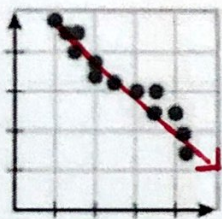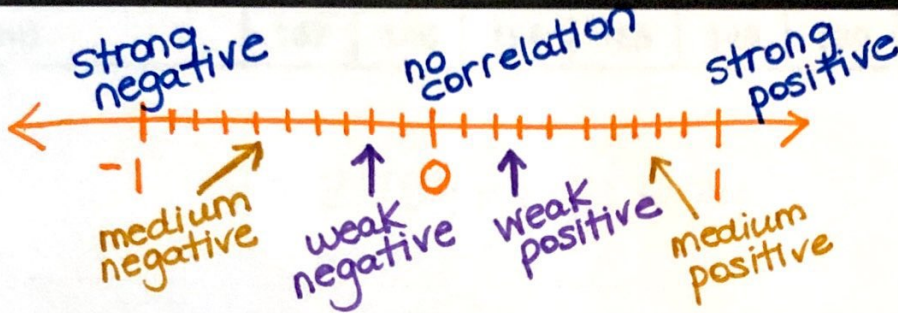④ Calculate
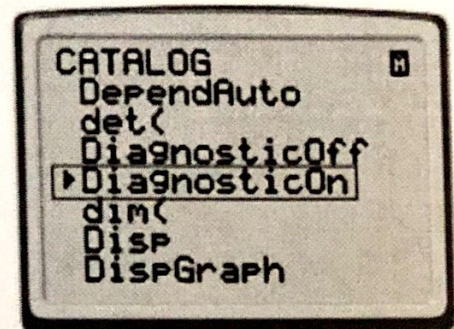
$$y = -0.318x + 77.733$$

(strong) negative correlation

— find the r-value in the calculator

Correlation Coefficient is a measure of how well the data set is fit by a model.

Properties of the Correlation Coefficient r

strong negative   no correlation   strong positive

-1 medium negative   weak negative 0 weak positive 1 medium positive

$r \approx -0.95$ $r \approx -0.6$ $r \approx 0$ $r \approx 0.6$ $r \approx 0.95$

You can use a graphing calculator to perform a linear regression and find the correlation coefficient r. To display the correlation coefficient, you may have to turn on the diagnostic mode. To do this, press **2nd** **0**, and choose the **DiagnosticOn** mode.

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Anthropology Application

Anthropologists use known relationships between the height and length of a woman's humerus bone, the bone between the elbow and the shoulder to estimate a woman's height. Some samples are shown in the table.

Bone Length and Height in Women								
Humerus Length (cm)	35	27	30	33	25	39	27	31
Height (cm)	167	146	154	165	140	180	149	155

$$y = 2.754x + 71.974$$

$$r = 0.991 \quad \text{strong positive correlation}$$

EXAMPLE 3

Nutrition Application

Find the following information for this data set on the number of grams of fat and the number of calories in sandwiches served at Dave's Deli.

Dave's Deli Sandwiches Nutritional Information								
Fat (g)	5	9	12	15	12	10	21	14
Calories	360	455	460	420	530	375	580	390

$$y = 11.141x + 309.767$$

$$r = 0.682$$

not the best
medium/mediocre
positive correlation