

Algebra 2      2.5

Use scatter plots and prediction equations

Use lines of regression\* to model data

bivariate data  $(x, y)$

scatter plot

correlation (positive, negative, none)

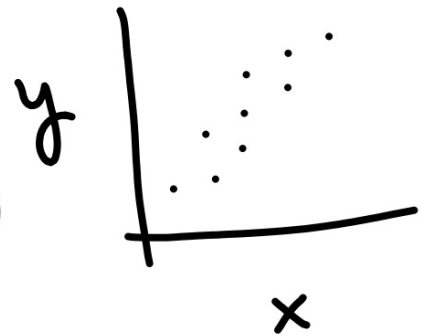
line of fit

prediction equation

regression equation

correlation coefficient

graphing calculators/computer & scatter plots



The scatter plot shows the number of visitors to Isle Royale National Park in Michigan per year.

### Visitors to Isle Royale National Park

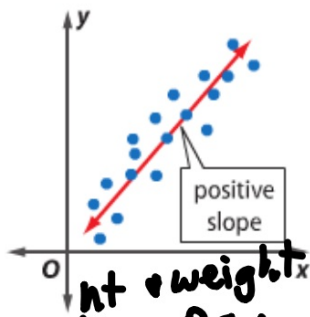


Source: National Park Service



## KeyConcept Scatter Plots

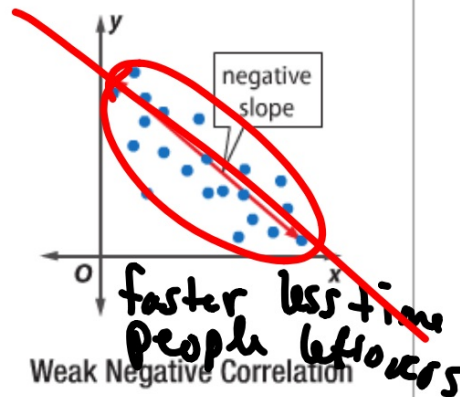
### positive correlation



Strong Positive Correlation

The slope of the line is positive and the points are close to the line.

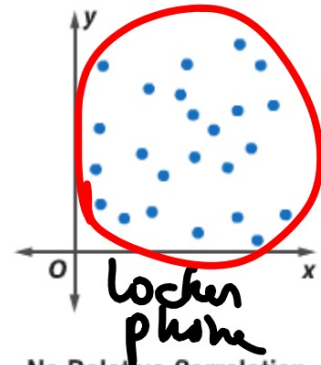
### negative correlation



Weak Negative Correlation

The slope of the line is negative and the points are not close to the line.

### no correlation



No Relative Correlation

There is no obvious pattern of increase or decrease for the given data.

# Real-World Example 1 Use a Scatter Plot and Prediction Equation

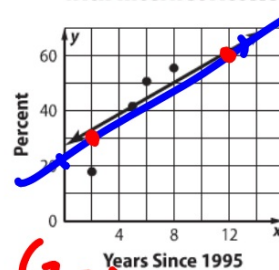
**TECHNOLOGY** The table shows the percent of U.S. households with Internet access.

| Year    | 1997 | 2000 | 2001 | 2003 | 2007 |
|---------|------|------|------|------|------|
| Percent | 18.0 | 41.5 | 50.4 | 54.7 | 61.7 |

Source: U.S. Census Bureau

- a. Make a scatter plot and a line of fit, and describe the correlation. Let  $x$  be the number of years since 1995.

Percent of Households with Internet Access



- b. Use two ordered pairs to write a prediction equation.

$$y = x + 48$$

$$y = 1x + B$$

- c. Predict the percent of households with Internet access in 2020.

$$\% = 1(47) + 48$$

$$50 = 1 \cdot 2 + B$$

How accurate does your prediction appear to be?

$$\% = 1 \cdot 25 + 48$$

$$50 = 2 + B$$

$$B = 48$$

Consider:

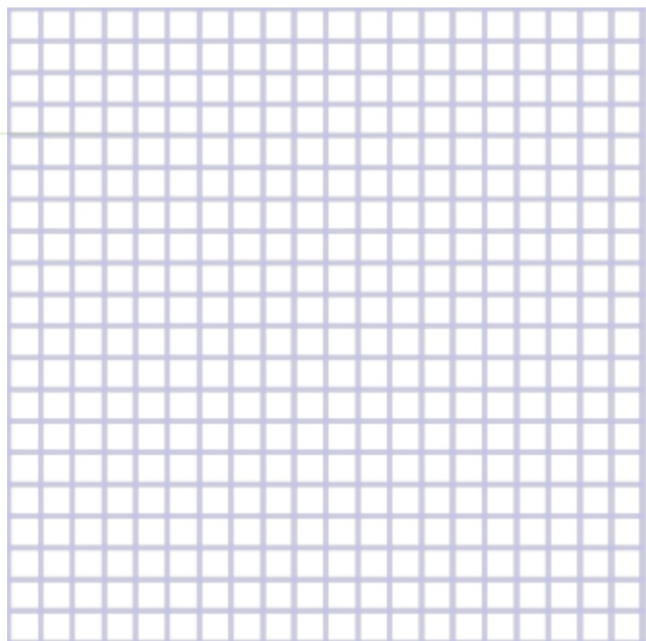
- Scatter in the data...
- Could it continue indefinitely?

73%

1. **HOUSING** The table shows the mean selling price of new, privately-owned, single-family homes for six consecutive years.

|   |               |       |       |       |       |       |       |
|---|---------------|-------|-------|-------|-------|-------|-------|
| X | Year          | 0     | 1     | 2     | 3     | 4     | 5     |
| Y | Price(\$1000) | 154.5 | 166.4 | 181.9 | 207.0 | 228.7 | 273.5 |

- A. Make a scatter plot and a line of fit, and describe the correlation.
- B. Write a prediction equation.
- C. Predict the selling price of a new home for year 8.
- D. How accurate does your prediction appear to be?



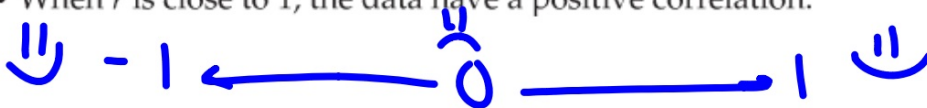
Graphing calculator (on computer...might need a consult from Ms. Kruse)



**2 Lines of Regression** Another method for writing a line of fit is to use a line of regression. A **regression line** is determined through complex calculations to ensure that the distance of all data points to the line of fit are at a minimum. Most graphing calculators and spreadsheets can perform these calculations easily.

The **correlation coefficient  $r$** ,  $-1 \leq r \leq 1$ , is a measure that shows how well data are modeled by a linear equation.

- When  $r$  is close to  $-1$ , the data have a negative correlation.
- When  $r = 0$ , the data have no correlation.
- When  $r$  is close to  $1$ , the data have a positive correlation.



APP: The only way to get a number for correlation!

p. 94

p. 96 5, 6, 7  
opt. ↑ g.c.

Basic calculator operation:

Turn on & check settings

Contrast adjustments

Mode key

y=

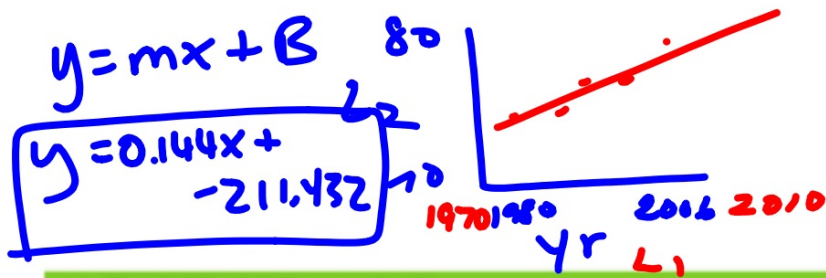
Statplots

Clear screen

Lists *Label > clear > enter*

2<sup>nd</sup> ↑ 2<sup>nd</sup> ↓

Also Alg 1



graphing calculators  
note: keystrokes are given  
on p. 94



### Real-World Example 2 Regression Line

The table shows the life expectancy for people born in the United States.

L1  
L2

|                      |      |      |      |      |      |      |
|----------------------|------|------|------|------|------|------|
| Year of Birth        | 1980 | 1983 | 1990 | 1995 | 2000 | 2006 |
| Life Expectancy (yr) | 73.7 | 74.6 | 75.4 | 75.8 | 76.8 | 77.7 |

Source: U.S. CDC

VT 1

Use a graphing calculator to make a scatter plot of the data. Find an equation for and graph a line of regression. Then use the equation to predict the life expectancy of a person born in 2025.

### Guided Practice

2. **MUSIC** The table at the right shows the percent of sales that were made in music stores in the United States for the period 1999–2008. Use a graphing calculator to make a scatter plot of the data. Find and graph a line of regression. Then use the function to predict the percent of sales made in a music store in 2018.

| Music Store Sales |                    |
|-------------------|--------------------|
| Year              | Sales<br>(percent) |
| 1999              | 44.5               |
| 2000              | 42.4               |
| 2001              | 42.5               |
| 2002              | 36.8               |
| 2003              | 33.2               |
| 2004              | 32.5               |
| 2005              | 39.4               |
| 2006              | 35.4               |
| 2007              | 31.1               |
| 2008              | 30.0               |

**Source:** Recording Industry Association of America

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Cricket data: official answers