Warm Up:
Take the equation y = 2x + 1
and write the new equation after it is shifted vertically up 3, horizontally to the left 4 and a vertical stretch by a factor of 2.

Then write the equation after a horizontal move to the right 3 and then a horizontal stretch by a factor of 1/2. (use original equation)

2. $f(x) = -x + 5$
$g(x) = -(x + 2) + 5$
$g(x) = -x - 2 + 5$
$g(x) = -x + 3$

3. $f(x) = \frac{1}{3}x - 2$
$f(x) \rightarrow af(x)$
$g(x) = 3(\frac{1}{3}x - 2)$
$g(x) = \frac{3}{3}x - 6$
$g(x) = x - 6$

4. $f(x) = -2x + 0.5$
$\frac{1}{b}x = \frac{1}{\frac{4}{3}}x = \frac{3}{4}x$
$g(x) = -2\left(\frac{3}{4}x\right) + 0.5$

8. $f(x) = -\frac{1}{4}x + 5$

$f(x) \rightarrow -f(x)$

$g(x) = -\left(-\frac{1}{4}x + 5\right)$

$g(x) = \frac{1}{4}x - 5$

9. $f(x) = \frac{2}{4}x - 2$

$f(x) = \frac{1}{2}x - 2$

$f(x) \rightarrow f(x) - 2$

$g(x) = \left(\frac{1}{2}x - 2\right) - 2$

$g(x) = \frac{1}{2}x - 4$

10. $f(x) = \frac{7}{2}x$

$\frac{1}{b}x = \frac{1}{0.5}x$

$= 2x$

$g(x) = \frac{7}{2}(2x)$

$g(x) = \frac{14x}{2}$

$g(x) = 7x$

13. $f(x) = x$

$h(x) = \frac{1}{2.75}x$

$g(x) = \frac{1}{2.75}(x + 1)$

14. $f(x) = x$

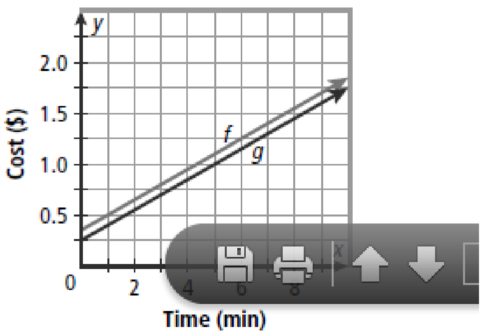
$h(x) = x - 6$

$g(x) = \frac{2}{3}(x - 6)$

15a. $f(x) = 0.15x + 0.25$

$g(x) = 0.15x + 0.35$

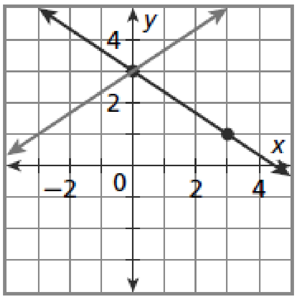
b.



16. $f(x) = -\frac{2}{3}x + 3$

$f(x) \rightarrow f(-x)$

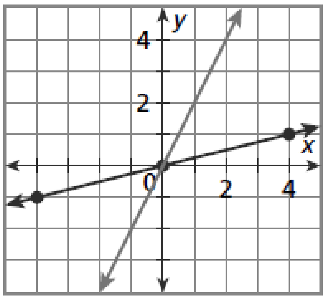
$g(x) = \frac{2}{3}x + 3$



17. $f(x) = \frac{1}{4}x$

$g(x) = 8(\frac{1}{4}x)$

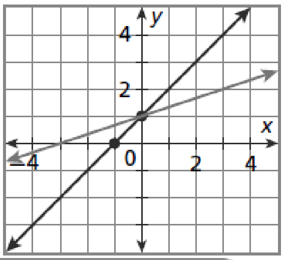
$g(x) = 2x$



18. $f(x) = x + 1$

$f(x) \rightarrow \left(\frac{1}{b}\right)x$

$g(x) = \frac{1}{3}x + 1$



21a. $f(x) = x$

$h(x) = f(x) + 2$

$= x + 2$

$-h(x) = -(x + 2)$

$g(x) = -x - 2$

b. $f(x) = x$

$h(x) = -f(x)$

$= -x$

$g(x) = -x + 2$

c. Transformations performed in a different order may result in different functions.

28. Possible answer: a vertical translation 14 units down and a horizontal compression by a factor of $\frac{1}{5}$ or a vertical stretch by a factor of 5 and a vertical translation 30 units down.

Objectives

Fit scatter plot data using linear models with and without technology.

Use linear models to make predictions.

Vocabulary

regression
correlation
line of best fit
correlation coefficient

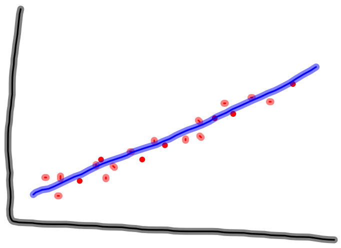
2-7 Curve Fitting with Linear Models

Researchers, such as anthropologists, are often interested in how two measurements are related. The statistical study of the relationship between variables is called **regression**.

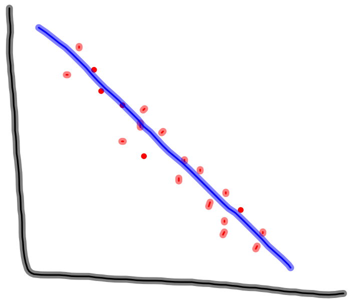
A *scatter plot* is helpful in understanding the form, direction, and strength of the relationship between two variables. **Correlation** is the strength and direction of the linear relationship between the two variables.

There are 3 types of correlation:

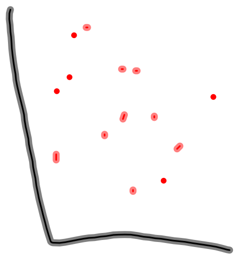
-Positive correlation:



-Negative correlation:



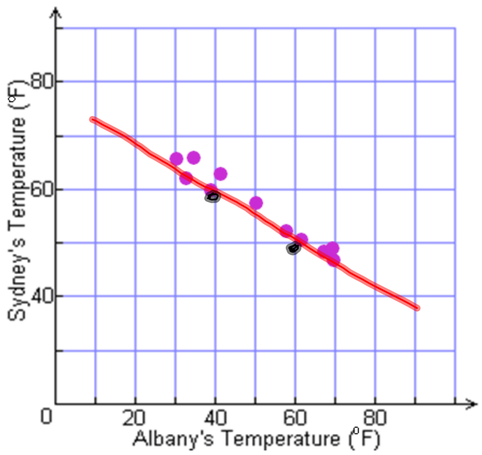
-No correlation:



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

Albany and Sydney are about the same distance from the equator. Make a scatter plot with Albany's temperature as the independent variable. Name the type of correlation. Then sketch a line of best fit and find its equation.

Average Minimum Temperature (°F)		
Month	**Albany**	**Sydney**
Jan	31	65
Feb	34	66
Mar	41	63
Apr	50	58
May	59	53
Jun	67	49
Jul	70	46
Aug	70	48
Sep	62	52
Oct	51	56
Nov	40	60
Dec	33	63



(40,60) (60,50)

$$\frac{50-60}{60-40} = \frac{-10}{20} = -\frac{1}{2}$$

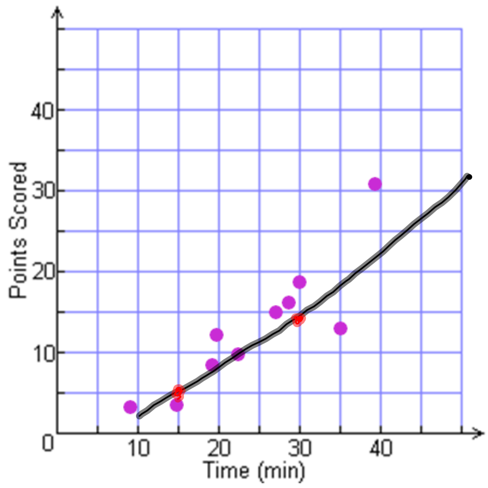
$$y-60 = -\frac{1}{2}(x-40)$$

$$y-60 = -\frac{1}{2}x+20$$

$$y = -\frac{1}{2}x+80$$

Make a scatter plot for this set of data. Identify the correlation, sketch a line of best fit, and find its equation.

Points Scored in Ten Games										
Minutes Played	28	35	8	20	39	23	19	27	15	30
Points Scored	16	13	2	12	31	10	9	15	4	19



(15,5) (30,15)

$$\frac{15-5}{30-15} = \frac{10}{15} = \frac{2}{3}$$

$$y-5 = \frac{2}{3}(x-15)$$

$$y-5 = \frac{2}{3}x - 10$$

$$y = \frac{2}{3}x - 5$$

The **correlation coefficient** r is a measure of how well the data set is fit by a model.

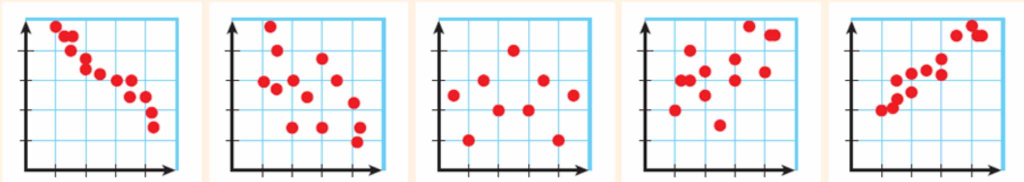
Properties of the Correlation Coefficient r

r is a value in the range $-1 \le r \le 1$.

If $r = 1$, the data set forms a straight line with a positive slope.

If $r = 0$, the data set has no correlation.

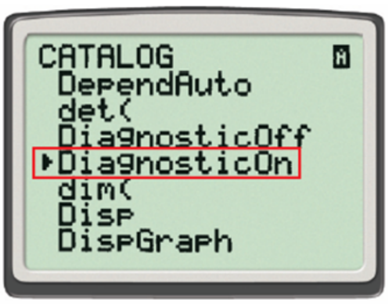
If $r = -1$, the data set forms a straight line with a negative slope.



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

You can use a graphing calculator to perform a linear regression and find the correlation coefficient r.

To display the correlation coefficient r, you may have to turn on the diagnostic mode. To do this, press 2nd 0, and choose the **DiagnosticOn** mode.



Anthropologists can use the femur, or thighbone, to estimate the height of a human being. The table shows the results of a randomly selected sample.

Femur Length and Height (cm)	
L_1 Length	L_2 Height
36	160
32	143
46	187
29	142
35	161
38	164
30	140
27	131

$y = 2.91x + 54.04$

The gas mileage for randomly selected cars based upon engine horsepower is given in the table.

Gas Mileage and Horsepower of Cars										
Horsepower x L_1	175	255	140	165	115	120	190	180	110	125
Mileage (mi/gal) y L_2	22	13	25	18	32	28	15	21	35	30

$y = -.14x + 47$ ~~.50~~

$y = -.14(210) + 47$

b. Find the correlation coefficient *r* and the line of best fit. Interpret the slope of the line of best fit in the context of the problem.

c. Predict the gas mileage for a 210-horsepower engine.

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) x	5	9	12	15	12	10	21	14
Calories y	360	455	460	420	530	375	580	390

Use the equation of the line of best fit to predict the number of grams of fat in a sandwich with 420 Calories. How close is your answer to the value given in the table?

$y = 11x + 309$

$420 = 11x + 309$

Make up your own set of data. Try to do numbers far apart for your x values and then find the line of best fit for those points. Try to see if you randomly select points with a high r-value.

Homework:

p. 146 # 2-8(2 and 3 by hand, rest with a calculator), 16, 24