Section 12.2

Example Suppose that we want to measure the relationship between an adults's age and height. Do you believe that an adult's age and height are related in some way?

1. What is the explanatory variable?

2. What is the response variable?

Section 12.3

Example Consider the following data relating a student's 1st and 2nd midterm scores. Assume that the students were randomly selected.

$x =$ 1st Midterm	75	54	90	85	98
$y =$ 2nd Midterm	78	59	86	84	95

1. Plot a scatterplot of the data.

2. Does it appear that the data follow a linear model?

3. Get into groups. Then "by eye" draw a line that appears to "fit" the data. For your line, pick two convenient points and use them to find the slope of the line. Find the y-intercept of the line by extending your lines so they cross the y-axis. Using the slopes and the y-intercepts, write your equation of "best fit". Do you think everyone will have the same equation? Why or why not?

4. Plug the data into your calculator lists and find the line of least squares regression.

5. If you were trying to predict the 2nd midterm score for a student with a 1st midterm of 30%, would this be interpolation or extrapolation? Explain.

Example For her botany class project, Jan wonders if there is a connection between the average weight of watermelons a vine produces and the root depth of the vine. Jan suspects that vines with deeper roots have a better water supply and also larger average melons.

Here are the data relating x = root depth (to the nearest inch) and y=mean weight of watermelon (to the nearest pound)

x	26	14	18	10	26	21	7	26	13	19	17	13	16	28	23
y	20	10	13	9	19	17	8	15	9	13	12	7	9	17	14

1. Find the equation of the least-squares regression line.

2. Why do we call the line the ”least-squares regression line?”

3. Predict the mean weight of watermelon per vine if the root depth of the vine is 20 inches.

4. Predict the mean weight of watermelon per vine if the root depth of the vine is 30 inches.

Example For her botany class project, Jan wonders if there is a connection between the average weight of watermelons a vine produces and the root depth of the vine. Jan suspects that vines with deeper roots have a better water supply and also larger average melons.

Here are the data relating x = root depth (to the nearest inch) and y=mean weight of watermelon (to the nearest pound)

x	26	14	18	10	26	21	7	26	13	19	17	13	16	28	23
y	20	10	13	9	19	17	8	15	9	13	12	7	9	17	14

Use the Calculator to find the line of least squares regression.

Use the Calculator to graph the scatter plot and the line of least squares regression.

Section 12.3

Example For each of the following, decide whether the correlation coefficient is positive or negative.

1. $x =$ student's quiz average and $y =$ student's exam average.

2. $x =$ Amount of alcohol consumed and $y =$ Cognitive ability score.

Example Suppose that you gathered the following information from students at the SRJC:

- GPA
- Average number of hours worked per week
- Average number of hours of sleep per night
- Height
- Weight
- Age
- Average number of hours per week spent on school work
- Average number of hours per week spent on free time

From this list, pick two variables that you believe are negatively correlated and two variables that you believe are positively correlated. Support your choices.

Example For her botany class project, Jan wonders if there is a connection between the average weight of watermelons a vine produces and the root depth of the vine. Jan suspects that vines with deeper roots have a better water supply and also larger average melons.

1. Based on Jan's conjecture, would you expect the correlation coefficient between root length and average weight of melons per vine to be negative or positive? Explain.

Here are the data relating x = root depth (to the nearest inch) and y=mean weight of watermelon (to the nearest pound)

x	26	14	18	10	26	21	7	26	13	19	17	13	16	28	23
y	20	10	13	9	19	17	8	15	9	13	12	7	9	17	14

2. Find the correlation coefficient.

3. What percent of the total variation in mean watermelon weight can be explained by using the linear model?

Section 12.4

Example For her botany class project, Jan wonders if there is a connection between the average weight of watermelons a vine produces and the root depth of the vine. Jan suspects that vines with deeper roots have a better water supply and also larger average melons.

Here are the data relating x = root depth (to the nearest inch) and y=mean weight of watermelon (to the nearest pound) again

x	26	14	18	10	26	21	7	26	13	19	17	13	16	28	23
y	20	10	13	9	19	17	8	15	9	13	12	7	9	17	14

Is there a significant linear relationship between x and y?

Example Consider the following data relating a student's 1st and 2nd midterm scores. Assume that the students were randomly selected.

$x =$ 1st Midterm	75	54	90	85	98
$y =$ 2nd Midterm	78	59	86	84	95

1. Find the correlation coefficient.

2. What percent of the total variation in 2nd midterm score can be explained by using the linear model?

3. Is there a significant linear relationship between x and y?

Example An economist is studying the job market in various neighborhoods in Denver, Colorado. Let x = total number of jobs in the neighborhood and let y = total number of entry level jobs in the neighborhood. A random sample of six neighborhoods was taken and the data are given in the table below.

x	16	33	50	28	50	25
y	2	3	6	5	9	3

1. Find the correlation coefficient.

2. Find the equation of the least squares regression line.

3. Find and interpret the coefficient of determination.

4. For a neighborhood with 40 jobs, how many entry level jobs are predicted? Is this interpolation or extrapolation?

5. Would it be safe to use your least squares regression line to predict the number of entry level jobs for a Denver neighborhood with a total of 100 jobs? Explain.

Example A study was conducted to see if there is a linear relationship between the square feet of living space, x, and sale price, y, of a home in Willow Glen. The following data were collected. Assume that the assumptions required for linear regression analysis have been met.

x	1650	1500	2200	1850	1200	2500
y	750000	740000	950000	825000	690000	1100000

1. Find the correlation coefficient.

2. Find the equation of the least squares regression line.

3. What percent of the relationship between square feet of living space and sale price can be attributed to the linear model?

4. Use your model to estimate the average sale price of a home that is 2000 square feet. Is this interpolation or extrapolation?

5. Use your model to estimate the average sale price of a home that is 1100 square feet. Is this interpolation or extrapolation?

6. At the 1% level of significance is there enough evidence to show that there is a significant positive linear correlation between the square feet of living space and sale price of a home in Willow Glen?