Activity 2.1: How Fast Did You Lose?

SOLs: None

Objectives: Students will be able to:
- Determine the average rate of change

Vocabulary:
- Scatterplot – a graph of ordered pair points
- Average rate of change – in algebra terms it is the slope of the line; in the broader sense it is how fast one variable is changing compared to another variable
- Delta Notation – the Greek letter delta, ∆, means the change in the variable (i.e. ∆y = y₂ − y₁)

Key Concept:

Average Rate of Change

- The ratio (∆w / ∆t) is called the average rate of change of weight, w, with respect to time, t (in weeks). In general, the average rate of change is
  \[
  \frac{\Delta w}{\Delta t} = \frac{w_2 - w_1}{t_2 - t_1}
  \]
  where \((t_1, w_1)\) is the initial point and \((t_2, w_2)\) is the final point

- With nonlinear plots (curves) the average rate of change of the independent variable can change over the course of the graph

Activity:
You are a member of a health and fitness club. The club’s registered dietitian and your personal trainer helped you develop a special eight-week diet and exercise program. The data in the following table represents your weight, w, as a function of time, t, over an eight week period.

<table>
<thead>
<tr>
<th>Time(weeks)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lb)</td>
<td>140</td>
<td>136</td>
<td>133</td>
<td>131</td>
<td>130</td>
<td>127</td>
<td>127</td>
<td>130</td>
<td>126</td>
</tr>
</tbody>
</table>

a) Plot the points \((t, w)\) on a graph
b) What is the practical domain of this function?

c) What is the practical range of this function?
Chapter 2: Linear Function Models and Problem Solving

<table>
<thead>
<tr>
<th>Time (weeks)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lb)</td>
<td>140</td>
<td>136</td>
<td>133</td>
<td>131</td>
<td>130</td>
<td>127</td>
<td>127</td>
<td>130</td>
<td>126</td>
</tr>
</tbody>
</table>

a) What was your weight at the beginning of the program?
b) What was your weight at the end of the first week?
c) During which week(s) does your weight increase?
d) During which week(s) does your weight decrease?
e) During which week(s) does your weight remain unchanged?
f) What is the change over the first five weeks?
g) What is significant about the sign of the number?
h) What is the ratio of the weight change / time change?
i) Determine the average rate of change over the last 4 weeks

Graphical Interpretation of Ave Rate of Change

Back to the graph we have drawn; connect the starting point and the fifth week point

a) What does the average rate of change of -2.6 lbs/wk tell us about this line segment?

b) Connect the points from t=5 to t=7 and determine the average rate of change

c) Interpret this value in relationship to your diet

d) Interpret this value in relationship to the graph

Concept Summary:
The change in x (x₂ - x₁) is denoted by ∆x
The change in y (y₂ - y₁) is denoted by ∆y
The quotient (∆y / ∆x) is called the average rate of change of y with respect to x. The units of measurement are y-units per 1 x-unit
The line segment connecting the points (x₁, y₁) and (x₂, y₂):
- Increases from left to right if ∆y/∆x > 0 (positive slope)
- Decreases from left to right if ∆y/∆x < 0 (negative slope)
- Remains constant if ∆y/∆x = 0 (zero slope – horizontal line)

Homework: pg 170-174; 1 - 10
Activity 2.2: The Snowy Tree Cricket

SOLs: None

Objectives: Students will be able to:
- Identify linear functions by a constant rate of change
- Interpret slope as an average rate of change
- Determine the slope of the line drawn through two points
- Identify increasing and decreasing linear functions using slope
- Determine the slope and the equation of a horizontal and vertical line

Vocabulary:
- Linear Function – a function that has a constant rate of change from any point to another
- Slope – is given by \( m \), and is equal to the rise over the run, or \( \Delta y / \Delta x \)
- Increasing function – has a positive slope
- Decreasing function – has a negative slope
- Horizontal Line – has a zero slope, \( y = f(x) = k \)
- Vertical Line – has an undefined slope, \( x = k \)

Key Concept:

Slope

The average rate of change between any two points on a line is always the same constant value. The “steepness” of the line is called the slope.

\[
m = \text{slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}
\]

\[
\text{distance up (+) or down(-)} \quad = \quad \frac{\text{distance right (+) or left (-)}}{\text{run}}
\]

Different Slopes for Different Folks

- **Positive** slope represents an increasing function
- **Negative** slope represents a decreasing function
- **A Zero** slope represents a constant function – a horizontal line
- **Undefined** slope represents a vertical line, which is not a function!
**Activity:** One of the more familiar late-evening sounds during the summer is the rhythmic chirping of a male cricket. Of particular interest is the *snowy tree cricket*, sometimes called the temperature cricket. It is very sensitive to temperature, speeding up or slowing down its chirping as the temperature rises or falls. The following data show how the number of chirps per minute of the snowy tree cricket is related to temperature.

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>55</th>
<th>60</th>
<th>65</th>
<th>70</th>
<th>75</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chirps/minute</td>
<td>60</td>
<td>80</td>
<td>100</td>
<td>120</td>
<td>140</td>
<td>160</td>
</tr>
</tbody>
</table>

Crickets are usually silent when the temperature falls below 55°F.

a) What is the practical domain of this function?

b) Determine the average rate of change between 55°F and 60°F.

c) What are the units of measure of this rate of change?

d) Determine the average rate of change between 65°F and 80°F.

<table>
<thead>
<tr>
<th>Temperature Increase</th>
<th>Ave Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 to 60</td>
<td>4</td>
</tr>
<tr>
<td>65 to 80</td>
<td>4</td>
</tr>
<tr>
<td>55 to 75</td>
<td></td>
</tr>
<tr>
<td>60 to 80</td>
<td></td>
</tr>
</tbody>
</table>

What can you conclude about the average rate of increase in the number of chirps per minute for any particular increase in temperature?

**Concept Summary:**

- Linear function:
  - Has a constant rate of change (slope)
  - Graph is a line
  - Slope, $m$, is the average range of change
  - $\text{Rise/Run} = \Delta y / \Delta x$
  - Increasing functions have a positive slope
  - Decreasing functions have a negative slope
  - A horizontal line is defined by $y = c$ or $f(x) = c$
  - A vertical line is defined by $x = a$

**Homework:** pg 185-92; 1 - 12
Activity 2.3: Depreciation

SOLs: None

Objectives: Students will be able to:
- Identify whether a situation can be modeled by a linear function
- Determine x and y intercepts of a graph
- Identify the practical meaning of x and y intercepts
- Develop the slope-intercept model of an equation of a line
- Use the slope-intercept formula to determine x and y intercepts
- Determine the zeros of a function

Vocabulary:
- **Vertical Intercept** – is the point the graph crosses the vertical axis (dependent variable)
- **Y-Intercept** – is the point the graph crosses the y-axis
- **Slope-Intercept Form** – a line in the form of \( y = b + mx \) or \( y = mx + b \)
- **Horizontal Intercept** – is the point the graph crosses the horizontal axis (independent variable)
- **X-Intercept** – is the point the graph crosses the x-axis. It is also known as a zero of the function
- **Positive slope** – \( m > 0 \), graph is increasing left to right
- **Negative slope** – \( m < 0 \), graph is decreasing left to right

Activity: You have decided to buy a new Honda Accord LX, but you are concerned about the value of the car depreciating over time. You search the Internet and obtain the following information from [www.intellichoice.com](http://www.intellichoice.com):

2010 Accord LX
- Suggested Retail Price $20,025
- Depreciation per Year $1,385

Complete the following table:

<table>
<thead>
<tr>
<th>Years of ownership</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value in Dollars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Is the value of the car a function of years of ownership?

What is the independent and dependent variable?

Select two ordered pairs and determine the average rate of change

What are the units for the average rate of change?

Select another two ordered pairs and determine the average rate of change

Is this a linear function? Why or why not?

Is this function increasing, decreasing or constant?

What is the vertical intercept, value-intercept in our problem?
What is the practical meaning of the y-intercept?

What is the slope-intercept form of the line?

Determine the n-intercept of the graph of the car value

What is the practical significance of the n-intercept?

**Example 1:** Identify the slope and y-intercept of the line whose equation is given. Write the y-intercept as an ordered pair.

a. \( y = -2x + 5 \)

b. \( s = \frac{3}{4}t + 2 \)

c. \( q = 2 - r \)

d. \( y = \frac{5}{6} + \frac{x}{3} \)

**Example 2:** Identify the slope, y-intercept and x-intercept of the line \( F = 1.8C + 32 \) and graph it.

**Concept Summary:**
- Slope Intercept form of Line: \( y = mx + b \)
  - Y-intercept \((0, b)\) is
    - The point where the graph crosses the y-axis
    - Found by setting \( x = 0 \) in the slope intercept form
  - X-intercept \((a, 0)\) is
    - The point where the graph crosses the x-axis
    - Also known as the zero of the function
    - Found by setting \( y = 0 \) in the slope intercept form
  - Increasing functions have a positive slope
  - Decreasing functions have a negative slope

**Homework:** pg 199-203; 1 - 8
Chapter 2: Linear Function Models and Problem Solving

Activity 2.4: Family of Functions

SOLs: None

Objectives: Students will be able to:
- Identify the effect of changes in the equation of a line on its graph
- Identify the effect of changes in the graph of a line on its equation
- Identify the change in the graph and the equation of a basic function as a translation, reflection or vertical stretch or shrink

Vocabulary:
Vertical Shift – a constant is added (shift up) or subtracted (shift down) to each output value
Horizontal Shift – a constant is added (shift left) or subtracted (shift right) to each input value
Reflection – a flip across an axis; algebraically a reflection across the x-axis occurs if y = f(x) = f(-x)
Stretch Factor – is called a; when the graph of y = f(x) changes to y = a•f(x)
Vertical Stretch – when the graph of y = f(x) changes to y = a•f(x) and |a| > 1
Vertical Shrink – when the graph of y = f(x) changes to y = a•f(x) and 0 < |a| < 1
Transformations – any translations (horizontal or vertical shifts), reflections and vertical stretches or shrinks

Key Concept:
Reflections across the X-axis:
- The graph of y = -x is a reflection of the graph of y = x across the x-axis
- In general, if y = f(x) is reflected across the x-axis, then the equation of the resulting graph is y = -f(x)
- The reflection is keeping the x-value the same and multiplying the output value, y, by negative one.

Reflections across the Y-axis:
- The graph of y = -x is also a reflection of the graph of y = x across the y-axis
- In general, if y = f(x) is reflected across the y-axis, then the equation of the resulting graph is y = f(-x)
- The reflection is keeping the y-value the same and multiplying the input value, x, by negative one.

Vertical Stretches (and Shrinks):
- A graph is stretched vertically when the function (output value) is multiplied by a constant, a > 1
- A graph is shrunk vertically when the function (output value) is multiplied by a constant, 0 < a < 1
- A graph is flipped and stretched vertically when the function (output value) is multiplied by a constant, a < -1
- A graph is flipped and shrunk vertically when the function (output value) is multiplied by a constant, -1 < a < 0

Activity: A primary objective of this textbook is to help you develop a familiarity with the graphs, equations, and properties of a variety of functions, including linear, quadratic, exponential, and logarithmic. You will group these functions into families and identify the similarities within a family and the differences between families. We will continue to explore the family of linear functions.

Vertical Shifts:
Given y = f(x) = 2x
Graph the function
Determine the slope and intercepts
Graph Y2 = 2x – 3 and Y3 = 2x + 4
Compare the graphs (slope and intercepts)

Horizontal Shifts:
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Given \( y = f(x) = 2x \)
Graph the function
Determine the slope and intercepts

Graph \( Y_2 = 2(x - 3) \) and \( Y_3 = 2(x + 2) \)
Compare the graphs (slope and intercepts)

**Both Shifts:**

Graph each of the following functions in the same window.
\[
\begin{align*}
Y_1 &= x^2 \\
Y_2 &= x^2 + 6 \\
Y_3 &= (x + 3)^2
\end{align*}
\]
How do the graphs compare?

Which is shifted horizontally?

What direction?

Which is shifted vertically?

What direction?

**X-Axis Reflections:**

Given \( y = f(x) = 3x + 6 \)
Graph the function
Determine the slope and intercepts

Reflect the graph across the x-axis
Write the equation of the reflection

Determine the slope and intercepts
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**Y-Axis Reflections:**
Given \( y = f(x) = 3x + 6 \)
Graph the function
Determine the slope and intercepts

Reflect the graph across the y-axis – find \( f(-x) \)
Write the equation of the reflection

Determine the slope and intercepts

**Vertical Stretches:**
Given \( y = f(x) = x \)
Graph the function
Determine the slope and intercepts

Graph \( Y_2 = 2x \) and \( Y_3 = 5x \)
Compare the three graphs: (slope and intercepts)

**Transformations:**
Given \( y = f(x) = |x| \)
Graph the function
Graph \( Y_2 = |x + 3| \)
Graph \( Y_3 = 2|x + 3| \)
Graph \( Y_4 = -2|x + 3| \)

**Concept Summary:**
- Vertical shifts in graphs are done by adding/subtracting a constant from each output value
- Horizontal shifts in graphs are done by adding/subtracting a constant from each input value
- Reflections across the x-axis: y-values change sign and x-values remain the same
- Reflections across the y-axis: x-values change sign and y-values remain the same
- Multiplying each output value by a constant, \( a \), stretches the graph
  - If \( 0 < |a| < 1 \) then the graph is vertically shrunk
  - If \( |a| > 1 \) then the graph is vertically stretched
  - If \( a \) is negative, then the graph if flipped across the x-axis
- All of the shifts and stretches are examples of transformations

**Homework:** pg 215-7; 1-7
Chapter 2: Linear Function Models and Problem Solving

Activity 2.5: Predicting Population

SOLs: None

Objectives: Students will be able to:
- Write an equation for a linear function given its slope and y-intercept
- Write linear functions in slope-intercept form, \( y = mx + b \)
- Determine the relative error in a measurement or prediction using a linear model
- Interpret the slope and y-intercept of linear functions in contextual situations
- Use the slope-intercept form of linear equations to solve problems

Vocabulary:
- Error – is the difference between the actual value and the predicted value; \( \text{error} = \text{actual} - \text{predicted} \)
- Observed Value – also known as the actual value
- Expected Value – also known as the predicted value
- Relative Error – is the ratio of the error to the observed value

Key Concept:

**Error and Relative Error**

- The error in a prediction is the difference between the observed value (actual value that was measured) and the predicted value from the model. The Relative error is the ratio of the error to the observed value.

\[
\text{Relative error} = \frac{\text{Observed value} - \text{predicted value}}{\text{Observed value}}
\]

- It is normally expressed as a percentage

Activity: According to the US Bureau of the Census, the population of the United States was approximately 132 million in 1940 and 151 in 1950. Assume that the rate of change of the population with respect to time is a constant value over the decade from 1940 to 1950.

Write the data as two ordered pairs

Plot the two data points and draw a line through them

What is the average rate of change of the population from 1940 to 1950 (time \( t = 0 \) to \( t = 10 \))? 

What is the slope of the line?

What is the practical meaning of the slope in the model?
What is the P-intercept of this line?

What is the practical meaning of the intercept?

What is the slope-intercept form of the population model line?

Assume that the average rate of change holds true through 1960. Use this equation to predict the 1960 US population.

The actual population for the US in 1960 was approximately 179 million. What is the relative error in the prediction we made?

What do you think was the cause of the model’s error?

Why would that be true (History question!)?

**Population Model:** Let's look at more recent data. The US population was approximately 249 million in 1990 and 281 million in 2000. Determine the slope of this line

Compare it with the slope of the 1940 to 1950 model

Which decade had the greatest population increase?

Determine the P-intercept in the new line

Write the slope-intercept form of the equation of the line

Predict the population in 2010

What assumption did we have to make in the prediction?

According to the linear model, \( P(t) = 3.2t + 249 \), in what year will the population be 350 million?

**Concept Summary:**
- Error is the difference between actual and predicted values
- Relative error is the ratio of the error to the observed value
- Relative error is usually reported as a percentage

**Homework:** pg 221-4; 1 - 6
Activity 2.6: Housing Prices

SOLs: None

Objectives: Students will be able to:
- Determine the equation for a linear function that includes two given points
- Interpret the slope and y-intercept of a linear function in contextual situations
- Use the point-slope form, \( y - k = m(x - h) \) of linear equations to solve problems

Vocabulary:
- **Point-Slope Form** – an equation form of a line that uses a point on the line \((h, k)\) and the slope of the line in the form: \( y - k = m(x - h) \)

Key Concept:

**Point-Slope Form**

- **Slope Intercept:** \( y = mx + b \)
- **Point Slope:** \( y - k = m(x - h) \)

\[
\text{Slope} = m = \frac{\Delta y}{\Delta x} = \frac{y - k}{x - h}, \text{ so} \\
m(x - h) = y - k
\]

Activity:
You have been aware of a steady increase in housing prices in your neighborhood since 2000. The house across the street sold for $125,000 in 2003, and then sold again in 2007 for $150,000. This data can be written in a table, where \( n \) represents the number of years since 2000 and \( P \) represents the sale price of a typical house in your neighborhood.

<table>
<thead>
<tr>
<th>Number of Years since 2000, ( n )</th>
<th>Housing Price ($K), ( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>125</td>
</tr>
<tr>
<td>7</td>
<td>150</td>
</tr>
</tbody>
</table>

Plot the two points on the graph to the right.
What is the slope of the line?

What is the practical meaning of the slope?

Use the ordered pair (3, 125) and plug it into \( y = mx + b \) and solve for \( b \)

Interpret the value of \( b \) in the housing function.
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Use the ordered pair (3, 125) to write the point slope form of the housing price function

Use the ordered pair (7, 150) to write the point slope form of the housing price function

Do they both give us the same slope-intercept form?

<table>
<thead>
<tr>
<th>20-year old Male 190.5 cm Tall</th>
</tr>
</thead>
<tbody>
<tr>
<td>w, Weight (kg)</td>
</tr>
<tr>
<td>B, Basal Energy Requirement (cals)</td>
</tr>
</tbody>
</table>

Assume B is a linear function of weight. Determine the slope of the line (from the above table)

Use the point-slope form to determine the B-intercept

Does it have any practical meaning?

**Concept Summary:**
- **Slope-Intercept form:** \( y = mx + b \)
- **Point-Slope form:** \( y - y_1 = m(x - x_1) \) where \((x_1, y_1)\) is a point on the line
  - or using \((h, k)\) as the point: \( y - k = m(x - h) \)
- **Determining the equation of a line (with two points)**
  1. Determine the slope of the line
  2. If the x-value of one of the points is zero, then it’s y-value is \(b\) and use slope intercept form, \(y = mx + b\)
  3. Otherwise use one of the points and the point-slope form and solve for \(y\) to get slope-intercept form

**Homework:** pg 228-33; 1, 2, 4, 6, 8, 9, 11, 13, 16, 18
Activity 2.7: Body Fat Percentage

SOLs: None

Objectives: Students will be able to:
- Construct scatterplots from sets of data pairs
- Recognize when patterns of points in a scatterplot have a linear form
- Recognize when the pattern in the scatterplot show that the two variables are positively or negatively related
- Identify individual data points, called outliers, that fall outside the general pattern of the other data
- Estimate and draw a line of best fit through a set of points in a scatterplot
- Determine residuals between the actual value and the predicted value for each point in the data set
- Use a graphing calculator to determine a line of best fit by the least-squares method
- Measure the strength of the correlation (association) by a correlation coefficient
- Recognize that a strong correlation does not necessarily imply a linear or cause and effect relationship

Vocabulary:
- Scatterplot – a graph of individual (x, y) points
- Outlier – a data point outside the general pattern of points in the scatterplot
- Residuals – a statistical term for the error: actual value – predicted value
- Least Squares Regression Line – a line that minimizes the sum of the squares of all the residuals
- Linear Correlation Coefficient – r, measures how strongly two variables follow a linear pattern
- Lurking Variable – better called an extraneous variable; one that is not measured or accounted for in the experiment

Key Concept:

TI-83 Instructions for Scatterplots
- Enter explanatory variable in L1
- Enter response variable in L2
- Press 2nd y= for StatPlot, select 1: Plot1
- Turn plot1 on by highlighting ON and enter
- Highlight the scatter plot icon and enter
- Press ZOOM and select 9: ZoomStat

Interpreting Scatterplots:
- Direction
  - positive association (positive slope left to right)
  - negative association (negative slope left to right)
- Form
  - linear – straight line,
  - curved – quadratic, cubic, etc, exponential, etc
- Strength of the form
  - weak
  - moderate (either weak or strong)
  - strong
- Outliers (any points not conforming to the form)
- Clusters (any sub-groups not conforming to the form)

Residuals:
- Positive residuals mean that the observed (actual value, y) lies above the line (predicted value, y-hat)
  - predicted value is smaller
- Negative residuals mean that the observed (actual value, y) lies below the line (predicted value, y-hat)
  - predicted value is larger

A strong correlation between two variables does not mean that a cause-and-effect relationship exists.
Cause and effect can only be determined by a well designed experiment and never by observation.
Activity: Your body fat percentage is simply the percentage of fat your body contains. If you weigh 150 pounds and have a 10% body fat, your body consists of 15 pounds of fat and 135 pounds of lean body mass (bone, muscle, organs, tissue, blood, etc). A certain amount of fat is essential to bodily functions. Fat regulates body temperature, cushions and insulates organs and tissues, and is the main form of the body’s energy reserve. The American Council on Exercise has established the following categories for male and females based on body fat %.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Essential Fat</th>
<th>Athletes</th>
<th>Fitness</th>
<th>Acceptable</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female (% fat)</td>
<td>10 – 12 %</td>
<td>14 – 20 %</td>
<td>21 – 24 %</td>
<td>25 – 31 %</td>
<td>≥ 32 %</td>
</tr>
<tr>
<td>Male(% fat)</td>
<td>2 – 4 %</td>
<td>6 – 13 %</td>
<td>14 – 17 %</td>
<td>18 – 25 %</td>
<td>≥ 26 %</td>
</tr>
</tbody>
</table>

A group of researchers is searching for alternative methods to measure body fat percentage. They first investigate if there is an association between body fat % and a person’s weight. The body fat percentage of 19 male subjects is accurately determined, using hydrostatic weighing method. Then each subject is weighed using a traditional scale. The results are below:

<table>
<thead>
<tr>
<th>W, weight (lbs)</th>
<th>175</th>
<th>181</th>
<th>200</th>
<th>159</th>
<th>195</th>
<th>192</th>
<th>205</th>
<th>173</th>
<th>187</th>
<th>188</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y, Body Fat %</td>
<td>16</td>
<td>21</td>
<td>25</td>
<td>6</td>
<td>22</td>
<td>30</td>
<td>32</td>
<td>21</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>W, weight (lbs)</td>
<td>240</td>
<td>175</td>
<td>168</td>
<td>246</td>
<td>160</td>
<td>215</td>
<td>155</td>
<td>146</td>
<td>219</td>
<td></td>
</tr>
<tr>
<td>Y, Body Fat %</td>
<td>15</td>
<td>22</td>
<td>9</td>
<td>38</td>
<td>14</td>
<td>27</td>
<td>12</td>
<td>10</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Plot the data points as ordered pairs of the form \((w, y)\)

Does there appear to be a linear relationship?

What is the general trend of the graph?

Identify any outliers (points that fall way outside the general trend or pattern of the data)

Use a straight edge to draw a line connecting the points \((175, 16)\) and \((200, 25)\). Use this line to represent the trend.

Determine the slope of this line

Determine the equation of the line

Predict the body fat % of a 192 pound male

After doing example 1, describe the relationship using “DFSOC”
Example 1: Describe the relationship using “DFSOC” of the following scatterplots:

Residuals:
Determine the residual from the 192 lb prediction

What does it tell us about the predicted value?

Determine the residual for a body weight of 168 lb

What does it tell us about the predict value?

Let’s use our calculator to help figure out all the residuals for our data. Remember we type it data.
“x-data” is entered in L1
“y-data” is entered in L2
Model: L3 = 0.36(L1) – 72
Residuals: L4 = L2 – L4
Scatterplot L4

Least Squares Regression:
Diagnostics must be turned on (see last page)
Use LinReg(ax+b) L1, L2 (from STAT, CALC)

Write down a = (the slope)
b = (the y-intercept)
r = (correlation coefficient)
Let’s plot the regression line, our first line, and the data (using our scatterplot).
Assign \( Y_1 = 0.36X - 47 \) (Original Line)
Assign \( Y_2 = 0.224x - 21.38 \) (Regression Line)
Hit GRAPH
Use the regression line to predict the body fat % for a 225 lb male

Our r-value was 0.71987 or \( r \approx 0.72 \) (not as strong as we thought)

**Correlation Coefficient:**
- Correlation makes no distinction between explanatory and response variables
- \( r \) does not change when we change the units of measurement of \( x, y \) or both
- Positive \( r \) indicates positive association between the variables and negative \( r \) indicates negative association
- The correlation \( r \) is always a number between -1 and 1

**Example 2:** Match the \( r \) values to the Scatterplots to the left
1) \( r = -0.99 \)
2) \( r = -0.7 \)
3) \( r = -0.3 \)
4) \( r = 0 \)
5) \( r = 0.5 \)
6) \( r = 0.9 \)

**Residuals Part Two:**
- The sum of the least-squares residuals is always zero
- Residual plots helps assess how well the line describes the data
- A good fit has
  - no discernable pattern to the residuals
  - and the residuals should be relatively small in size
- A poor fit violates one of the above
  - Discernable patterns:
    - Curved residual plot
    - Increasing / decreasing spread in residual plot
Chapter 2: Linear Function Models and Problem Solving

Activity Revisited:
A group of researchers is searching for alternative methods to measure body fat percentage. They then check a person’s waist and body fat %. The results are below:

<table>
<thead>
<tr>
<th>W, waist (in)</th>
<th>32</th>
<th>36</th>
<th>38</th>
<th>33</th>
<th>39</th>
<th>40</th>
<th>41</th>
<th>35</th>
<th>38</th>
<th>33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y, Body Fat %</td>
<td>16</td>
<td>21</td>
<td>25</td>
<td>6</td>
<td>22</td>
<td>30</td>
<td>32</td>
<td>21</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>W, weight (lbs)</td>
<td>40</td>
<td>36</td>
<td>32</td>
<td>44</td>
<td>33</td>
<td>41</td>
<td>34</td>
<td>34</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Y, Body Fat %</td>
<td>15</td>
<td>22</td>
<td>9</td>
<td>38</td>
<td>14</td>
<td>27</td>
<td>12</td>
<td>10</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Plot the data and describe it using “DFSOC”

Use the LinReg feature of the calculator to determine the equation of the regression line

Determine the correlation coefficient

Which is a more reliable predictor of body fat %, waist size or weight?

Concept Summary:
- Scatterplots are graphs of individual data points and are useful in visually seeing relationships
- Outlier is a data point far outside the general pattern of points in a scatterplot
- The line of best fit is the line that lies in the middle of the linear pattern of the data points
- The correlation coefficient, r, measures how strong the linear relationship between the variables is
- Residuals are the vertical distance between the data point and the predicted point on the best-fit line
- Regression line is considered the best-fit line for paired data
- Least-squares regression minimizes the sum of the squares of the residuals

Homework: pg 244-48, 1, 2, 4, 5 (line in 4b is P = -0.51t + 24.675 and in 5b is y = 8.66x + 120.52)
Lab 2.8: Plot before Calculating

**SOLs:** None

**Objectives:** Students will be able to:
- Understand the need to first make a scatterplot of the data before calculating a correlation coefficient and regression line

**Vocabulary:** none new

**Activity:** 4 Data Sets

**Concept Summary:**
- Plotting data can help us avoid “dumb” calculator errors

**Homework:** complete worksheet and turn in for a grade
Chapter 2: Linear Function Models and Problem Solving

Lab 2-8

In 1973, statistician Frank Anscombe published the article “Graphs in Statistical Analysis” in the *American Statistician*, vol 27, pages 17-21. The article contained the following four sets of 11 pairs of data.

**Instructions:** Enter x-data for datasets 1, 2, 3 into L1. Enter y-data for datasets 1, 2, 3 into L2, L3, and L4. Enter x-data for data set 4 into L5 and y-data into L6. Then run LinReg(ax+b) on each set of data and record your answers into the table below. Answer the questions below the table. Draw the scatterplots for each dataset on the graphs on the back. Also draw the regression lines on each graph. Answer to questions on the back.

**Data Set 1**

<table>
<thead>
<tr>
<th>x</th>
<th>10</th>
<th>8</th>
<th>13</th>
<th>9</th>
<th>11</th>
<th>14</th>
<th>6</th>
<th>4</th>
<th>12</th>
<th>7</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>8.04</td>
<td>6.95</td>
<td>7.58</td>
<td>8.81</td>
<td>8.33</td>
<td>9.96</td>
<td>7.24</td>
<td>4.26</td>
<td>10.84</td>
<td>4.82</td>
<td>5.68</td>
</tr>
</tbody>
</table>

**Data Set 2**

<table>
<thead>
<tr>
<th>x</th>
<th>10</th>
<th>8</th>
<th>13</th>
<th>9</th>
<th>11</th>
<th>14</th>
<th>6</th>
<th>4</th>
<th>12</th>
<th>7</th>
<th>5</th>
</tr>
</thead>
</table>

**Data Set 3**

<table>
<thead>
<tr>
<th>x</th>
<th>10</th>
<th>8</th>
<th>13</th>
<th>9</th>
<th>11</th>
<th>14</th>
<th>6</th>
<th>4</th>
<th>12</th>
<th>7</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>7.46</td>
<td>6.72</td>
<td>12.74</td>
<td>7.11</td>
<td>7.81</td>
<td>8.84</td>
<td>6.08</td>
<td>5.39</td>
<td>8.15</td>
<td>6.42</td>
<td>5.73</td>
</tr>
</tbody>
</table>

**Data Set 4**

<table>
<thead>
<tr>
<th>x</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>8</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>6.58</td>
<td>5.76</td>
<td>7.71</td>
<td>8.84</td>
<td>8.47</td>
<td>7.04</td>
<td>5.25</td>
<td>5.56</td>
<td>7.91</td>
<td>6.89</td>
<td>12.50</td>
</tr>
</tbody>
</table>

**Fill in the following table**

<table>
<thead>
<tr>
<th>Data Set</th>
<th>Linear Correlation Coefficient, r</th>
<th>Linear Regression Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>y =</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>y =</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>y =</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>y =</td>
<td></td>
</tr>
</tbody>
</table>

1) Compare the equations and correlation coefficients for the four sets of data

2) What type of correlation between the variable x and y is indicated by the correlation coefficient (think Direction, Form and Strength)?

Data Set 1:

Data Set 2:

Data Set 3:

Data Set 4:

On the back, graph the Data Sets (in a scatterplot) and the regression lines for each of the four data sets:
3) A correlation coefficient value of $r = 0.816$ indicates a strong positive association between the two variables $x$ and $y$. However, does that mean a line is the best fit for the data (remember residuals!)? Explain

Data Set 1:

Data Set 2:

Data Set 3:

Data Set 4:

4) Data set 3 has an outlier. Remove the outlier from the data set and recalculate the equation of the regression line. Fill it in below. What is the value of the correlation coefficient? What does this indicate?

$$Y = \quad X + \quad r = 0$$

5) What was Mr. Ansombe trying to demonstrate using his four data sets?
Activity 2.9: College Tuition

SOLs: None

Objectives: Students will be able to:
- Determine the equation of a regression line using a graphing calculator
- Use the regression equation to interpolate and extrapolate

Vocabulary:
Interpolation – using a regression model to predict an output within the boundaries of the input values
Extrapolation – using a regression model to predict an output outside the boundaries of the input values

Key Concept:

Interpolation and Extrapolation

Activity:
The following table contains the average tuition and required fees for all 4-year colleges from 1987 through 2003

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$5964</td>
<td>$8238</td>
<td>$10,330</td>
<td>$11,888</td>
<td>$12,922</td>
<td>$14,504</td>
</tr>
</tbody>
</table>

A) Enter the year data in L1 and the tuition data in L2
B) Graph the scatterplot on your calculator
C) Determine the regression line
D) Determine the correlation coefficient
E) Use the regression equation to predict the average tuition and fees at a private 4-year colleges in 1993 (t=6).
Is this an interpolation or extrapolation?

F) In 2005 (t=18). Is this an interpolation or extrapolation?

G) Use your graph to estimate what year the tuition will exceed $20,000

Problem:
Over the past quarter century, the number of bachelor’s degrees conferred by degree-granting institutions has steadily increased. The following table contains data on the number of bachelor’s degrees (in thousands) earned by women in a given year.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># degrees</td>
<td>423</td>
<td>465</td>
<td>492</td>
<td>558</td>
<td>634</td>
<td>708</td>
<td>775</td>
</tr>
</tbody>
</table>

A) Enter the year data in L1 and the tuition data in L2
B) Graph the scatterplot on your calculator
C) Determine the regression line
D) What is the slope of the line? What is the meaning?
E) Predict the number of degrees granted in 2010

Concept Summary:
The linear regression equation is the linear equation that “best fits” a set of data
The regression line is a mathematical model for the data
Interpolation is a prediction of an output value using the regression line within the extremes of the input values
Extrapolation is a prediction of an output value using the regression line outside the extremes of the input value (always viewed with skepticism)

Homework: pg 255-6; 1-2
Lab 2.10: Body Parts

SOLs: None

Objectives: Students will be able to:
- Collect and organize data in a table
- Plot data in a scatterplot
- Recognize linear patterns in paired data

Vocabulary: None new

Concept Summary:
- Linear Regression models can be used in real-life situations

Homework: complete worksheet and turn-in for grade
Lab 10

Fill in the data for your entire class, and record it in the following table:

<table>
<thead>
<tr>
<th>Nr</th>
<th>Student</th>
<th>Sex</th>
<th>Height</th>
<th>Arm Span</th>
<th>Wrist</th>
<th>Foot</th>
<th>Neck</th>
<th>Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr Headlee</td>
<td>M</td>
<td>73</td>
<td>73.75</td>
<td>7.5</td>
<td>10.75</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) What are some relationships you can identify based on visual inspection of the data? For example, how do the heights relate to arm spans?

2) Construct a scatterplot for heights versus arm spans on the grid below:

![Scatterplot Grid]

Does the scatterplot confirm what you may have guessed in Problem 1?

3) Use your calculator to create scatterplots for the following pairs of data, and state whether or not there appears to be a linear relationship. Comment on how the scatterplots either confirmed or went against the observations you made in problem 1.
Chapter 2: Linear Function Models and Problem Solving

<table>
<thead>
<tr>
<th>Variables</th>
<th>Linear Relationship?</th>
<th>Regression Equation</th>
<th>Correlation Coeff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>Foot Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arm Span</td>
<td>Wrist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot Length</td>
<td>Neck Circumference</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4) Comments:

Make a scatterplot of Height versus Femur Length

5) Describe any pattern observed in the scatterplot
   - Direction:
   - Form:
   - Strength:
   - Outliers or Clusters:

6) List the correlation coefficient  \( r = \) ________

7) Determine the equation of the regression line for the data: \( Ht = \) ________FL+ _________

8) Using the equation above, predict the height of a person whose femur is 21 inches: \( Ht = \) _________

9) Anthropologists have developed the following formula to predict the height of a male based on the length of the femur. Use the formula to determine Mr Headlee’s height.
   \[ Ht = 1.888FL + 32.010 \]
   Mr. Headlee’s Ht: _______

10) Determine the linear regression equation for just the males in the class: \( Ht = \) ________FL+ _________

11) Determine the linear regression equation for just the females in the class: \( Ht = \) ________FL+ _________

12) Compare your results in 10 with the anthropologists for Males (\( Ht = 1.888FL + 32.010 \))

13) Compare your results in 11 with the anthropologists for Females: (\( Ht = 1.945FL + 28.679 \))
Activity 2.11: Long Distance by Phone

SOLs: None

Objectives: Students will be able to:
- Graph a piecewise linear function
- Write a piecewise linear function to represent a given situation
- Determine if a piecewise linear function is continuous
- Graph a function defined by \( y = |x - c| \)

Vocabulary:
- Piecewise function – a function that is defined by more than one equation over its domain
- Absolute value – symbols: \(| |\); gives only the positive result of the function

Activity: A certain long-distance telephone carrier offers the following rates for calls outside the state in which you live: $0.15 per minute for the first 10 minutes, $0.08 per minute for each minute thereafter. Also, whereas most companies round up to the next minute for any fraction of a minute, this company charges for the exact duration of your call.

1. Complete the following table:

<table>
<thead>
<tr>
<th>T (in min)</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (in $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Write an equation for the cost for calls less than 10 minutes

3. Where does the “break point” occur in the cost?

4. What is the cost of a 6-minute call?

5. Determine the cost of a 33-minute call and interpret the result

6. Sketch the graph of the cost function

7. A competitor offers $0.99 for the first 20 minutes and $0.07 for each minute thereafter. Complete the following table:

<table>
<thead>
<tr>
<th>T (in min)</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>C (in $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write an equation that gives the cost for calls less than 20 minutes

Write an equation that gives the cost for call more than 20 minutes

Write the piece-wise function for the cost of this long-distance service

Determine the cost of a 33 minute call

8. Which is a better deal for a 33 minute call?
Gas Problem: Your natural gas bill is computed based on units of 1000 cubic feet.

1. Complete the following table:

<table>
<thead>
<tr>
<th>x (in K cu ft)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>50</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>C, Monthly Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Write an equation for the delivery charge, if you use 3000 cubic feet of less

3. Write an equation to represent the delivery charge if the number of thousand cubic feet used is greater than 3 and less than 50. Remember x represents the total number of thousand cubic feet used.

4. Write an equation to represent the delivery charge if the number of thousand cubic feet used is more than 50.

5. Write the piece-wise function for the delivery charge of gas

6. What is the delivery charge if you use 157 thousand cubic feet of gas?

7. If it costs $1.721 for each thousand cubic feet of gas used (supply charge), then what was your total gas bill that month?
Chapter 2: Linear Function Models and Problem Solving

Absolute Value:
1. What is the domain of the function f?

2. Complete the following table:

<table>
<thead>
<tr>
<th>x</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(x)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Describe the shape of the graph

4. What is the range of the function?

5. Sketch a graph of the function f.

6. Sketch it on your calculator

7. Sketch a graph of $y = |x - 2|$.

8. What type of shift occurred?

9. Sketch a graph of $y = |x| + 2$

10. What type of shift occurred?

Concept Summary:
Piecewise function is a function that is defined differently for certain “pieces” of its domain.
The absolute value is a special piecewise function:

\\[ |x| = \begin{cases} 
  x & \text{if } x \geq 0 \\
  -x & \text{if } x < 0 
\end{cases} \]

The absolute value of a linear function, $g(x) = |x - c|$, always has a v-shaped graph with a vertex at $(c, 0)$

Homework: pg 267–71; 1-6
Chapter 2: Linear Function Models and Problem Solving

Activity 2.R: Chapter Review

SOLs: None

Objectives: Students will be able to complete all chapter 2 objectives

Vocabulary: None new

Key Concept:

Homework: pg 267–71; 1-6

Chapter 2 TI-83 Instruction Sheet:

To construct a SCATTERPLOT:

**Step 1:** type in the data into two lists (STAT, EDIT)
- Use L1 for the x-values
- Use L2 for the y-values

**Step 2:** Go to the STATPLOT (2nd Y=)
- Hit ENTER on Plot1
- Turn plot on (hit enter with the On flashing)
- Use the blue arrow keys to go down one level and select the first graph (by hitting ENTER)
- Use the blue arrow key to go down one level and make sue Xlist: says L1
  - if it doesn’t, then hit 2nd 1 to put it there
- Use the blue arrow key to go down one level and make sue Ylist: says L2
  - if it doesn’t, then hit 2nd 2 to put it there
- Use which ever “mark” you want

**Step 3:** Hit ZOOM 9 (for the calculator to graph with the proper window settings)

To do a least-squares REGRESSION line:

**Step 1:** type in the data into two lists (STAT, EDIT)
- Use L1 for the x-values
- Use L2 for the y-values

**Step 2:** Turn Diagnostics On by:
- 2nd 0 (CATALOG)
  - Use blue arrow keys to go down to DiagnosticOn
  - Hit enter twice (to turn it on)

**Step 3:** Go to STAT, CALC
- Hit 4 (LinReg(ax + b))
  - Hit 2nd 1 (for L1), hit COMMA key, hit 2nd 2 (for L2) and then hit ENTER

**Step 4:** Read off the slope (a = ), the y-intercept (b = ), correlation coefficient (r =), and r² (an AP Stat value)

To do a graph of a PIECEWISE function:

**Step 1:** type in the piecewise function in the following manner --
- Y1 = (first piece)(domain values) + (second piece)(domain values) + ……
  - (for as many pieces as you have)
- Make sure you put in the parentheses that are listed above!!

To get the domain values in with <, >, ≤, or ≥ symbols; we need to hit 2nd MATH to get to the TEST menu

**Step 2:** Go to the WINDOW menu to set up your graphing window to the graph properly

**Step 3:** Hit GRAPH
Chapter 2: Linear Function Models and Problem Solving

5-minute reviews:

Activity 2-1
1. What is the average rate of change as known as?
2. What is the formula for average rate of change of \( y = f(x) \)?
3. Using the table below, determine the average rate of change between the given time periods
   a) \( t = 1 \) and \( t = 3 \)
   b) \( t = 2 \) and \( t = 5 \)

Activity 2-2
1. What is the formula for slope?
2. Write the slopes for each of the following graphs and match up the equation of the line corresponding to the graphs.
   \( y = x, y = -x, y = 4, x = 4 \)

Activity 2-3
1. What is the formula for slope-intercept form of a line?
2. How do you find the y-intercept of a line?
3. How do you find the x-intercept of a line?
4. How can we use our calculator to find the intercepts?

Activity 2-4
Identify each of the following with the type of shift involved:
- \( y = 3x - 5 \)
- \( y = |x| \)
- \( y = 3(x + 2) - 5 \)
- \( y = |x| + 1 \)
- \( y = 3x - 5 - 4 \)
- \( y = |x - 9| \)
- \( y = 3(x - 3) - 5 \)
- \( y = |x + 8| \)
- \( y = 3x - 5 + 6 \)
- \( y = |x| - 7 \)
Chapter 2: Linear Function Models and Problem Solving

Activity 2-5
1. What is the slope in the line connecting (2000, 300M) and (2010, 314M)?

2. What is the relative error associated with the following predictions?
   A. Observed: 10  Predicted: 12
   B. Observed: 30  Predicted: 25
   C. Observed: 100 Predicted: 125
   D. Observed: 250 Predicted: 300

Activity 2-6
1. Match the Equation of the line with its name
   - Point–Slope Form
   - Slope–Intercept Form
   - Standard Form

2. Find the point-slope form of a line containing (2, 5) and (4, 9).

3. Find the slope-intercept form of the line in number 2 above.

Activity 2-7
1. Describe the scatter plot to the right

2. What is the linear correlation coefficient, r, in the graph above?

3. What is another name for the “residual”?

4. From LINREG on our calculator:
   What value do we find the slope?
   What value is the y-intercept?
Chapter 2: Linear Function Models and Problem Solving

Activity 2-9
1. Label the graph:
   - Show interpolation area(s)
   - Show extrapolation area(s)

2. Describe scatterplot

3. What do we say about interpolations?

4. What do we say about extrapolations?