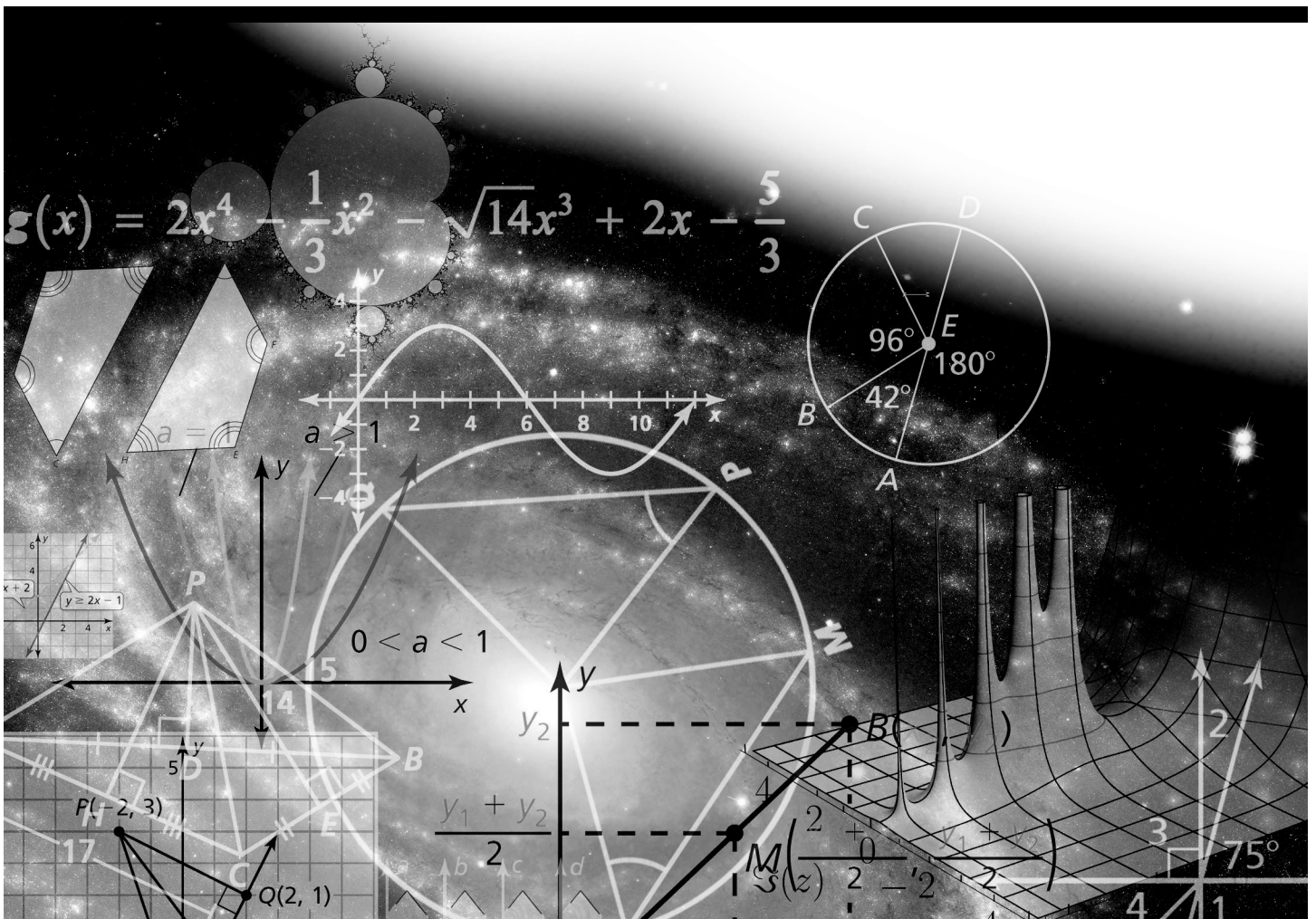


# CHAPTER 10

## Data Analysis and Displays

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**Chapter  
10****Maintaining Mathematical Proficiency**

The table shows the results of a survey. Display the data in a histogram.

1.

Movies attended last month	Frequency
0–1	16
2–3	12
4–5	8

2.

Hours of homework	Frequency
0–1	8
2–3	15
4–5	4
6–7	1

The table shows the results of a survey. Display the data in a circle graph.

3.

Favorite ice cream flavor	Vanilla	Chocolate	Strawberry	Butter Pecan
Students	5	6	4	3

4.

Favorite Sport	Baseball	Tennis	Basketball	Soccer	Golf
Students	10	4	8	7	2

# 10.1

## Measures of Center and Variation

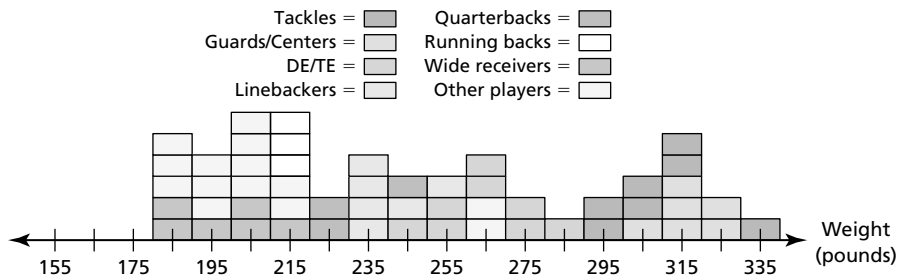
For use with Exploration 10.1

**Essential Question** How can you describe the variation of a data set?

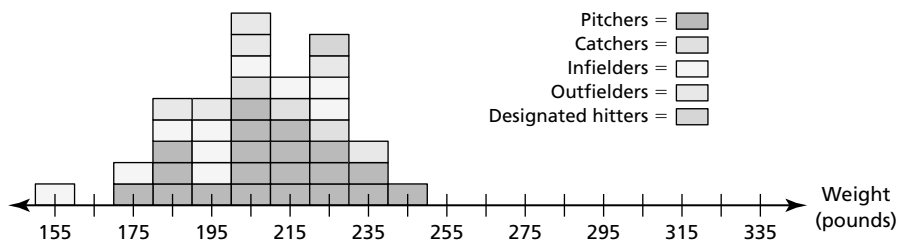
### 1 EXPLORATION: Describing the Variation of Data

**Work with a partner.** The graphs show the weights of the players on a professional football team and a professional baseball team.

**Weights of Players on a Football Team**



**Weights of Players on a Baseball Team**



- Describe the data in each graph in terms of how much the weights vary from the mean. Explain your reasoning.
- Compare how much the weights of the players on the football team vary from the mean to how much the weights of the players on the baseball team vary from the mean.
- Does there appear to be a correlation between the body weights and the positions of players in professional football? in professional baseball? Explain.

**10.1 Measures of Center and Variation (continued)**

**2 EXPLORATION:** Describing the Variation of Data

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

**Work with a partner.** The weights (in pounds) of the players on a professional basketball team by position are as follows.

Power forwards: 235, 255, 295, 245; small forwards: 235, 235; centers: 255, 245, 325; point guards: 205, 185, 205; shooting guards: 205, 215, 185.

Make a graph that represents the weights and positions of the players. Does there appear to be a correlation between the body weights and the positions of players in professional basketball? Explain your reasoning

**Communicate Your Answer**

3. How can you describe the variation of a data set?

**10.1****Practice**

For use after Lesson 10.1

**Notes:****Core Concepts****Mean**

The **mean** of a numerical data set is the sum of the data divided by the number of data values. The symbol  $\bar{x}$  represents the mean. It is read as “x-bar.”

**Median**

The **median** of a numerical data set is the middle number when the values are written in numerical order. When a data set has an even number of values, the median is the mean of the two middle values.

**Mode**

The **mode** of a data set is the value or values that occur most often. There may be one mode, no mode, or more than one mode.

**Notes:****Standard Deviation**

The **standard deviation** of a numerical data set is a measure of how much a typical value in the data set differs from the mean. The symbol  $\sigma$  represents the standard deviation. It is read as “sigma.” It is given by

$$\sigma = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \cdots + (x_n - \bar{x})^2}{n}}$$

where  $n$  is the number of values in the data set. The deviation of a data value  $x$  is the difference of the data value and the mean of the data set,  $x - \bar{x}$ .

**Step 1** Find the mean,  $\bar{x}$ .

**Step 2** Find the deviation of each data value,  $x - \bar{x}$ .

**Step 3** Square each deviation,  $(x - \bar{x})^2$ .

**Step 4** Find the mean of the squared deviations. This is called the *variance*.

**Step 5** Take the square root of the variance.

**Notes:**

**10.1 Practice (continued)****Data Transformations Using Addition**

When a real number  $k$  is added to each value in a numerical data set

- the measures of center of the new data set can be found by adding  $k$  to the original measures of center.
- the measures of variation of the new data set are the *same* as the original measures of variation.

**Data Transformations Using Multiplication**

When each value in a numerical data set is multiplied by a real number  $k$ , where  $k > 0$ , the measures of center and variation can be found by multiplying the original measures by  $k$ .

**Notes:****Worked-Out Examples****Example #1**

(a) Find the mean, median, and mode of the data set and (b) determine which measure of center best represents the data. Explain.

3, 5, 1, 5, 1, 1, 2, 3, 15

a. **Mean:**  $\bar{x} = \frac{3 + 5 + 1 + 5 + 1 + 1 + 2 + 3 + 15}{9}$   
 $= \frac{36}{9} = 4$

**Median:** 1, 1, 1, 2, 3, 3, 5, 5, 15

The middle value is 3.

**Mode:** 1, 1, 1, 2, 3, 3, 5, 5, 15

The data value that occurs most often is 1.

The mean is 4, the median is 3, and the mode is 1.

- b. The median best represents the data. The mode is less than most of the data and the mean is greater than most of the data.

**10.1 Practice (continued)****Example #2**

Find the value of  $x$ .

9, 10, 12,  $x$ , 20, 25; The median is 14.

9, 10, 12,  $x$ , 20, 25

$$\frac{12 + x}{2} = 14$$

$$2 \cdot \frac{(12 + x)}{2} = 2 \cdot 14$$

$$12 + x = 28$$

$$\begin{array}{r} -12 \\ \hline x = 16 \end{array}$$

The value of  $x$  is 16.

**Practice A**

- Consider the data set: 2, 5, 16, 2, 2, 7, 3, 4, 4.
  - Find the mean, median, and mode of the data set.
  - Determine which measure of center best represents the data. Explain.
- The table shows the masses of eight gorillas.

Masses (kilograms)							
160	157	162	158	44	160	159	161

- Identify the outlier. How does the outlier affect the mean, median, and mode?
- Describe one possible explanation for the outlier.

**10.1 Practice (continued)**

3. The heights of the members of two girls' basketball teams are shown. Find the range of the heights for each team. Compare your results.

Team A Heights (inches)									
58	75	60	48	56	78	60	57	54	59

Team B Heights (inches)									
49	50	70	56	58	66	64	57	62	63

4. Consider the data in Exercise 3.
- Find the standard deviation of the heights of Team A. Interpret your result.
  - Find the standard deviation of the heights of Team B. Interpret your result.
  - Compare the standard deviations for Team A and Team B. What can you conclude?
5. Find the values of the measures shown when each value in the data set increases by 8.
- Mean: 42      Median: 40      Mode: 38  
Range: 15      Standard deviation: 4.9



## Practice B

In Exercises 1 and 2, (a) find the mean, median, and mode of the data set and (b) determine which measure of center best represents the data. Explain.

1. 5, 9, 4, 2, 5, 6, 7, 5, 9, 1, 9, 4                      2. 24, 18, 4, 20, 22, 26, 22, 24
3. The table shows the weights of hams (in pounds).

Ham weight (pounds)	9.35	6.72	10.12	9.51	8.89	7.5	10.8	7.1	9.45
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- a. Find the mean, median, and mode of the lengths.
- b. Which measure of center best represents the data? Explain.
- c. A tenth ham is added, which weighs 6.5 pounds. How does this additional value affect the mean, median, and mode? Explain.

In Exercises 4 and 5, find the value of  $x$ .

4.  $-11.5, 12, -14.5, x$ ; The mean is 0.5.                      5. 42, 55,  $x, 80$ ; The median is 66.
6. The table shows the lengths of hospital stays (in days) of patients due to gastrointestinal blockage.

Length of stay (days)	3	2	2	3	4	20	3	2	4
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- a. Identify the outlier. How does the outlier affect the mean, median, and mode?
- b. Describe one possible explanation for the outlier.

In Exercises 7 and 8, find (a) the range and (b) the standard deviation of the data set.

7. 74, 52, 65, 64, 58                      8. 11.0, 8.8, 9.2, 10.4, 11.5, 12.7
9. Find the values of the measures shown when each value in the data set is multiplied by 3.

Mean: 180                      Median: 175                      Mode: 150

Range: 80                      Standard deviation: 24.5