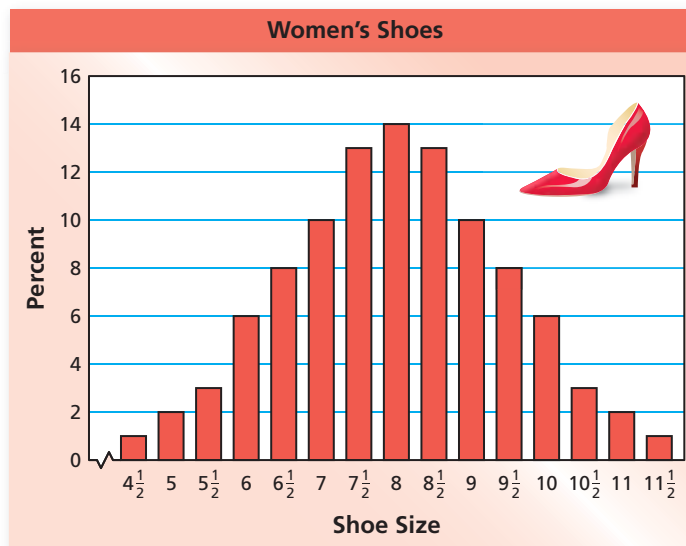


Essential Question What is the meaning of the word “average?” How can you find the average of a collection of numbers?

1 ACTIVITY: Describing an Average

Work with a partner. A women’s shoe store is analyzing its stock. The bar graph shows the percent of women’s shoes in stock for each size.



- What percent of the shoes are size $7\frac{1}{2}$, 8, or $8\frac{1}{2}$?
- There are 200 pairs of shoes in stock. How many are size 7? Explain your reasoning.
- What is the average shoe size for the shoes in stock? Explain.

2 ACTIVITY: Describing a Collection of Shoe Sizes

Work with a partner. A women’s shoe store has 20 customers with the following sizes.

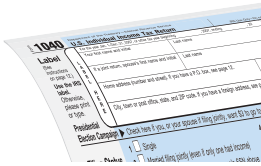


- Use a table or a graph to organize the shoe sizes of the 20 customers.
- Write a short paragraph describing the shoe sizes. In your paragraph, describe the “average shoe size” of the customers.
- Is the entire stock in the shoe store, as shown in Activity 1, well represented by these 20 customers?

3 ACTIVITY: Talking About Averages

Work with a partner. Talk about the statement. What type of survey or research do you think was done to write each statement?

- The average height for men in the United States is 5 feet, 9 inches.
- The average annual income for a family in the United States is \$52,000.
- The average fuel economy for a car in the United States is 17 miles per gallon.
- The average age of a person living in the United States is 36.4 years.
- The average amount of dog food eaten by a dog in the United States is 1.2 pounds per day.



What Is Your Answer?

- IN YOUR OWN WORDS** What is the meaning of the word “average?” How can you find the average of a collection of numbers? Give two examples of averages.
- There are 5 students in the cartoon. Four of the students are 66 inches tall. One is 96 inches tall.
 - How do you think the students decided that their average height is 6 feet?
 - Does a height of 6 feet seem like a good representation of the average height of the 5 students? Explain why or why not.



“Yup, the average height in our class is 6 feet.”

Practice

Use what you learned about averages to complete Exercises 4 and 5 on page 214.

Key Vocabulary

mean, p. 212
outlier, p. 213

Key Idea

Mean

Words The **mean** of a data set is the sum of the data divided by the number of data values.

Numbers Data: 8, 5, 6, 9 Mean: $\frac{8 + 5 + 6 + 9}{4} = \frac{28}{4} = 7$
 (Note: 4 data values)

EXAMPLE 1 Standardized Test Practice

Text Messages Sent

Mark: 120
Laura: 95
Stacy: 101
Josh: 125
Kevin: 82
Maria: 108
Manny: 90

The table shows the number of text messages sent by a group of friends over one week. What is the mean number of messages sent?

- (A) 100 (B) 102 (C) 103 (D) 104

$$\begin{aligned} \text{mean} &= \frac{120 + 95 + 101 + 125 + 82 + 108 + 90}{7} && \leftarrow \text{Sum of the data} \\ &= \frac{721}{7}, \text{ or } 103 && \leftarrow \text{Number of values} \\ &&& \text{Simplify.} \end{aligned}$$

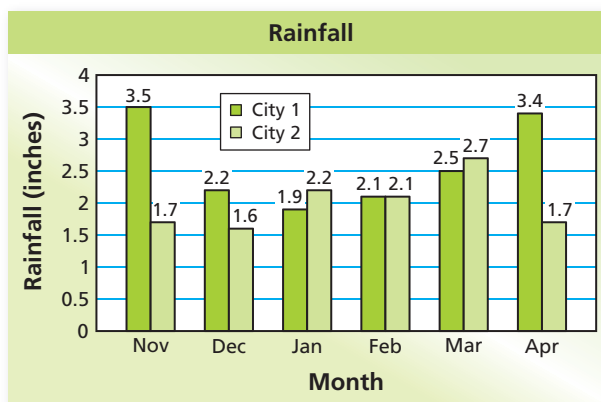
∴ The mean number of text messages sent is 103. The correct answer is (C).

EXAMPLE 2 Comparing Means

Reading

A mean is a type of average.

The double bar graph shows the monthly rainfall amounts for two cities over a six-month period. Compare the mean monthly rainfalls.



City 1 mean: $\frac{3.5 + 2.2 + 1.9 + 2.1 + 2.5 + 3.4}{6} = \frac{15.6}{6}$, or 2.6

City 2 mean: $\frac{1.7 + 1.6 + 2.2 + 2.1 + 2.7 + 1.7}{6} = \frac{12}{6}$, or 2

∴ Because 2.6 is greater than 2, City 1 averaged more rainfall.

On Your Own

Find the mean of the data.

- 49, 62, 52, 54, 61, 70, 55, 53
- 7.2, 8.5, 7.0, 8.1, 6.7

An **outlier** is a data value that is much greater or much less than the other values. When included in a data set, it can affect the mean.

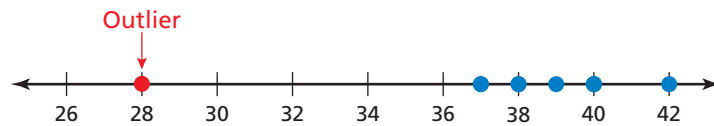
EXAMPLE 3 Finding a Mean With and Without an Outlier

Shetland Pony Heights (in.)				
40	37	39	40	42
38	38	37	28	40

The table shows the heights of several Shetland ponies.

- Identify the outlier.
- Find the mean with and without the outlier.
- Describe how the outlier affects the mean.

- Graph the heights on a number line.



The height of 28 inches is very low compared to the other heights. So, it is an outlier.

- Mean with outlier:

$$\frac{40 + 37 + 39 + 40 + 42 + 38 + 38 + 37 + 28 + 40}{10} = \frac{379}{10}, \text{ or } 37.9$$

Mean without outlier:

$$\frac{40 + 37 + 39 + 40 + 42 + 38 + 38 + 37 + 40}{9} = \frac{351}{9}, \text{ or } 39$$

- With the outlier, the mean is less than all but three of the heights. Without the outlier, the mean better represents the heights.

On Your Own

For each data set, identify the outlier. Then describe how it affects the mean.

- Weights (in pounds) of dogs at a kennel
48, 50, 55, 60, 8, 37, 50
- Prices for flights from Miami, Florida to San Juan, Puerto Rico
\$456, \$512, \$516, \$900, \$436, \$516

5.4 Exercises

Vocabulary and Concept Check

- NUMBER SENSE** Is the mean always equal to a value in the data set? Explain.
- NUMBER SENSE** How can you tell whether a data set has an outlier?
- REASONING** Arrange the words to explain how to find a mean.

the data values

divide by

the number of data values

add

then

Practice and Problem Solving

Describe the “average” of the data.

- Ages in a class: 11, 12, 12, 12, 12, 12, 13
- Movies seen this week: 0, 0, 0, 1, 1, 2, 4

Find the mean of the data.

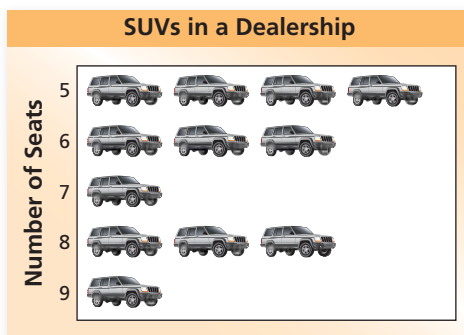
1 6.

Pets Owned	
Brandon	I
Jill	III
Mark	II
Nicole	IIII
Steve	0

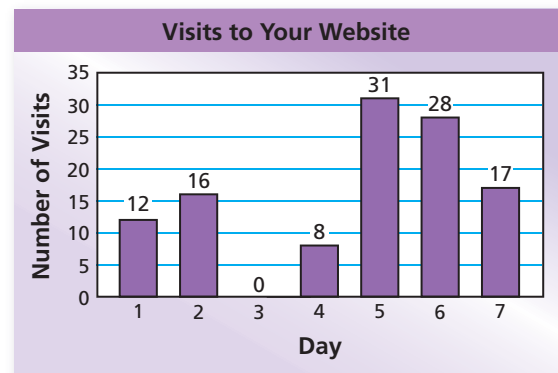
7.

Brothers and Sisters	
Amanda	♀
Eve	♀♀♀♀
Joseph	♂♂♂♂
Michael	♂♂

8.



9.



3 10.

GOLF The table shows where Tiger Woods finished in tournaments in a recent year.

- What was his mean finish?
- Describe two outliers for the data.

Tiger Woods Finishes							
1	1	2	1	1	12	6	2
15	37	1	2	1	22	9	1

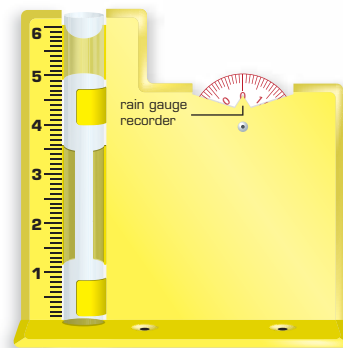
- COMMERCIALS** The table shows the lengths of the commercial breaks during a one-hour television show. What is the mean length of a commercial break?

Time (minutes)	4.2	3.5	4.55	2.75	2.25
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Month	Rainfall (inches)	Month	Rainfall (inches)
Jan	2.22	Jul	3.27
Feb	1.51	Aug	5.40
Mar	1.86	Sep	5.45
Apr	2.06	Oct	4.34
May	3.48	Nov	2.64
Jun	4.57	Dec	2.14

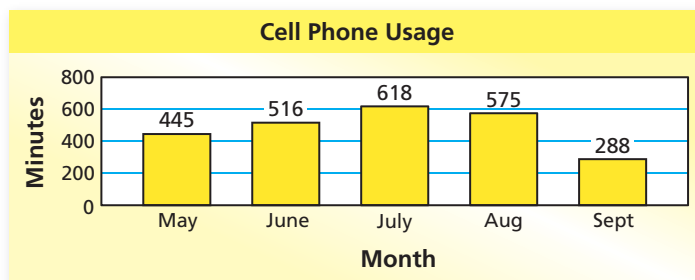
12. **RAINFALL** The table shows the monthly rainfall at a measuring station. What is the mean monthly rainfall?

13. **OPEN-ENDED** Create two different sets of data that have six values and a mean of 21.



14. **CELL PHONE** The bar graph shows your cell phone usage for five months.

- Which data value is an outlier? Explain.
- Find the mean with and without the outlier. Then describe how the outlier affects the mean.
- Describe a situation that could have caused the outlier in this problem.



15. **HEIGHT** The table shows the heights of the basketball players from two schools. What is the difference between the mean heights of the two teams? Do outliers affect either mean? Explain.

	Player Height (inches)														
Dolphins	59	65	53	56	58	61	64	68	51	56	54	57			
Tigers	63	68	66	58	54	55	61	62	53	70	64	64	62	67	69

16. **ALLOWANCE** In your class, 7 students do not receive a weekly allowance, 5 students receive \$3, 7 students receive \$5, 3 students receive \$6, and 2 students receive \$8. What is the mean weekly allowance? Explain how you found your answer.

17. **Reasoning** A collection of 8 backpacks has a mean weight of 14 pounds. A different collection of 12 backpacks has a mean weight of 9 pounds. What is the mean weight of the 20 backpacks? Explain how you found your answer.



Fair Game Review what you learned in previous grades & lessons

Evaluate the expression. *(Skills Review Handbook)*

18. $\frac{8 + 10}{2}$

19. $\frac{26 + 34}{2}$

20. $\frac{18 + 19}{2}$

21. $\frac{14 + 17}{2}$

22. **MULTIPLE CHOICE** What is the best estimate of 26% of 38? *(Section 4.5)*

(A) 8

(B) 10

(C) 12

(D) 15