

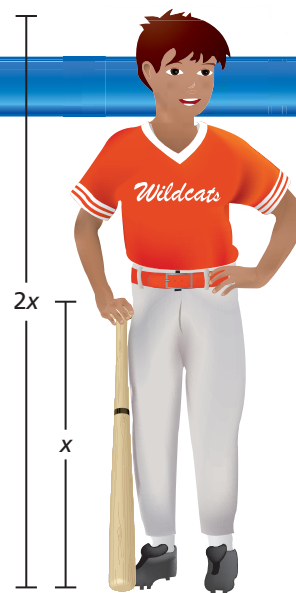
5.3 Writing Proportions

Essential Question How can you write a proportion that solves a problem in real life?

1 ACTIVITY: Writing Proportions

Work with a partner. A rough rule for finding the correct bat length is “the bat length should be half of the batter’s height.” So, a 62-inch-tall batter uses a bat that is 31 inches long. Write a proportion to find the bat length for each given batter height.

- 58 inches
- 60 inches
- 64 inches



2 ACTIVITY: Bat Lengths

Work with a partner. Here is a more accurate table for determining the bat length for a batter. Find all the batter heights and corresponding weights for which the rough rule in Activity 1 is exact.

		Height of Batter (inches)							
		45–48	49–52	53–56	57–60	61–64	65–68	69–72	Over 72
Weight of Batter (pounds)	Under 61	28	29	29					
	61–70	28	29	30	30				
	71–80	28	29	30	30	31			
	81–90	29	29	30	30	31	32		
	91–100	29	30	30	31	31	32		
	101–110	29	30	30	31	31	32		
	111–120	29	30	30	31	31	32		
	121–130	29	30	30	31	32	33	33	
	131–140	30	30	31	31	32	33	33	
	141–150	30	30	31	31	32	33	33	
	151–160	30	31	31	32	32	33	33	33
	161–170		31	31	32	32	33	33	34
	171–180				32	33	33	34	34
	Over 180					33	33	34	34

Proportions

In this lesson, you will

- write proportions.
- solve proportions using mental math.

3 ACTIVITY: Writing Proportions

Math Practice

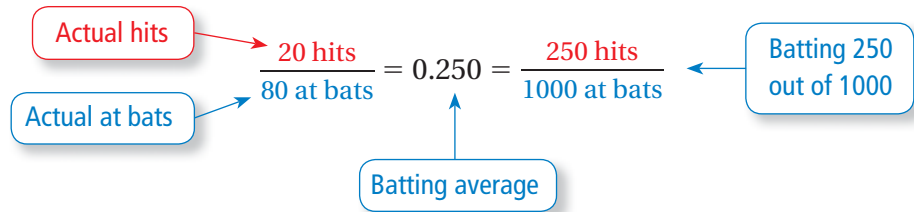
Evaluate Results

How do you know if your results are reasonable? Explain.

Work with a partner. The batting average of a baseball player is the number of “hits” divided by the number of “at bats.”

$$\text{batting average} = \frac{\text{hits } (H)}{\text{at bats } (A)}$$

A player whose batting average is 0.250 is said to be “batting 250.”



Write a proportion to find how many hits H a player needs to achieve the given batting average. Then solve the proportion.

- 50 times at bat; batting average is 0.200.
- 84 times at bat; batting average is 0.250.
- 80 times at bat; batting average is 0.350.
- 1 time at bat; batting average is 1.000.

What Is Your Answer?

- IN YOUR OWN WORDS** How can you write a proportion that solves a problem in real life?
- Two players have the same batting average.

	At Bats	Hits	Batting Average
Player 1	132	45	
Player 2	132	45	

Player 1 gets four hits in the next five at bats. Player 2 gets three hits in the next three at bats.

- Who has the higher batting average?
- Does this seem fair? Explain your reasoning.

Practice

Use what you discovered about proportions to complete Exercises 4–7 on page 182.

One way to write a proportion is to use a table.

	Last Month	This Month
Purchase	2 ringtones	3 ringtones
Total Cost	6 dollars	x dollars

Use the columns or the rows to write a proportion.

Use columns:

$$\frac{2 \text{ ringtones}}{6 \text{ dollars}} = \frac{3 \text{ ringtones}}{x \text{ dollars}}$$

Numerators have the same units.

Denominators have the same units.

Use rows:

$$\frac{2 \text{ ringtones}}{3 \text{ ringtones}} = \frac{6 \text{ dollars}}{x \text{ dollars}}$$

The units are the same on each side of the proportion.

EXAMPLE 1 Writing a Proportion

Black Bean Soup

1.5 cups black beans
0.5 cup salsa
2 cups water
1 tomato
2 teaspoons seasoning

A chef increases the amounts of ingredients in a recipe to make a proportional recipe. The new recipe has 6 cups of black beans. Write a proportion that gives the number x of tomatoes in the new recipe.

Organize the information in a table.

	Original Recipe	New Recipe
Black Beans	1.5 cups	6 cups
Tomatoes	1 tomato	x tomatoes

One proportion is $\frac{1.5 \text{ cups beans}}{1 \text{ tomato}} = \frac{6 \text{ cups beans}}{x \text{ tomatoes}}$.

On Your Own

- Write a different proportion that gives the number x of tomatoes in the new recipe.
- Write a proportion that gives the amount y of water in the new recipe.

Now You're Ready
Exercises 8–11

EXAMPLE 2 Solving Proportions Using Mental Math

Solve $\frac{3}{2} = \frac{x}{8}$.

Step 1: Think: The product of 2 and what number is 8?

$$\frac{3}{2} = \frac{x}{8}$$

$2 \times ? = 8$

Step 2: Because the product of 2 and 4 is 8, multiply the numerator by 4 to find x .

$$3 \times 4 = 12$$

$$\frac{3}{2} = \frac{x}{8}$$

$2 \times 4 = 8$

∴ The solution is $x = 12$.

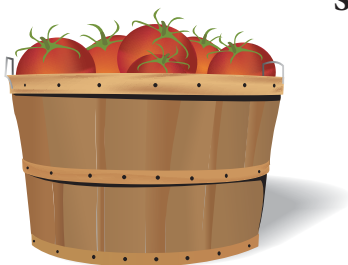
EXAMPLE 3 Solving Proportions Using Mental Math

In Example 1, how many tomatoes are in the new recipe?

Solve the proportion $\frac{1.5}{1} = \frac{6}{x}$.

← cups black beans

← tomatoes



Step 1: Think: The product of 1.5 and what number is 6?

$$1.5 \times ? = 6$$

$$\frac{1.5}{1} = \frac{6}{x}$$

Step 2: Because the product of 1.5 and 4 is 6, multiply the denominator by 4 to find x .

$$1.5 \times 4 = 6$$

$$\frac{1.5}{1} = \frac{6}{x}$$

$1 \times 4 = 4$

∴ So, there are 4 tomatoes in the new recipe.

On Your Own

Now You're Ready
Exercises 16–21

Solve the proportion.

3. $\frac{5}{8} = \frac{20}{d}$

4. $\frac{7}{z} = \frac{14}{10}$

5. $\frac{21}{24} = \frac{x}{8}$

6. A school has 950 students. The ratio of female students to all students is $\frac{48}{95}$. Write and solve a proportion to find the number f of students who are female.

Vocabulary and Concept Check

- WRITING** Describe two ways you can use a table to write a proportion.
- WRITING** What is your first step when solving $\frac{x}{15} = \frac{3}{5}$? Explain.
- OPEN-ENDED** Write a proportion using an unknown value x and the ratio 5 : 6. Then solve it.

Practice and Problem Solving

Write a proportion to find how many points a student needs to score on the test to get the given score.

- test worth 50 points; test score of 40%
- test worth 50 points; test score of 78%
- test worth 80 points; test score of 80%
- test worth 150 points; test score of 96%

Use the table to write a proportion.

8.

	Game 1	Game 2
Points	12	18
Shots	14	w

9.

	May	June
Winners	n	34
Entries	85	170

10.

	Today	Yesterday
Miles	15	m
Hours	2.5	4

11.

	Race 1	Race 2
Meters	100	200
Seconds	x	22.4

12. **ERROR ANALYSIS** Describe and correct the error in writing the proportion.

	Monday	Tuesday	
Dollars	2.08	d	$\frac{2.08}{16} = \frac{d}{8}$
Ounces	8	16	

- T-SHIRTS** You can buy 3 T-shirts for \$24. Write a proportion that gives the cost c of buying 7 T-shirts.
- COMPUTERS** A school requires 2 computers for every 5 students. Write a proportion that gives the number c of computers needed for 145 students.
- SWIM TEAM** The school team has 80 swimmers. The ratio of seventh-grade swimmers to all swimmers is 5 : 16. Write a proportion that gives the number s of seventh-grade swimmers.

Solve the proportion.

2 3 16. $\frac{1}{4} = \frac{z}{20}$

17. $\frac{3}{4} = \frac{12}{y}$

18. $\frac{35}{k} = \frac{7}{3}$

19. $\frac{15}{8} = \frac{45}{c}$

20. $\frac{b}{36} = \frac{5}{9}$

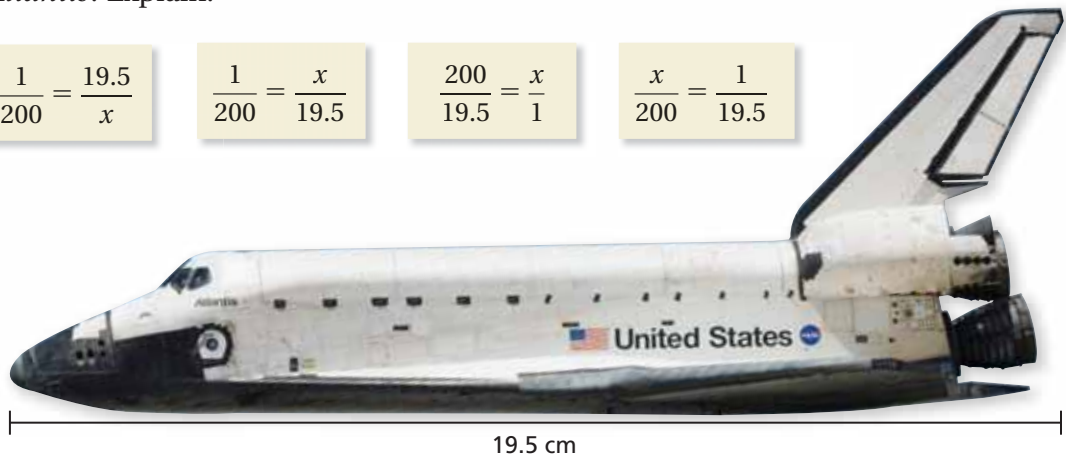
21. $\frac{1.4}{2.5} = \frac{g}{25}$

22. **ORCHESTRA** In an orchestra, the ratio of trombones to violas is 1 to 3.

- There are 9 violas. Write a proportion that gives the number t of trombones in the orchestra.
- How many trombones are in the orchestra?

23. **ATLANTIS** Your science teacher has a 1 : 200 scale model of the space shuttle *Atlantis*. Which of the proportions can you use to find the actual length x of *Atlantis*? Explain.

$\frac{1}{200} = \frac{19.5}{x}$	$\frac{1}{200} = \frac{x}{19.5}$	$\frac{200}{19.5} = \frac{x}{1}$	$\frac{x}{200} = \frac{1}{19.5}$
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24. **YOU BE THE TEACHER** Your friend says “ $48x = 6 \cdot 12$.” Is your friend right? Explain.

Solve $\frac{6}{x} = \frac{12}{48}$.

25. **Reasoning** There are 180 white lockers in the school. There are 3 white lockers for every 5 blue lockers. How many lockers are in the school?



Fair Game Review what you learned in previous grades & lessons

Solve the equation. (Section 3.4)

26. $\frac{x}{6} = 25$

27. $8x = 72$

28. $150 = 2x$

29. $35 = \frac{x}{4}$

30. **MULTIPLE CHOICE** What is the value of $-\frac{9}{4} + \left| -\frac{8}{5} \right| - 2\frac{1}{2}$? (Section 2.3)

(A) $-6\frac{7}{20}$

(B) $-5\frac{7}{20}$

(C) $-3\frac{3}{20}$

(D) $-2\frac{3}{20}$