

6.5 Percents of Increase and Decrease

Essential Question What is a percent of decrease? What is a percent of increase?

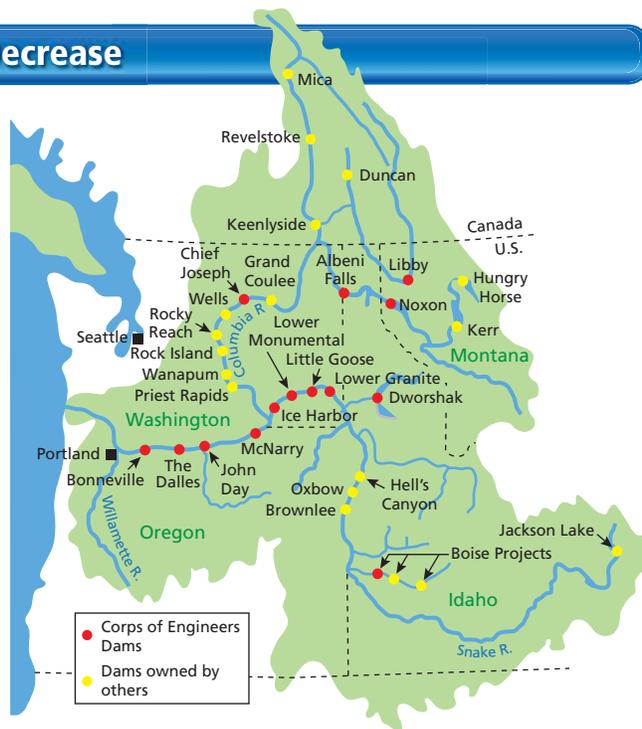
1 ACTIVITY: Percent of Decrease

Work with a partner.

Each year in the Columbia River Basin, adult salmon swim upriver to streams to lay eggs and hatch their young.

To go up the river, the adult salmon use fish ladders. But to go down the river, the young salmon must pass through several dams.

At one time, there were electric turbines at each of the eight dams on the main stem of the Columbia and Snake Rivers. About 88% of the young salmon passed through these turbines unharmed.



- a. Copy and complete the table to show the number of young salmon that made it through the dams.

Dam	0	1	2	3	4	5	6	7	8
Salmon	1000	880	774						

Percents

In this lesson, you will

- find percents of increase.
- find percents of decrease.

$$88\% \text{ of } 1000 = 0.88 \cdot 1000 = 880$$

$$88\% \text{ of } 880 = 0.88 \cdot 880 = 774.4 \approx 774$$

- b. Display the data in a bar graph.
- c. By what percent did the number of young salmon decrease when passing through each dam?

2

ACTIVITY: Percent of Increase

Math
PracticeConsider Similar
Problems

How is this activity similar to the previous activity?

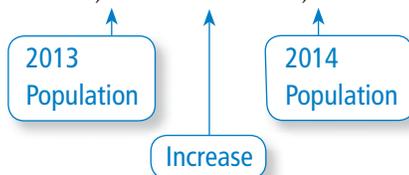
Work with a partner. In 2013, the population of a city was 18,000 people.

- a. An organization projects that the population will increase by 2% each year for the next 7 years. Copy and complete the table to find the populations of the city for 2014 through 2020. Then display the data in a bar graph.

For 2014:

$$\begin{aligned} 2\% \text{ of } 18,000 &= 0.02 \cdot 18,000 \\ &= 360 \end{aligned}$$

$$18,000 + 360 = 18,360$$



Year	Population
2013	18,000
2014	18,360
2015	
2016	
2017	
2018	
2019	
2020	



- b. Another organization projects that the population will increase by 3% each year for the next 7 years. Repeat part (a) using this percent.
- c. Which organization projects the larger populations? How many more people do they project for 2020?

What Is Your Answer?

3. **IN YOUR OWN WORDS** What is a percent of decrease? What is a percent of increase?
4. Describe real-life examples of a percent of decrease and a percent of increase.

Practice

Use what you learned about percent of increase and percent of decrease to complete Exercises 4–7 on page 244.

Key Vocabulary

percent of change,
p. 242
percent of increase,
p. 242
percent of decrease,
p. 242
percent error, p. 243

A **percent of change** is the percent that a quantity changes from the original amount.

$$\text{percent of change} = \frac{\text{amount of change}}{\text{original amount}}$$

Key Idea**Percents of Increase and Decrease**

When the original amount increases, the percent of change is called a **percent of increase**.

$$\text{percent of increase} = \frac{\text{new amount} - \text{original amount}}{\text{original amount}}$$

When the original amount decreases, the percent of change is called a **percent of decrease**.

$$\text{percent of decrease} = \frac{\text{original amount} - \text{new amount}}{\text{original amount}}$$

EXAMPLE 1 Finding a Percent of Increase

The table shows the numbers of hours you spent online last weekend. What is the percent of change in your online time from Saturday to Sunday?

Day	Hours Online
Saturday	2
Sunday	4.5

The number of hours on Sunday is greater than the number of hours on Saturday. So, the percent of change is a percent of increase.

$$\begin{aligned} \text{percent of increase} &= \frac{\text{new amount} - \text{original amount}}{\text{original amount}} \\ &= \frac{4.5 - 2}{2} && \text{Substitute.} \\ &= \frac{2.5}{2} && \text{Subtract.} \\ &= 1.25, \text{ or } 125\% && \text{Write as a percent.} \end{aligned}$$

So, your online time increased 125% from Saturday to Sunday.

On Your Own

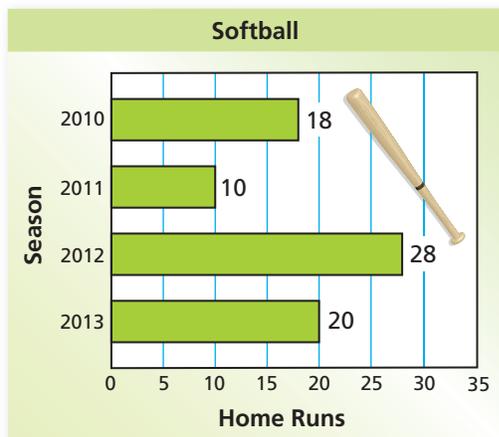
Find the percent of change. Round to the nearest tenth of a percent if necessary.

- 10 inches to 25 inches
- 57 people to 65 people



EXAMPLE 2 Finding a Percent of Decrease

The bar graph shows a softball player's home run totals. What was the percent of change from 2012 to 2013?



The number of home runs decreased from 2012 to 2013. So, the percent of change is a percent of decrease.

$$\begin{aligned}\text{percent of decrease} &= \frac{\text{original amount} - \text{new amount}}{\text{original amount}} \\ &= \frac{28 - 20}{28} && \text{Substitute.} \\ &= \frac{8}{28} && \text{Subtract.} \\ &\approx 0.286, \text{ or } 28.6\% && \text{Write as a percent.}\end{aligned}$$

So, the number of home runs decreased about 28.6%.

Key Idea

Percent Error

A **percent error** is the percent that an estimated quantity differs from the actual amount.

$$\text{percent error} = \frac{\text{amount of error}}{\text{actual amount}}$$

Study Tip

The amount of error is always positive.

EXAMPLE 3 Finding a Percent Error

You estimate that the length of your classroom is 16 feet. The actual length is 21 feet. Find the percent error.

The amount of error is $21 - 16 = 5$ feet.

$$\begin{aligned}\text{percent error} &= \frac{\text{amount of error}}{\text{actual amount}} && \text{Write percent error equation.} \\ &= \frac{5}{21} && \text{Substitute.} \\ &\approx 0.238, \text{ or } 23.8\% && \text{Write as a percent.}\end{aligned}$$

The percent error is about 23.8%.

On Your Own

Now You're Ready
Exercises 8–15
and 18

- In Example 2, what was the percent of change from 2010 to 2011?
- WHAT IF?** In Example 3, your friend estimates that the length of the classroom is 23 feet. Who has the greater percent error? Explain.


Vocabulary and Concept Check

- VOCABULARY** How do you know whether a percent of change is a *percent of increase* or a *percent of decrease*?
- NUMBER SENSE** Without calculating, which has a greater percent of increase?
 - 5 bonus points on a 50-point exam
 - 5 bonus points on a 100-point exam
- WRITING** What does it mean to have a 100% decrease?


Practice and Problem Solving

Find the new amount.

- | | |
|-------------------------------|----------------------------------|
| 4. 8 meters increased by 25% | 5. 15 liters increased by 60% |
| 6. 50 points decreased by 26% | 7. 25 penalties decreased by 32% |

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

- | | |
|--|--------------------------------------|
| 1 2 8. 12 inches to 36 inches | 9. 75 people to 25 people |
| 10. 50 pounds to 35 pounds | 11. 24 songs to 78 songs |
| 12. 10 gallons to 24 gallons | 13. 72 paper clips to 63 paper clips |
| 14. 16 centimeters to 44.2 centimeters | 15. 68 miles to 42.5 miles |
16. **ERROR ANALYSIS** Describe and correct the error in finding the percent increase from 18 to 26.



$$\frac{26 - 18}{26} \approx 0.31 = 31\%$$



17. **VIDEO GAME** Last week, you finished Level 2 of a video game in 32 minutes. Today, you finish Level 2 in 28 minutes. What is your percent of change?
- 3 18. **PIG** You estimate that a baby pig weighs 20 pounds. The actual weight of the baby pig is 16 pounds. Find the percent error.

19. **CONCERT** You estimate that 200 people attended a school concert. The actual attendance was 240 people.
- Find the percent error.
 - What other estimate gives the same percent error? Explain your reasoning.

Identify the percent of change as an *increase* or a *decrease*. Then find the percent of change. Round to the nearest tenth of a percent if necessary.

20. $\frac{1}{4}$ to $\frac{1}{2}$

21. $\frac{4}{5}$ to $\frac{3}{5}$

22. $\frac{3}{8}$ to $\frac{7}{8}$

23. $\frac{5}{4}$ to $\frac{3}{8}$

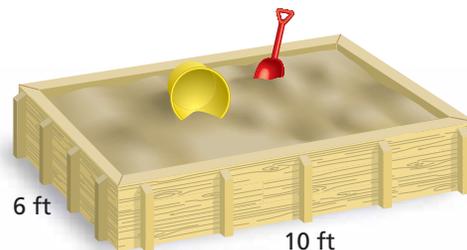
24. **CRITICAL THINKING** Explain why a change from 20 to 40 is a 100% increase, but a change from 40 to 20 is a 50% decrease.

25. **POPULATION** The table shows population data for a community.

Year	Population
2007	118,000
2013	138,000

- What is the percent of change from 2007 to 2013?
- Use this percent of change to predict the population in 2019.

26. **GEOMETRY** Suppose the length and the width of the sandbox are doubled.



- Find the percent of change in the perimeter.
- Find the percent of change in the area.

27. **CEREAL** A cereal company fills boxes with 16 ounces of cereal. The acceptable percent error in filling a box is 2.5%. Find the least and the greatest acceptable weights.



28. **PRECISION** Find the percent of change from June to September in the time to run a mile.

29. **CRITICAL THINKING** A number increases by 10%, and then decreases by 10%. Will the result be *greater than*, *less than*, or *equal* to the original number? Explain.

30. **DONATIONS** Donations to an annual fundraiser are 15% greater this year than last year. Last year, donations were 10% greater than the year before. The amount raised this year is \$10,120. How much was raised 2 years ago?

31. **Reasoning** Forty students are in the science club. Of those, 45% are girls. This percent increases to 56% after new girls join the club. How many new girls join?



Fair Game Review What you learned in previous grades & lessons

Write and solve an equation to answer the question. (Section 6.4)

32. What number is 25% of 64?

33. 39.2 is what percent of 112?

34. 5 is 5% of what number?

35. 18 is 32% of what number?

36. **MULTIPLE CHOICE** Which set of ratios does *not* form a proportion? (Section 5.2)

(A) $\frac{1}{4}, \frac{6}{24}$

(B) $\frac{4}{7}, \frac{7}{10}$

(C) $\frac{16}{24}, \frac{2}{3}$

(D) $\frac{36}{10}, \frac{18}{5}$