Percent of Change

Main IDEA

Find and use the percent of increase or decrease.

Targeted TEKS 8.14 The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. **(A) Identify and apply mathematics to everyday experiences, to activities in and outside school**, with other disciplines, and with other mathematical topics. *Also addresses TEKS 8.2(B), 8.3(B).*

NEW Vocabulary

percent of change
percent of increase
percent of decrease
markup
selling price
discount

GET READY for the Lesson

MONEY MATTERS Over the years, some prices increase. Study the change in gasoline prices from 1930 to 1960.

Price of a Gallon of Gasoline	
Year	Price (¢)
1930	10
1940	15
1950	20
1960	25

Source: Senior Living

1. How much did the price increase from 1930 to 1940?

2. Write the ratio $\dfrac{\text{amount of increase}}{\text{price in 1930}}$. Then write the ratio as a percen

3. How much did the price increase from 1940 to 1950? Write the ratio $\dfrac{\text{amount of increase}}{\text{price in 1940}}$. Then write the ratio as a percent.

4. How much did the price increase from 1950 to 1960? Write the ratio $\dfrac{\text{amount of increase}}{\text{price in 1950}}$. Then write the ratio as a percent.

5. **MAKE A CONJECTURE** Why are the amounts of increase the same b the percents different?

The percent that an amount changes from its original amount is called the **percent of change**.

KEY CONCEPT   Percent of Change

Words	A percent of change is a ratio that compares the change in quantity to the original amount.
Symbols	percent of change $= \dfrac{\text{amount of change}}{\text{original amount}}$

To find the percent of change, do the following:

Step 1 Subtract to find the amount of change.

Step 2 Write the ratio $\dfrac{\text{amount of change}}{\text{original amount}}$ as a decimal.

Step 3 Write the decimal as a percent.

When the new amount is greater than the original, the percent of change is a **percent of increase**. When the new amount is less than the original, the percent of change is called a **percent of decrease**.

STUDY TIP

Percent of Change
When finding percent of change, always use the original amount as the whole.

Real-World EXAMPLES   Find Percent of Change

1 CLUBS The Science Club had 25 members. Now it has 30 members. Find the percent of change. State whether the change is an *increase* or *decrease*.

Step 1   The amount of change is 30 − 25 or 5.

Step 2
$$\text{percent of change} = \frac{\text{amount of change}}{\text{original amount}}$$ Definition of percent of change

$$= \frac{5}{25}$$ The amount of change is 5. The original amount is 25.

$$= 0.2$$ Divide.

Step 3   The decimal 0.2 written as a percent is 20%. So, the percent of change is 20%.

Since the new number of members is greater than the original, it is a percent of increase.

2 COMIC BOOKS Consuela had 20 comic books. She gave some to her friend. Now she has 13 comic books. Find the percent of change. State whether the percent of change is an *increase* or a *decrease*.

Step 1   The amount of change is 20 − 13 or 7.

Step 2
$$\text{percent of change} = \frac{\text{amount of change}}{\text{original amount}}$$ Definition of percent of change

$$= \frac{7}{20}$$ The amount of change is 7. The original amount is 20.

$$= 0.35$$ Divide.

Step 3   The decimal 0.35 written as a percent is 35%. So, the percent of change is 35%.

The new amount is less than the original. It is a percent of decrease.

Real-World Link . . . .
In 1940, the average comic book sold for $0.10, but today it is worth more than $700. That's a 6,999% increase in value!
Source: antiqueweb.com

✓ CHECK Your Progress

Find each percent of change. Round to the nearest tenth if necessary. State whether the percent of change is an *increase* or a *decrease*.

a. original: 6 hours
   new: 10 hours

b. original: 80 water bottles
   new: 55 water bottles

c. original: 15 meters
   new: 6 meters

d. original: 1.25 hours
   new: 3.5 hours

Online Personal Tutor at tx.msmath3.com

A store sells an item for more than it paid for that item. The extra money is used to cover the expenses and to make a profit. The increase in the price is called the **markup**. The percent of markup is a percent of increase. The amount the customer pays is called the **selling price**.

EXAMPLE **Find the Selling Price**

③ **MARKETING** Shonny is selling some embroidered jackets on a Web site. She wants to price the jackets 25% over her cost, which is $35. Find the selling price for a jacket.

STUDY TIP

Check for Reasonableness
To estimate the selling price, think 25% of 35 is about $\frac{1}{4}$ of 36 or 9. The selling price should be about $35 + $9, or $44.

METHOD 1 Find the amount of the markup first.

The whole is $35. The percent is 25. You need to find the amount of the markup, or the part. Let m represent the amount of the markup.

$$\underline{part} = \underline{percent} \cdot \underline{whole}$$

$m = 0.25 \cdot 35$ Write the percent equation.

$m = 8.75$ Multiply.

Add the markup $8.75 to Shonny's cost $35 to find the selling price.
$35 + $8.75 = $43.75

METHOD 2 Find the total percent first.

The customer will pay 100% of Shonny's cost plus an extra 25% of the cost. Find 100% + 25% or 125% of Shonny's cost. Let p represent the price.

$$\underline{part} = \underline{percent} \cdot \underline{whole}$$

$p = 1.25 \cdot 35$ Write the percent equation.

$p = 43.75$ Multiply.

The selling price of the jacket is $43.75.

✓ **CHOOSE Your Method**

Find the selling price for each item given the percent of markup.

e. digital camera: $120, 55% markup

f. sunglasses: $7, 30% markup

g. **SHIPPING** Cheng-Yu ordered a book that cost $24 from an online store. Her total with the shipping charge was $27. What was the percent of markup charged for shipping?

The amount by which a regular price is reduced is called the **discount**. The percent of change is a percent of decrease.

Chapter 5 Percent

mathOnline **Extra Examples at** tx.msmath3.com
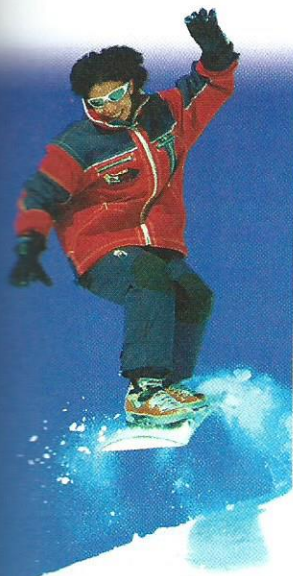
EXAMPLE **Find the Sale Price**

4 **SHOPPING** The Sport Chalet is having a sale. A snowboard has an original price of $95. It is on sale for 35% off the original price. Find the sale price of the snowboard.

METHOD 1 Find the amount of the discount first.

The percent is 35, and the whole is 95. We need to find the amount of the discount, or the part. Let d represent the amount of discount.

$$\underbrace{part} = \underbrace{percent} \cdot \underbrace{whole}$$

$d = 0.35 \cdot 95$ Write the percent equation.

$d = 33.25$ Multiply.

Subtract the amount of the discount from the original price to find the sale price. $95 - \$33.25 = \$61.75$.

METHOD 2 Find the percent paid first.

If the amount of the discount is 35%, the percent paid is 100% − 35% or 65%. Find 65% of $95. Let s represent the sale price.

$$\underbrace{part} = \underbrace{percent} \cdot \underbrace{whole}$$

$s = 0.65 \cdot 95$ Write the percent equation.

$s = 61.75$ Multiply.

The sale price of the snowboard is $61.75.

✓ **CHOOSE** Your Method

Find the sale price of each item to the nearest cent.

h. CD: $14.50, 10% off   **i.** sweater: $39.95, 25% off

CHECK Your Understanding

Examples 1–2
(p. 285)

Find each percent of change. Round to the nearest tenth if necessary. State whether the percent of change is an *increase* or a *decrease*.

1. original: $40
   new: $32

2. original: 25 CDs
   new: 32 CDs

3. original: 325 miles
   new: 400 miles

Example 3
(p. 286)

Find the selling price for each item given the percent of markup.

4. roller blades: $60, 35% markup   5. coat: $87, 33% markup

Example 4
(p. 287)

6. **BICYCLES** Find the sale price of a bicycle that is regularly $140 and is on sale for 40% off the original price.

Exercises

Find each percent of change. Round to the nearest tenth if necessary. State whether the percent of change is an *increase* or a *decrease*.

7. original: 6 tickets
   new: 9 tickets

8. original: 27 guests
   new: 39 guests

9. original: $80
   new: $64

10. original: $560
    new: $420

11. original: 68°F
    new: 51°F

12. original: 150 e-mails
    new: 98 e-mails

13. **TELEVISION** On Tuesday night, 17.8 million households watched a popular television show. On Wednesday night, 16.6 million households watched the same show. Find the percent of decrease in the number of households watching the show from Tuesday to Wednesday.

14. **STOCK** Patrice invested $300 into a particular stock. The amount doubled within a few weeks. Find the percent of increase.

Find the selling price for each item given the cost to the store and the markup.

15. computer: $700, 30% markup

16. CD player: $120, 20% markup

17. jeans: $25, 45% markup

18. baseball cap: $12, 48% markup

Find the sale price of each item to the nearest cent.

19. video game: $75, 25% off

20. trampoline: $399, 15% off

21. skateboard: $119.95, 30% off

22. earrings: $19.50, 35% off

23. **INTERNET** An Internet service provider offers connection speed that is 35% faster than dial-up. If it takes Brad 8 seconds to connect to the Internet using dial-up, how long would it take using this provider?

24. **ANIMALS** At birth, a giraffe was 62 inches tall and grew at the highly unusual rate of 0.5 inch per hour. By what percent did the height of the giraffe increase in the first 24 hours?

25. 🏴 **FIND THE DATA** Refer to the Texas Data File on pages 16–19. Choose some data and write a real-world problem in which you would need to find the percent of change.

26. **MILK** The table gives the price of milk for various years. During which ten-year period did the price of milk have the greatest percent of increase?

Price of a Gallon of Milk	
Year	Price ($)
1970	1.23
1980	1.60
1990	2.15
2000	2.78

Source: Senior Living

27. **MOVIES** Students receive a 20% discount off the price of an adult ticket at the theater. If a student ticket is $6.80, find the price of an adult ticket. (*Hint:* Let p represent the part and $p + 6.80$ represent the whole.)

28. **CHALLENGE** Blake bought a computer listed for $x at a 15% discount. He also paid a 5% sales tax. After 6 months, he decided to sell the computer for $y, which was 55% of what he paid originally. Express y in terms of x.

29. **FIND THE ERROR** Jared and Sidney are solving the following problem:
    The price of a school play ticket rose from $5.75 to $6.25. What is the percent of increase for the price of a ticket? Who is correct? Explain your reasoning.
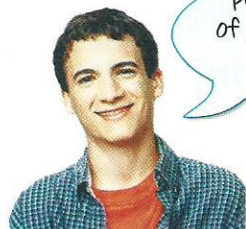
percent of change $= \dfrac{0.50}{5.75}$
$= 0.087$ or 8.7%

Jared

percent of change $= \dfrac{0.50}{6.25}$
$= 0.08$ or 8%

Sidney

30. **WRITING IN MATH** Write and solve a real-world problem involving a 25% increase or decrease in some quantity.

TEST PRACTICE

31. The track widths of a race track are shown below. What is the percent of increase in the track width from the straightaway to the turn?

Part of the Track	Width (ft)
straightaway	50
turn	60

A 8.3%   C 16.7%

B 10%   D 20%

32. Grace and her two brothers shared the cost of a new video game system equally. The original price of the system was $179. They received a 15% discount off the original price and paid 7.5% sales tax on the discounted price. Find the approximate amount that each paid for the video game system.

F $51   H $60

G $55   J $66

Spiral Review

33. **TAXES** An average of 40% of the cost of gasoline goes to state and federal taxes. If gasoline sells for $2.15 per gallon, how much goes to taxes? (Lesson 5-7)

Estimate. (Lesson 5-6)

34. 21% of 60   35. 25% of 83   36. 12% of 31   37. 34% of 95

Express each rate as a unit rate. (Lesson 4-1)

38. $36 in 3 hours   39. 1.5 inches of rain in 5 months

GET READY for the Next Lesson

PREREQUISITE SKILL Solve each equation. (Lesson 2-7)

40. $45 = 300 \cdot a \cdot 3$ 41. $24 = 200 \cdot 0.04 \cdot y$ 42. $21 = 60 \cdot m \cdot 5$