Chapter 2

Fractions, Decimals, and Percents

Ratios and Proportional Relationships

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

MP Mathematical Practices
1, 2, 3, 4, 5, 6, 7

Math in the Real World

Outer Space Due to the pull of gravity, an astronaut who weighs 180 pounds on Earth would weigh $\frac{1}{6}$ of that on the moon.

Write the astronaut's weight on the moon in the box below.

FOLDABLES Study Organizer

1. Cut out the Foldable in the back of this book.
2. Place your Foldable on page 166.
3. Use the Foldable throughout this chapter to help you learn about fractions, decimals, and percents.

85

Focus narrowing the scope

This chapter focuses on content from the **Ratios and Proportional Relationships** (RP) domain.

Coherence connecting within and across g

Previous
Students used and solved ratio and rate problems.

Now
Students convert decimals to fractions, percents to fractions and decimals, and solve percent problems.

Next
Students will subtract, mult divide whole and decimals.

Rigor pursuing concepts, fluency, and appl

The Levels of Complexity charts located throu chapter indicate how the exercises progress f understanding and procedural skills and fluen and critical thinking.

Launch the Chapter

Math in the Real World

Outer Space Show students that the astronaut's on the moon is $\frac{1}{6}$ of his weight on Earth by having the fraction $\frac{30}{180}$ in simplest form.

What Tools Do You Need?

Vocabulary Activity

LA As you proceed through the chapter, introduce each vocabulary term using the following routine. Ask the students to say each term aloud after you say it.

Define: A percent proportion is one ratio or fraction that compares part of a quantity to the whole quantity. The other ratio is the equivalent percent written as a fraction with a denominator of 100.

Example: $\frac{3}{4} = \frac{75}{100}$ 75% of 4 = 3

Ask:

- *What is 20% of 85?* 17

Reading Math

Students are encouraged to connect everyday meanings to mathematical meanings of words used in mathematics to improve understanding of word problems. When completing the exercises, students should use a dictionary and choose the everyday definition of the word that is closest to the mathematical definition of the word.

LA Have students read the Everyday Meaning section.

Ask:

- *How does knowing an everyday meaning for a mathematical term help you to understand the mathematical meaning of the word?* Sample answer: If you know the everyday meaning, you can relate it to the mathematical meaning.
- *Is a factor of a number greater than or equal to, or less than or equal to the number? Explain.* Sample answer: It is less than or equal to the number because a factor helps make a product or number.
- *How can the everyday meaning of "multiple" be used to explain the mathematical meaning?* Sample answer: The everyday meaning of "multiple" is consisting of more than one or shared by many, multiples can sometimes be shared by many numbers. For example, 24 is a multiple of the numbers 1, 2, 3, 4, 6, 8, 12, and 24.

What Tools Do You Need?

Vocabulary

least common denominator	proportion
percent	rational number
percent proportion	

Study Skill: Reading Math

Everyday Meaning The key to understanding word problems is to understand the meaning of the mathematical terms in the problem.

You will use the terms *factor* and *multiple* in this chapter. Here are two sentences that show their everyday meanings.

- Mathematics helped *factor* in their decision to postpone the picnic.
- The quarterback won *multiple* post-season awards.

Use the following to show how the everyday meaning is connected to the mathematical meaning.

Term	Everyday Meaning	Mathematical Meaning	Connection
Factor	something that actively contributes to a decision or result	2 and 3 are factors of 6.	A factor helps to make a decision. In mathematics, factors "make up" a product.
Multiple	consisting of more than one or shared by many	The multiples of 2 are 0, 2, 4, 6, ...	Multiple means many. In mathematics, a number has infinitely many multiples.

Practice Make a list of other words that have the prefixes *fact-* or *multi-*. Determine what the words in each list have in common. Sample answers are given.

Word	Meaning	Connection
faction	a group within a larger group	refer to part of something
factory	a building with the facilities for manufacturing goods	
multimedia	the combined use of several media	refer to more than one
multicultural	representing several different cultures	

What Dodu Already Know?

List three things you already know about fractions, decimals, and percents in the first section. Then list three things you would like to learn about fractions, decimals, and percents in the second section. See students' work.

Fractions, Decimals, and Percents

What I know	What I want to find out

When Will Dodu Use This?

Here is an example of how fractions, decimals, and percents are used in the real world.

Activity Suppose one-half of the students in your class are boys. How would you write one half as a fraction? a decimal? a percent? Which form would you use to represent one-half of the class? Explain your reasoning.

See students' work.

What Dodu Already Know

In this activity, students assess their prior know
three things they already know and three thing
like to learn about concepts in the chapter.

- You may want to add a third option of "I don't
those students who do not have any prior kn
the topic.
- After completing the chapter, have students
page and have them add three new facts tha
about the topic.

When Will Dodu Use This?

Activity

Students learn to choose when to use a fracti
percent to express a value.

Are You Ready?

Use this page to determine if students have skills that are needed for the chapter.

Quick Review

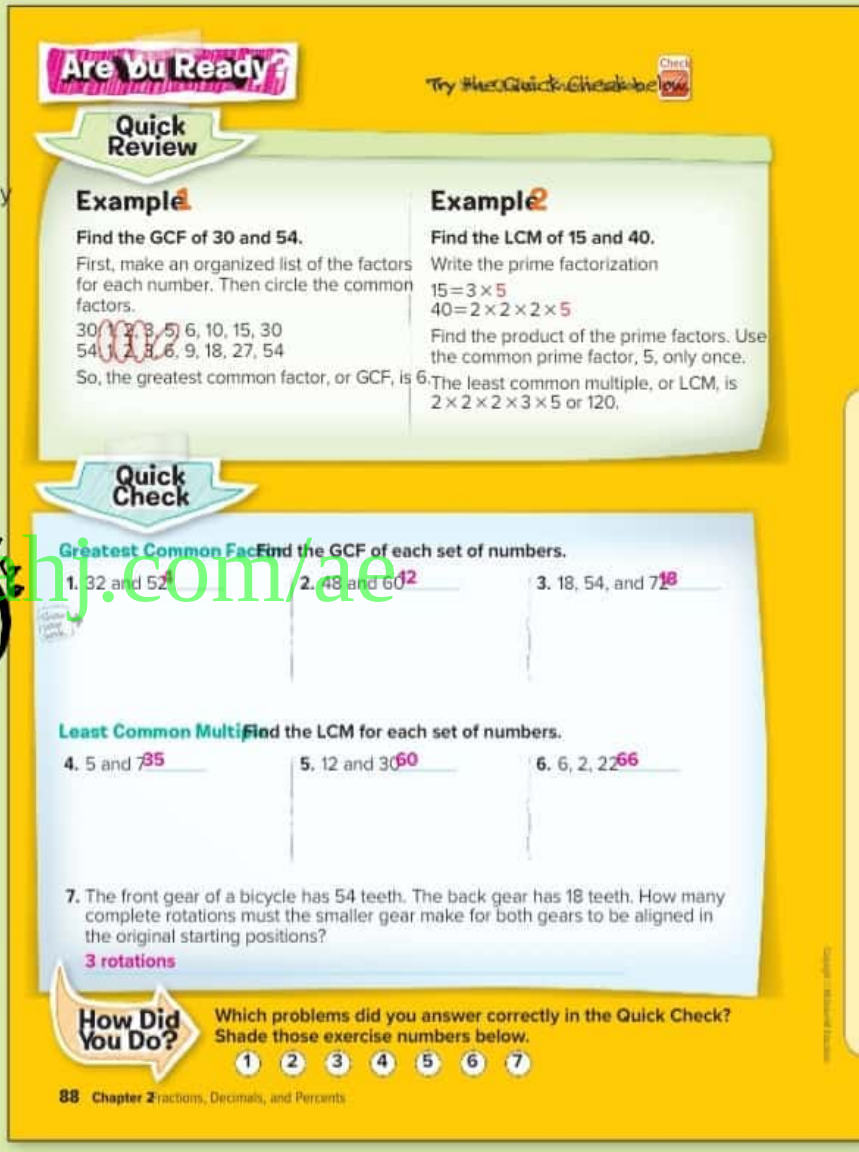
Students with strong math backgrounds may opt to go directly to the Quick Check.

Quick Check

If students have difficulty with the exercises, present an additional example to clarify any misconceptions.

Exercises 1–3
Find the GCF of 27 and 36.

Exercises 4–6
Find the LCM of 24 and 72.



Are You Ready?

Try the Quick Check below.

Quick Review

Example 1

Find the GCF of 30 and 54.

First, make an organized list of the factors for each number. Then circle the common factors.

30: 1, 2, 3, 5, 6, 10, 15, 30
54: 1, 2, 3, 6, 9, 18, 27, 54

So, the greatest common factor, or GCF, is 6.

Example 2

Find the LCM of 15 and 40.

Write the prime factorization

$15 = 3 \times 5$
$40 = 2 \times 2 \times 2 \times 5$

Find the product of the prime factors. Use the common prime factor, 5, only once.

The least common multiple, or LCM, is $2 \times 2 \times 2 \times 3 \times 5$ or 120.

Quick Check

Greatest Common Factor Find the GCF of each set of numbers.

1. 32 and 52 — 4
2. 48 and 60 — 12
3. 18, 54, and 72 — 18

Least Common Multiple Find the LCM for each set of numbers.

4. 5 and 7 — 35
5. 12 and 30 — 60
6. 6, 2, 22 — 66

7. The front gear of a bicycle has 54 teeth. The back gear has 18 teeth. How many complete rotations must the smaller gear make for both gears to be aligned in the original starting positions?
   3 rotations

How Did You Do? Which problems did you answer correctly in the Quick Check? Shade those exercise numbers below.

1 2 3 4 5 6 7

88 Chapter 2 Fractions, Decimals, and Percents

Lesson 1

Decimals and Fractions

Real-World Link

Music The instruments below show the part of students in the school orchestra that play each type of instrument.

Brass 0.25

1. Write 0.25 in word form. twenty-five hundredths
2. Write 0.25 as a fraction. $\frac{25}{100}$

Percussion 0.15

3. Write 0.15 in word form. fifteen hundredths
4. Write 0.15 as a fraction. $\frac{15}{100}$

Strings 0.31

5. Write 0.31 in word form. thirty-one hundredths
6. Write 0.31 as a fraction. $\frac{31}{100}$

Woodwind 0.29

7. Write 0.29 in word form. twenty-nine hundredths
8. Write 0.29 as a fraction. $\frac{29}{100}$

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

Vocabulary

rational number

Mathematical Practices

1, 3, 4, 5

Which Mathematical Practices do you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Write decimals as fractions or mixed n vice versa.

Coherence onnecting within and across g

Previous	Now	Next
Students solved problems using ratios and rates.	Students write decimals as fractions and fractions as decimals.	Students will percents as fr fractions as p

Rigor pursuing concepts, fluency, and appl

See the Levels of Complexity chart on page 9

ENGAGE EXPLORE EXPLAIN ELABORATE EV

Launch the Lesson

Ideas for Use

You may wish to launch the lesson using a wh group, think-pair-share activity, or independen

LA **Roundrobin** Each student in a grou explains the answer to one or more o 1–8. Student 1 gives the answer to Exercise 1. S explains how the answer to Exercise 1 was fou the answer to Exercise 2, and so on.

Alternate Strategies

AL Have students construct a place-value ch identifying the place value of the right-mo th

BL Have students write a decimal to the tho such as 0.128, provide the word form and fracti simplest form. MP 1, 4

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

1. Write a decimal as a fraction.

AL • *Say 0.6 in words.* six tenths

• *What fraction is represented by the words?* $\frac{6}{10}$

OL • *How do you write a fraction in simplest form?* Divide the numerator and denominator by the GCF.

• *What is the GCF of 6 and 10?* 2

BL • *What are common fraction-decimal equivalents for fractions with a denominator of 5?* $\frac{1}{5}=0.2; \frac{2}{5}=0.4; \frac{3}{5}=0.6; \frac{4}{5}=0.8; \frac{5}{5}=1$

Need Another Example?
Write 0.4 as a fraction in simplest form. $\frac{2}{5}$

2. Write a decimal as a fraction.

AL • *Say 0.45 in words.* forty-five hundredths

OL • *How is this example different than the one in Example 1?* Example 2 is to the hundredths place.

BL • *What common factor can you always use when simplifying a fraction with a numerator and denominator ending in a 0 or a 5?*

Need Another Example?
Write 0.38 as a fraction in simplest form. $\frac{19}{50}$

3. Write a decimal as a fraction.

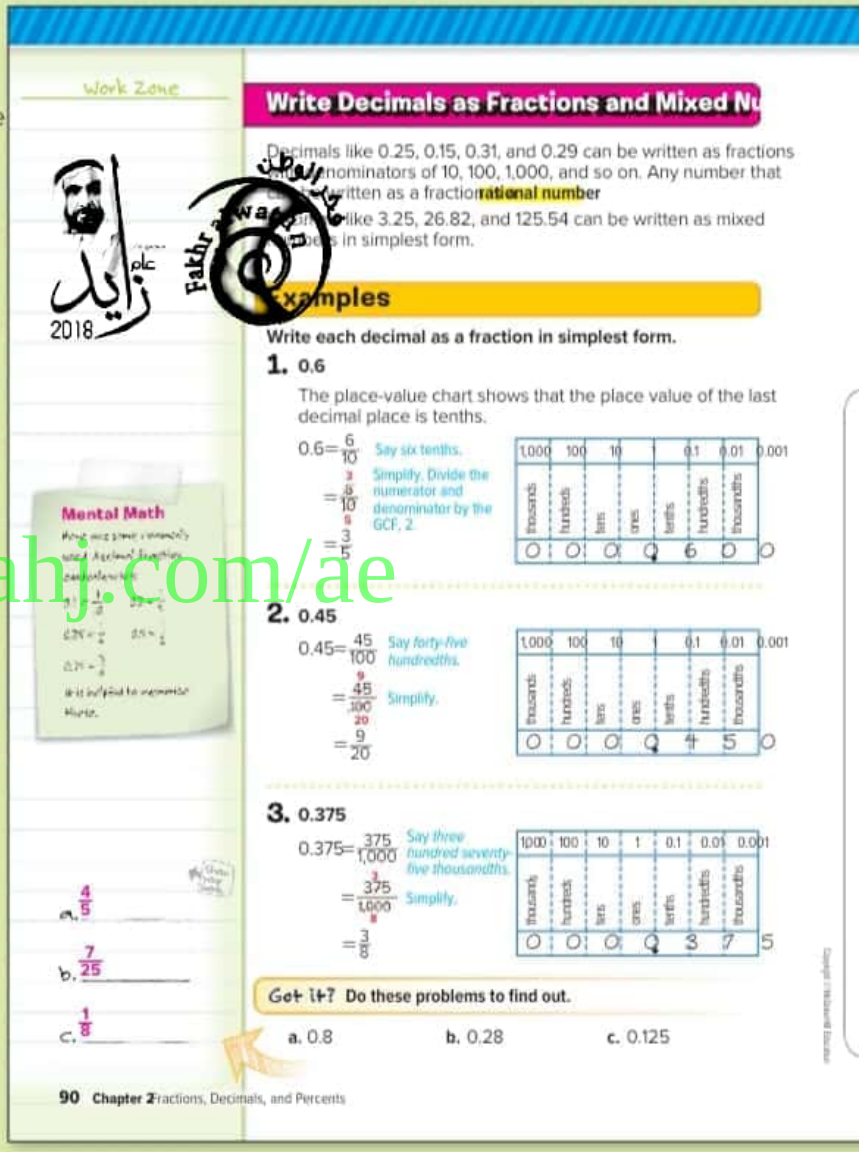
AL • *Say 0.375 in words.* three hundred seventy-five thousandths

• *What fraction is represented by the words?* $\frac{375}{1,000}$

OL • *What is the GCF of 375 and 1,000?* 125

• *How is this example different than the previous two examples?* Example 3 is to the thousandths place.

Need Another Example?
Write 0.264 as a fraction in simplest form. $\frac{33}{125}$



Work Zone

Mental Math

a. $\frac{4}{5}$

b. $\frac{7}{25}$

c. $\frac{1}{8}$

Write Decimals as Fractions and Mixed Nu

Decimals like 0.25, 0.15, 0.31, and 0.29 can be written as fractions with denominators of 10, 100, 1,000, and so on. Any number that can be written as a fraction is a **rational number**. Decimals like 3.25, 26.82, and 125.54 can be written as mixed numbers in simplest form.

Examples

Write each decimal as a fraction in simplest form.

1. 0.6

The place-value chart shows that the place value of the last decimal place is tenths.

$0.6=\frac{6}{10}$ Say six tenths.

$=\frac{3}{10}$ Simplify. Divide the numerator and denominator by the GCF, 2.

$=\frac{3}{5}$

1,000	100	10	1	0.1	0.01	0.001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths
0	0	0	0	6	0	0

2. 0.45

$0.45=\frac{45}{100}$ Say forty-five hundredths.

$=\frac{45}{100}$ Simplify.

$=\frac{9}{20}$

1,000	100	10	1	0.1	0.01	0.001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths
0	0	0	0	4	5	0

3. 0.375

$0.375=\frac{375}{1,000}$ Say three hundred seventy-five thousandths.

$=\frac{375}{1,000}$ Simplify.

$=\frac{3}{8}$

1000	100	10	1	0.1	0.01	0.001
thousands	hundreds	tens	ones	tenths	hundredths	thousandths
0	0	0	0	3	7	5

Get It? Do these problems to find out.

a. 0.8 b. 0.28 c. 0.125

Ratios and Proportional Relationships

Example

4. The average length of a conch shell is 9.85 inches. Express 9.85 as a mixed number in simplest form.

$9.85 = 9\frac{85}{100}$ Say nine and eighty-five hundredths.

$= 9\frac{\overset{17}{\cancel{85}}}{\underset{20}{\cancel{100}}}$ or $9\frac{17}{20}$ in. Simplify.

Got it? Do this problem to find out.

d. It takes approximately 4.65 quarts of milk to make a pound of cheese. Express this amount as a mixed number in simplest form. $4\frac{13}{20}$ qt

Write Fractions and Mixed Numbers as Deci

For fractions with denominators that are *factors* of 10, 100, or [illegible] you can write equivalent fractions with these denominators.

Example

5. Write $\frac{9}{12}$ as a decimal.

Method 1 Write an equivalent fraction.

$\frac{9}{12} = \frac{3}{4} = \frac{75}{100}$ Simplify $\frac{9}{12}$. Then multiply the numerator and denominator of $\frac{3}{4}$ by 25.

$= 0.75$ Read 0.75 as seventy-five hundredths.

Method 2 Divide the numerator by the denominator.

$\frac{9}{12} \rightarrow 12\overline{)9.00}$ (0.75; −84; 60; −60; 0)

To divide 9 by 12, place a decimal point after 9 and annex as many zeros as necessary to complete the division.

Got it? Do these problems to find out.

e. $\frac{3}{5}$ f. $\frac{14}{25}$ g. $\frac{102}{250}$

e. 0.6

f. 0.56

g. 0.408

Examples

4. Write a decimal as a mixed number.

AL • *Say 9.85 in words.* nine and eighty-five hundredths

• *How do you know that the mixed number will be greater than 1?* The decimal is greater than 1.

OL • *What fraction is represented by the words?* $9\frac{85}{100}$

• *Is this in simplest form?* no

• *What is the GCF of 85 and 100?* 5

BL • *How do you know that the simplified fraction will ha a denominator of 20?* Sample answer: Decimals that have a terminating 5 in the hundredths place can be wri as a fraction with a denominator of 20.

• *Are the fractions $\frac{985}{100}$ and $9\frac{85}{100}$ equivalent? Explain.* yes; $\frac{985}{100}$ is an improper fraction. 900 hundredths equals 9

Need Another Example?

In 2008, Hurricane Fay produced one of the southeast's heaviest rainfalls in history. One area recorded 27.65 inche of rain. Write this amount as a mixed number in simplest form. $27\frac{13}{20}$ in.

5. Write a fraction as a decimal.

AL • *Is 12 a factor of 100?* no

• *What is $\frac{9}{12}$ written in simplest form?* $\frac{3}{4}$

OL • *What is $\frac{3}{4}$ rewritten as a fraction with a denominator of 100?* $\frac{75}{100}$

• *In Method 1, why did we have to write the fraction a first?* The denominator 12 does not divide 100 evenly.

BL • *Which method do you prefer for writing the fraction a decimal? Explain.* See students' work.

• *Generate your own fraction and its decimal equival* See students' work.

Need Another Example?

Write $\frac{12}{15}$ as a decimal. 0.8

Example

6. Write a mixed number as a decimal.

AL • *What is $\frac{3}{8}$ in word form?* three and three-eighths

• *How do you know the decimal will be greater than 1?* The fraction is greater than 1.

OL • *Can you rewrite $\frac{3}{8}$ as a fraction with a denominator of 10, 100, or 1,000? If so, what is it?* Yes; $\frac{3}{8}$ is equivalent to $\frac{375}{1,000}$

• *Why do we multiply the numerator and denominator by 125?* The denominator does not divide 100 evenly, but it does divide 1,000 evenly. 1,000 ÷ 8 = 125

BL • *Explain another method you could use to write $\frac{3}{8}$ as a decimal.* Sample answer: You could divide the numerator by the denominator.

Need Another Example?
The Northern Mockingbird can have a wingspan of $12\frac{3}{4}$ inches. Write this number as a decimal. 12.75

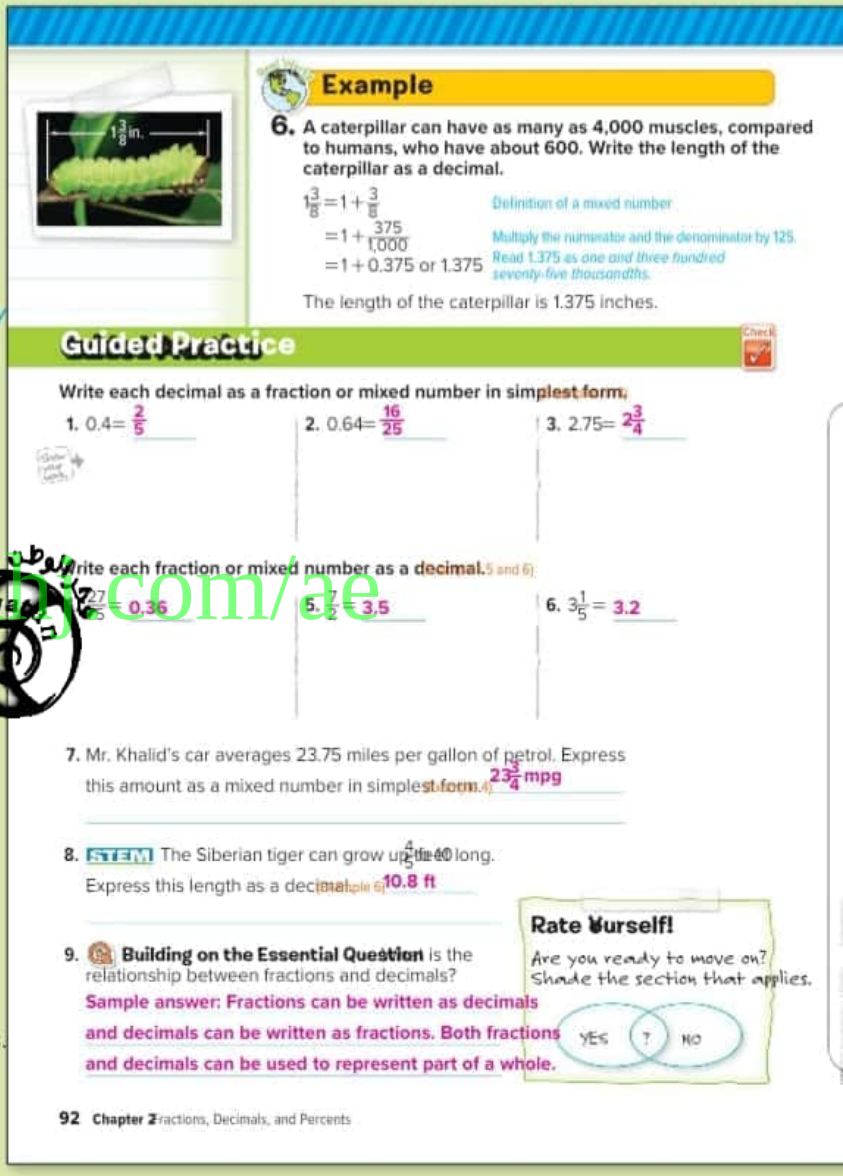
Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this section.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Rally Robin** In groups, assign one student as the Rally Robin Leader, who poses questions to help complete each exercise. The rest of the group takes turns responding orally to each question. MP 1

BL LA **Trade-a-Problem** Each student creates a problem involving a conversion from a decimal to a fraction and a problem involving a conversion of a fraction to a decimal, choosing denominators that will yield terminating decimals. They should trade problems and solve each other's problems. If the solutions do not agree, students work together to find the errors. MP 1, 4



Example

6. A caterpillar can have as many as 4,000 muscles, compared to humans, who have about 600. Write the length of the caterpillar as a decimal.

$1\frac{3}{8} = 1 + \frac{3}{8}$ Definition of a mixed number

$= 1 + \frac{375}{1,000}$ Multiply the numerator and the denominator by 125.

$= 1 + 0.375$ or 1.375 Read 1.375 as one and three hundred seventy-five thousandths.

The length of the caterpillar is 1.375 inches.

Guided Practice

Write each decimal as a fraction or mixed number in simplest form.

1. $0.4 = \frac{2}{5}$
2. $0.64 = \frac{16}{25}$
3. $2.75 = 2\frac{3}{4}$

Write each fraction or mixed number as a decimal.

4. $\frac{27}{25} = 0.36$
5. $3\frac{1}{2} = 3.5$
6. $3\frac{1}{5} = 3.2$

7. Mr. Khalid's car averages 23.75 miles per gallon of petrol. Express this amount as a mixed number in simplest form. $23\frac{3}{4}$ mpg

8. STEM The Siberian tiger can grow up to 10 feet long. Express this length as a decimal. $10\frac{4}{5}$ ft 10.8 ft

9. **Building on the Essential Question** What is the relationship between fractions and decimals?
Sample answer: Fractions can be written as decimals and decimals can be written as fractions. Both fractions and decimals can be used to represent part of a whole.

Rate Yourself!
Are you ready to move on? Shade the section that applies.

Name _____ My Homework _____

Independent Practice

Write each decimal as a fraction in simplest form. (Example 1–3)

1. 0.5 = $\frac{1}{2}$
2. 0.7 = $\frac{7}{10}$
3. 0.33 = $\frac{33}{100}$
4. 0.875 = $\frac{7}{8}$

Write each fraction or mixed number as a decimal. (Example 5 and 6)

5. $\frac{77}{200}$ = 0.385
6. $\frac{1}{20}$ = 0.05
7. $\frac{12}{75}$ = 0.16
8. $8\frac{21}{40}$ = 8.525

9. STEM Mercury orbits the Sun in $87\frac{24}{25}$ Earth days. Venus orbits the Sun in $224\frac{7}{10}$ Earth days, and Mars orbits the Sun in $686\frac{49}{50}$ days. Write each mixed number as a decimal. (Example 6)
Mercury: 87.96; Venus: 224.7; Mars: 686.98

10. STEM Last week, a share of stock gained a total of 1.64 points. Express this gain as a mixed number in simplest form. (Example 4)
$1\frac{16}{25}$

11. **Use Math Tools** The table shows the ingredients in an Italian sandwich.

Ingredient	Amount (lb)
meat	0.35
vegetables	0.15
secret sauce	0.05
bread	0.05

a. What fraction of a pound is each ingredient?
meat: $\frac{7}{20}$; vegetables: $\frac{3}{20}$; sauce: $\frac{1}{20}$; bread: $\frac{1}{20}$

b. How much more meat is in the sandwich than vegetables? Write the amount as a fraction in simplest form.
$\frac{1}{5}$ lb

c. What is the total weight of the Italian sandwich? Write the amount as a fraction in simplest form.
$\frac{3}{5}$ lb

ENGAGE EXPLORE **EXPLAIN** **ELABORATE** E

3 Practice and Apply

Independent Practice and Extra Practic

The Independent Practice pages are meant
homework assignment. The Extra Practice p
for additional reinforcement or as a second-

Levels of Complexity

The levels of the exercises progress from 1 t
indicating the lowest level of complexity.

	Exercises	
	1–10, 18–27	11–13, 28–32
Level 3		
Level 2		
Level 1		

Suggested Assignments

You can use the table below that includes e
complexity levels to select appropriate exe
students' needs.

Differentiated Homework Optio		
AL	Approaching Level	1–11, 13, 14, 16, 17, 31, 3
OL	On Level	1–9 odd, 11–14, 16, 17, 31, 3
BL	Beyond Level	11–17, 31, 32

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	15
3 Construct viable arguments and critique the reasoning of others.	14, 16
5 Use appropriate tools strategically.	11, 17, 30

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

Have students write $\frac{14}{15}$ and $\frac{5}{8}$ as decimals. $0.9\overline{3}$; 0.625

Watch Out!

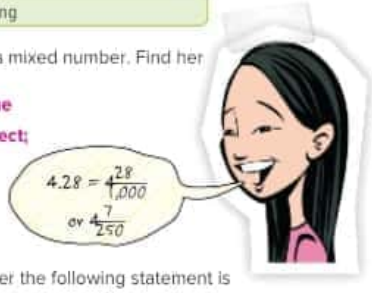
Find the Error In Exercise 14, students may not understand place value. Remind them that any digits to the left of the decimal point indicate a number that is greater than one.

12. Ziad can run the 100-meter dash in $\frac{1}{5}$ seconds. Nawaf's best time is 19.8 seconds. How much faster is Ziad than Nawaf in the 100-meter dash? 3.6 s

13. STEM The average length of a ladybug can range from 0.08 to 0.4 inch. Find two lengths that are within the given span. Write them as fractions in simplest form. Sample answer: $\frac{1}{5}$ in. and $\frac{7}{20}$ in.

H.O.T. Problems Higher Order Thinking

14. **Find the Error** Reem is writing 4.28 as a mixed number. Find her mistake and correct it.
Reem wrote the wrong place value in the denominator, so her fraction was incorrect; $4.28 = 4\frac{28}{100}$ or $4\frac{7}{25}$



15. **Persevere with Problems** Decide whether the following statement is *always*, *sometimes*, or *never* true. Explain your reasoning.

Any decimal that ends with a digit in the thousandths place can be written as a fraction with a denominator that is divisible by both 2 and 5.

Always; a decimal that ends in the thousandths place can have a denominator of 1,000. Since 1,000 is divisible by 2 and 5, the denominator of every such terminating decimal is divisible by 2 and 5.

16. **Reason Inductively** Write a fraction with a decimal value between $\frac{1}{2}$ and $\frac{3}{4}$. Write both the fraction and the equivalent decimal.
Sample answer: $\frac{7}{12} = 0.58\overline{3}$

17. **Use Math Tools** Nayada is making a costume for her school play. She needs to buy 2 meters of cotton fabric at a cost of AED 3.49 per meter, and $\frac{1}{2}$ meter of satin fabric at AED 5.98 per meter. She has AED 15 to spend on the fabric. Use mental math to determine if she will have enough money. Explain.
yes; Sample answer: the fabric costs about AED 10, so AED 15 is enough.

Name _____ My Homework _____

Extra Practice

Write each decimal as a fraction or mixed number in simplest form.

18. 0.3 = $\frac{3}{10}$

0.3 is three tenths.

19. 0.65 = $\frac{13}{20}$

20. 0.425 = $\frac{17}{40}$

21. 9.35 = $9\frac{7}{20}$

Write each fraction or mixed number as a decimal.

22. $\frac{19}{25}$ = 0.76

23. $\frac{311}{500}$ = 0.622

24. $\frac{5}{8}$ = 0.625

25. $14\frac{3}{5}$ = 14.6

26. Riad lives 0.85 kilometers from his school. Write this distance as a fraction in simplest form.

$\frac{17}{20}$ km

27. Al Salam Primary School has an average of $23\frac{3}{8}$ students per teacher. Write this mixed number as a decimal.

23.375

28. Hamad bought 20 meters of fencing. He used 5.9 meters to surround one flower garden and 10.3 meters to surround another garden. Write the amount remaining as a fraction in simplest form.

$3\frac{4}{5}$ m

29. In a survey, 9 out of 15 students named math as their favorite class. Express this rate as a decimal.

0.6

30. **Use Math Tools** The frequency table shows the favorite college football teams of middle school students. What fraction of the students chose Al Itihad? Write the fraction as a decimal.

$\frac{1}{4}$, 0.25

Team	Tally	Frequency
Al Quwa	|	3
Al Ahli	𝍸 |	6
Al Itihad	𝍸	5
Al Azm	|	2
Al Ain	||	4

Power Up! Test Practice

Exercises 31 and 32 prepare students for more rigorous thinking needed for the assessment.

31.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP6
Scoring Rubric	
1 point	Students correctly answer the question.

32.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practices	MP5, MP6
Scoring Rubric	
2 points	Students correctly shade 4 of the 16 triangles AND correctly fill in the box.
1 point	Students correctly shade 4 of the 16 triangles OR correctly fill in the box.

Power Up! Test Practice

31. Layla ran the distances shown in the table. Write the total distance, in kilometers, as a fraction in simplest form.

Day	Distance (km)
Monday	0.35
Wednesday	0.2
Friday	0.25

$\frac{4}{5}$ km

32. Shade 0.25 of the design. Write a fraction in simplest form to represent the shaded part of the design.

$\frac{1}{4}$

Spiral Review

Simplify each fraction.

33. $\frac{20}{100} = \frac{1}{5}$

34. $\frac{35}{100} = \frac{7}{20}$

35. $\frac{72}{100} = \frac{18}{25}$

36. $\frac{48}{100} = \frac{12}{25}$

37. Jassir made 230 flyers for training. He handed two flyers out to each student. How many students received flyers?

115 students

38. Look for a pattern and complete the table.

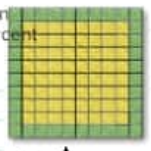
Multiplication Problem	Product
36×100	3,600
36×10	360
36×1	36
36×0.1	3.6
36×0.01	0.36

Inquiry Lab
Model Percents

inquiry HOW can you model a percent?

MP Mathematical Practices 1, 3, 4

Jasim is using 1-inch tiles to make the mosaic shown at the right. He needs a total of 100 tiles. What percent of the tiles are green?



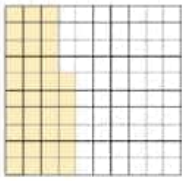
What do you know? Jasim is using 1-inch tiles to make the mosaic with 100 tiles.

What do you need to find? the percent of tiles that are green

Hands-On Activity 1

A 10× 10 grid can be used to represent *hundredths*. It can also represent percents. The word *percent* (%) means *out of one hundred*. For example, 50% means 50 out of one hundred.

Step 1 Use a 10× 10 grid to model the percent of tiles in the mosaic that are green.



Step 2 In the mosaic, 36 tiles out of 100 are green.

As a fraction, this is $\frac{36}{100}$. When the denominator is 100, the numerator gives the numerical value of the percent.

So, 36 % of the squares are green.

Focus narrowing the scope

Objective Represent percents with concrete

Coherence onnecting within and acro

Now Students use models, such as 10 × 10 grids and bar diagrams, to represent percents.

Next Students will write p fractions and fractio

Rigor pursuing concepts, fluency, and

See the Levels of Complexity chart on pa

ENGAGE EXPLORE EXPLAIN ELABORATE

1 Launch the Lab

Activities 1–3 are intended to be used as activities. Activity 1 is designed to provide students than Activities 2 and 3.

Materials 10 × 10 grid paper

Hands-On Activity 1

AL LA **Pairs Consult** Have students work complete the activity. Have Student 1 lead Step 1, then have Student 2 lead the disc Each person is responsible to ask questio they and their partner understand how to using a 10× 10 grid. When all pairs have co activity, call on one pair to present their re MP 1, 5

BL LA **Pairs Discussion** Have students dis could model other percents using 10×10 grids, 22.5%, and 103%. Have them present their MP 1, 3, 5

Hands-On Activity 2

AL LA **Think-Pair-Share** Have students work in pairs to complete Activity 2. Give students about one minute to think through their responses, without talking or writing. Then have them share their ideas with their partner. Then have students complete the activity in their texts. Finally, have each pair of students share their responses with another pair of students. MP 1, 3

BL LA **Pairs Discussion** Have students discuss how they could use a 10 × 10 grid to represent multiples of common percents, such as multiples of 1% (3%, 8%, or 13%), multiples of 10% (20%, 30%, or 40%), and multiples of 25% (50% or 75%). Then have them discuss how they would use a 10 × 10 grid to represent $3\frac{1}{3}$% or $66\frac{2}{3}$%. Have them present their results to the class. MP 1, 5

Hands-On Activity 3

AL LA **Pairs Consult** Have students work with the same partner they worked with in Activity 2. Have students create a bar diagram that represents 40%. Then have them tape the bar diagram to this page in their texts. MP 1, 5

BL LA **Pairs Discussion** Have students compare and contrast using a 10 × 10 grid or a bar diagram to represent percents. Ask them which model they would prefer to use to represent each of the following. Have them use their preferred method to represent each of the following. Have them share their responses and models with the class. MP 1, 3, 5

See students' preferences.

- a multiple of 10%, such as 30%, 50%, or 70%
- a multiple of 1%, such as 9% or 11%
- a multiple of $3\frac{1}{3}$%, such as $66\frac{2}{3}$%

Common percents are 1%, 10%, 25%, and $33\frac{1}{3}$%. Using these percents and their multiples makes mental math easier.

Hands-On Activity 2

Model 25% with a 10 × 10 grid.

Step 1 25% means 25 out of 100.

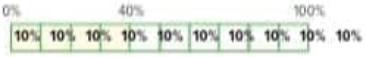
Step 2 Shade the squares, filling one column at a time.
Shade 25 squares out of 100.

What fraction of the 10 × 10 grid is shaded? $\frac{25}{100}$

What decimal represents the shaded part of the grid? 0.25

Hands-On Activity 3

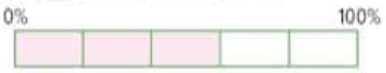
Percents can also be modeled with bar diagrams. The entire bar represents 100%. The bar diagram below is divided into 10 equal sections, each representing 10%. The shaded region represents 40%.



Model 60% with a bar diagram.

Step 1 The bar diagram below is divided into 5 equal sections.
To find the value of each section, divide 100 by 5 to get 20%.
So, each section represents 20 %.

Step 2 20 % + 20 % + 20 % = 60%
Shade 3 sections of the diagram.

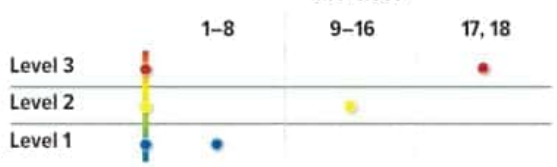


2 Collaborate

The **Investigate** and **Analyze and Reflect** tions are intended to be used as small-group investigati **Create** e section is intended to be used as independent exercises

Levels of Complexity

The levels of the exercises progress from 1 to 3, with Lev indicating the lowest level of complexity.



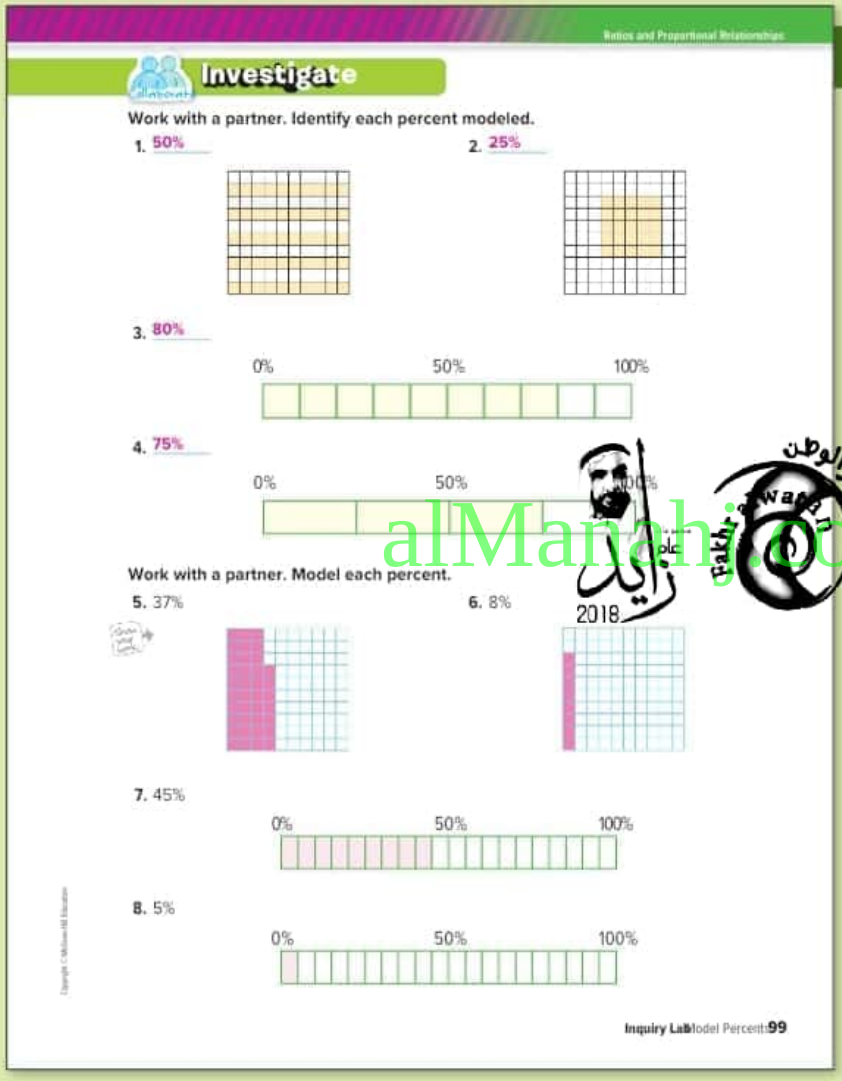
Investigate

AL LA **Team-Pair-Solo** ave students work as a small team to complete the odd-numbered exercises, ensurin each team member understands how to represent and percents. Then have groups divide into pairs to comple Exercises 2 and 4. Finally, have students work individua complete the remaining exercises on the page. Upon completion, have them return to their original group to responses and discuss and resolve any diffe

BL LA **Pairs Consult** ave students work with a partne to extend Exercise 8 by answering the question

Ask:

- *How many sets of 5% are there in 1* 0%?
- *If the numerical value of each section was 2, what wo the numerical value of the entire bar diagram?* 40
- *If 100% represents the number 40, what percent woul represented by the numbe* 20?
- *What percent represents 8 out o* 20?
- *What number is 20% of 8*0?
- *20% of what number is* 40?



Analyze and Reflect

AL LA For Exercises 9–14, begin as a whole group. Provide selected solutions to help complete the table. Have students work in pairs to complete the remaining sections of the table. MP 1, 5

Ask:

- *How many squares are there in the 10×10 grid?* 100
- *How does the number in the third column relate to the number in the second column?* It is one-tenth of the value.
- *How does the number in the fourth column relate to the number in the third column?* It is double the value.

BL LA **Roundrobin** Students work in pairs to complete the table, then extend the table by adding percents, such as 20%, 75%, 90%, and 95%, and finding the number of shaded sections for each model listed in the table. MP 1, 8

Ask:

- *When extending the table, what numbers (for the percents) can you choose to follow the same pattern?* numbers that end in 0 or 5
- *Refer to Exercise 15. Explain how you can find the number for the model in part a.* Sample answer: $\frac{1}{6}$ of the model is shaded, and $\frac{1}{6} \times 100 = \frac{100}{6}$. Write $\frac{100}{6}$ as a mixed number: 100 divided by 6 is 16, with a remainder of 4. So, the whole number part is 16; 4 becomes the numerator of the fraction part, with 6 as a denominator. And $\frac{4}{6}$ can be simplified to $\frac{2}{3}$. So, $\frac{100}{6} = 16\frac{2}{3}$.

Create

BL LA **Trade-a-Problem** Have students trade their problem they wrote in Exercise 17 with a partner and solve each other's problem. Have them discuss any differences in solutions. MP 1, 3

Inquiry Students should be able to answer "HOW can you model a percent?" Check for student understanding and provide guidance, if needed.

Analyze and Reflect

Sample answers: 16–18

Work with a partner to determine the number of shaded sections for each model. The first one is done for you.

	Percent	Number of Shaded Sections using each Model		
		10×10 Grid	Bar Diagram with 10 Equal Sections	Bar Diagram with 20 Equal Sections
	45	45	4.5	9
9.	15	15	1.5	3
10.	30	30	3	6
11.	55	55	5.5	11
12.	70	70	7	14
13.	85	85	8.5	17
14.	65	65	6.5	13

15. Write the percent shown by each model. Explain your reasoning.

$33\frac{1}{3}\%$; Sample answer: $\frac{1}{3}$ of the model is shaded. $\frac{1}{3}$ of 100 is $33\frac{1}{3}$.

$66\frac{2}{3}\%$; Sample answer: $\frac{2}{3}$ of the model is shaded. $\frac{2}{3}$ of 100 is $66\frac{2}{3}$.

$16\frac{2}{3}\%$; Sample answer: $\frac{1}{6}$ of the model is shaded. $\frac{1}{6}$ of 100 is $16\frac{2}{3}$.

16. MP **Reason Inductively** How can you use a model to write a percent as a fraction with a denominator of 100? Write the number that comes before the percent symbol over a denominator of 100.

Create

17. MP **Model with Mathematics** Write a real-world problem that involves a percent. Then model the percent used in the problem. By the time a player had his first basketball practice, 40% of the school year was over; See students' work for model.

18. Inquiry HOW can you model a percent? You can model a percent by using a 10×10 grid or a bar diagram.

Ratios and Proportional Relationships

Lesson 2

Percents and Fractions

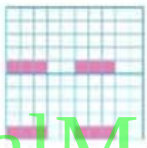
Real-World Link

Sports Students were asked to choose their favorite sport to play.

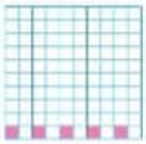
1. For each sport, shade a 10 × 10 grid that represents the number of students out of 100 that chose the sport. **Sample answers are given.**

Basketball 3 out of 20

Football 3 out of 25



Gymnastics 1 out of 20



Swimming 9 out of 100

2. What fraction with a denominator of 100 represents the number of students who chose each sport?

Basketball: $\frac{15}{100}$ Football: $\frac{12}{100}$

Gymnastics: $\frac{5}{100}$ Swimming: $\frac{9}{100}$

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

Vocabulary

percent

Mathematical Practices

1, 3, 4, 5

Which Mathematical Practices did you use? Shade the circle(s) that applies.

- ① Persevere with Problems
- ② Reason Abstractly
- ③ Construct an Argument
- ④ Model with Mathematics
- ⑤ Use Math Tools
- ⑥ Attend to Precision
- ⑦ Make Use of Structure
- ⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Write percents as fractions and

Coherence connecting within and a

Previous	Now	N
Students used models to represent percents.	Students write equivalent forms of fractions and percents.	Stu equ per

Rigor pursuing concepts, fluency, an

See the Levels of Complexity chart on p

ENGAGE EXPLORE EXPLAIN ELABORA

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson usin group, think-pair-share activity, or inde

LA **Pairs Discussion** ave pair Exercises 1 and 2. Have stude pair to compare answers and resolve a

Alternate Strategies

AL For basketball, help students to u two columns represents a group of 20 3 sections in each group o MP 2, 5

BL Have students determine if they c that represents 2 out of 33, by shading Have them justify their response. Then for which values of w can they easily s represent 2 out of MP 1, 3, 5

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

1. Write a percent as a fraction.

AL • *What is a percent?* a ratio that compares a number to 100

• *What does 50% mean in words?* 50 out of 100

OL • *What fraction, with a denominator of 100, represents 50%?* $\frac{50}{100}$

• *How do we write the fraction in simplest form?* Divide the numerator and the denominator by the GCF, 50.

BL • *Of the following percents, which one would have a denominator of 100, when written as a fraction in simplest form? Explain. 25%, 57%, 72%.* Sample answer: 57 and 100 do not have a GCF greater than 1.

Need Another Example?
Write 60% as a fraction in simplest form. $\frac{3}{5}$

2. Write a percent as a fraction.

AL • *What is the percent we are given?* 55%

• *What does 55% mean in words?* 55 out of 100

OL • *What fraction, with a denominator of 100, represents 55%?* $\frac{55}{100}$

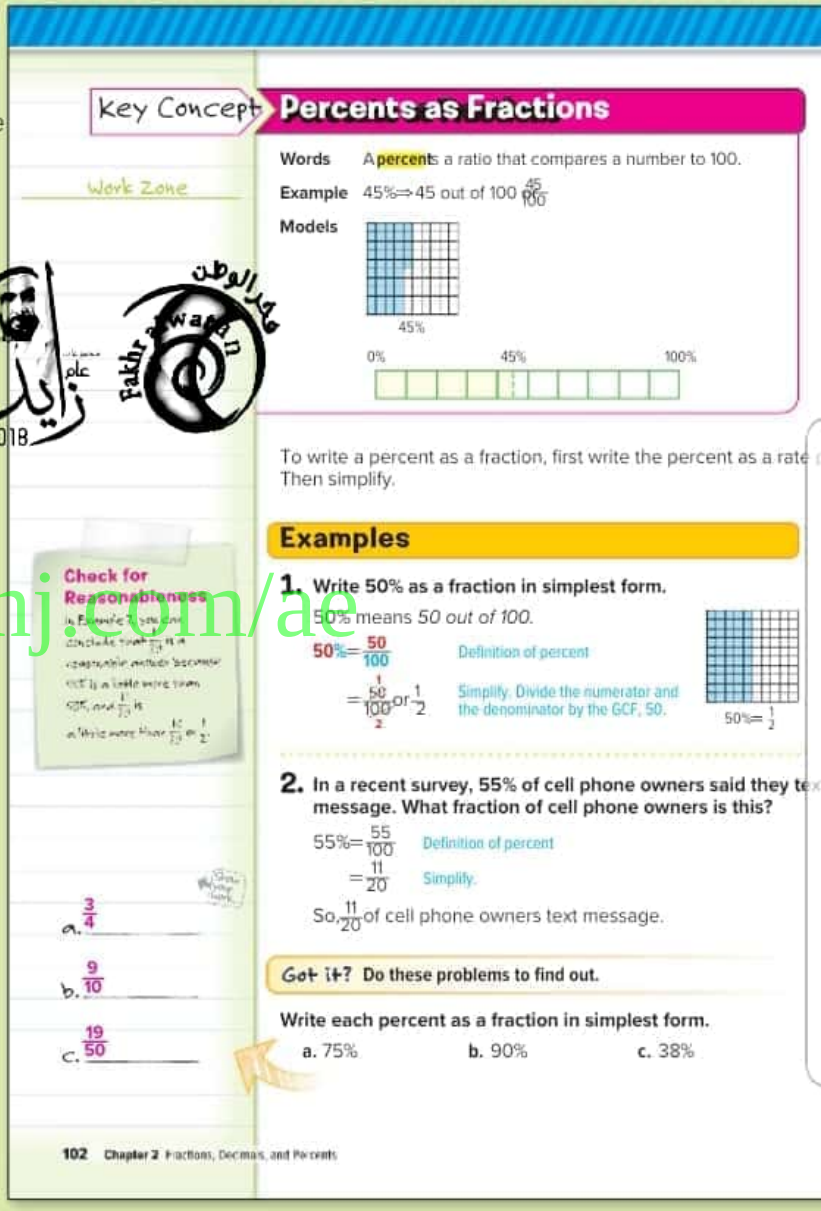
• *Is this in simplest form?* no

• *How do we write the fraction in simplest form?* Divide the numerator and the denominator by the GCF, 5.

• *How do you know that the answer is reasonable?* Sample answer: 11 out of 20 is a little more than one-half of 20 and 55% is a little more than one-half.

BL • *What fraction of the cell phone owners surveyed said they do not text message? Express in simplest form.* $\frac{9}{20}$

Need Another Example?
In a sand sculpture contest, 65% of the sculptures were castles. What fraction of the sand sculptures were castles? $\frac{13}{20}$



Key Concept **Percents as Fractions**

Words A percent is a ratio that compares a number to 100.

Example 45% ⇒ 45 out of 100 $\frac{45}{100}$

Models

To write a percent as a fraction, first write the percent as a rate. Then simplify.

Examples

1. Write 50% as a fraction in simplest form.

50% means *50 out of 100*.

$50\% = \frac{50}{100}$ Definition of percent

$= \frac{50}{100} = \frac{1}{2}$ or $\frac{1}{2}$ Simplify. Divide the numerator and the denominator by the GCF, 50.

$50\% = \frac{1}{2}$

2. In a recent survey, 55% of cell phone owners said they te... message. What fraction of cell phone owners is this?

$55\% = \frac{55}{100}$ Definition of percent

$= \frac{11}{20}$ Simplify.

So, $\frac{11}{20}$ of cell phone owners text message.

Got it? Do these problems to find out.

Write each percent as a fraction in simplest form.

a. 75% b. 90% c. 38%

Work Zone

Check for Reasonableness

a. $\frac{3}{4}$

b. $\frac{9}{10}$

c. $\frac{19}{50}$

102 Chapter 2 Fractions, Decimals, and Percents

Example

3. The table shows the percent of each movie type rented during a month. What fraction of the rentals were action movies?

Types of Movies	
Action	35%
Children's	5%
Comedy	45%
Drama	5%
Horror	5%
Documentary	5%

$35\% = \frac{35}{100}$ — Definition of percent

$= \frac{\overset{7}{35}}{\underset{20}{100}}$ — Divide the numerator and denominator by the GCF, 5.

Action movies were rented $\frac{7}{20}$ of the time.

Got it? Do this problem to find out.

d. Write the fraction of rentals that were horror movies.

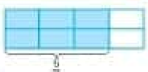
d. $\frac{1}{20}$

Fractions as Percents

To write a fraction as a percent, find an equivalent ratio with 100 as a denominator.

Example

4. Write the fraction $\frac{6}{8}$ as a percent.



$\frac{6}{8}$

$\frac{6}{8} = \frac{3}{4}$ — Simplify by dividing by the GCF, 2

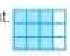
$\frac{3}{4} = \frac{■}{100}$ — Write equivalent ratios. One ratio is the fraction. The other ratio is the unknown value compared to 100.

$\frac{3}{4} = \frac{75}{100}$ (×25) — Since 4 × 25 = 100, multiply 3 by 25 to find the unknown value.

So, $\frac{75}{100}$ or 75% of the rectangle is shaded.

Got it? Do this problem to find out.

e. Write the fraction $\frac{9}{12}$ as a percent.



e. 75%

Examples

3. Write a percent as a fraction.

AL • *What is the problem asking you to find?* the fraction of the rentals that were action movies

OL • *What fraction, with a denominator of 100, does 35% represent?* $\frac{35}{100}$

• *Why do we divide the numerator and denominator by 5?* To write the fraction in simplest form, divide by the GCF.

BL • *Explain how you could find the fraction of the rentals that were either comedy, drama, or horror. Then write the fraction in simplest form.* Add the percent for each of the three categories, and then write the total percent as a fraction. $45\% + 5\% + 5\% = 55\% = \frac{55}{100} = \frac{11}{20}$

Need Another Example?

The table shows what percent of each color of car is owned by people in one neighborhood. What fraction of the cars were blue? $\frac{9}{20}$

Color of Cars	
red	35%
blue	45%
gray	40%

4. Write a fraction as a percent.

AL • *How many sections of the model are shaded?* 6

• *What fraction is represented by the model?* $\frac{6}{8}$

OL • *What is $\frac{6}{8}$ in simplest form?* $\frac{3}{4}$

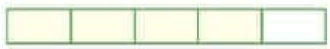
• *Why do we write equivalent ratios?* To find the percent that is equivalent to the fraction $\frac{3}{4}$, we write two equivalent ratios. One is the fraction $\frac{3}{4}$. The other ratio represents the percent (the unknown value compared to 100).

• *What is $\frac{75}{100}$ written as percent?* 75%

BL • *Why do we simplify the fraction before expressing it with a denominator of 100?* The denominator 8 does not divide 100 evenly, but the denominator 4 does divide 100 evenly.

Need Another Example?

Write a percent to represent the shaded portion of the model. 80%



Example

5. Write a fraction as a percent.

AL
- *How many shots did Mitch make in the championship game?* 12
- *How many shots did Mitch attempt in the championship game?* 40
- *What fraction represents the outcome of Mitch's shots in the championship game?* $\frac{12}{40}$

OL
- *What is $\frac{12}{40}$ in simplest form?* $\frac{3}{10}$
- *What is $\frac{3}{10}$ written as a fraction with a denominator of 100?* $\frac{30}{100}$
- *What is $\frac{30}{100}$ written as a percent?* 30%

BL
- *Is there another way you can solve this problem? Explain.* Sample answer: Divide 12 by 40, which equals 0.3. Then write the decimal 0.3 as three tenths, which is $\frac{3}{10}$ or $\frac{30}{100}$ which is 30%.

Need Another Example?
Anya finished 42 out of her 60 math problems in class. What percent of the math problems did Anya finish in class? 70%

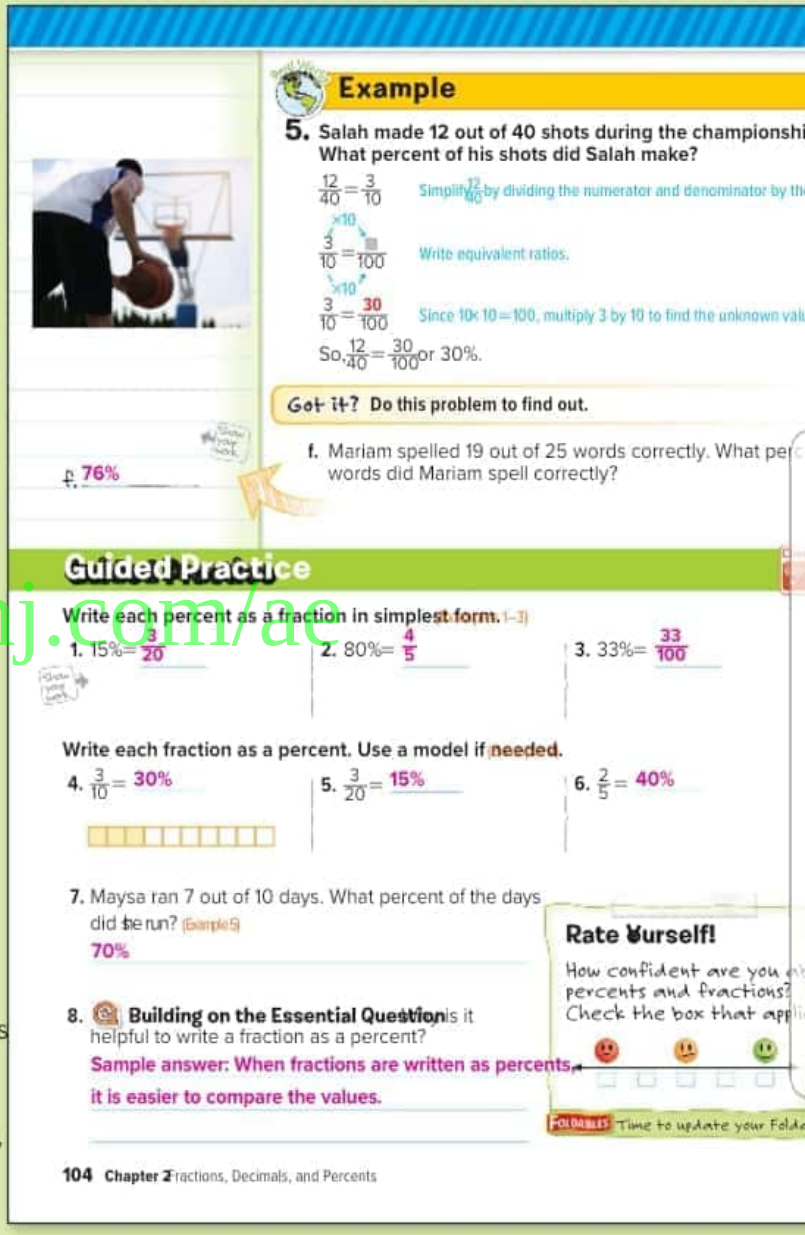
Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Roundrobin** Have pairs complete exercises 1–3. Have Student 1 write the percent as a fraction with a denominator of 100. Student 2 simplifies the fraction if necessary, or states that it is already simplified. Have students trade roles for each exercise. MP 3, 4

BL LA **Pairs Consult** Have students predict which of the following percents, when written as fractions in simplest form, will have denominators of 100: 18%, 27%, 32%, 45%, and 81%. Have them justify their responses. MP 3, 4



Example

5. Salah made 12 out of 40 shots during the championshi
What percent of his shots did Salah make?

$\frac{12}{40} = \frac{3}{10}$ Simplify $\frac{12}{40}$ by dividing the numerator and denominator by th

$\frac{3}{10} = \frac{\square}{100}$ (×10) Write equivalent ratios.

$\frac{3}{10} = \frac{30}{100}$ (×10) Since 10 × 10 = 100, multiply 3 by 10 to find the unknown valu

So, $\frac{12}{40} = \frac{30}{100}$ or 30%.

Got it? Do this problem to find out.

f. Mariam spelled 19 out of 25 words correctly. What per
words did Mariam spell correctly?

f. 76%

Guided Practice

Write each percent as a fraction in simplest form. (1–3)

1. 15% = $\frac{3}{20}$
2. 80% = $\frac{4}{5}$
3. 33% = $\frac{33}{100}$

Write each fraction as a percent. Use a model if needed.

4. $\frac{3}{10}$ = 30%
5. $\frac{3}{20}$ = 15%
6. $\frac{2}{5}$ = 40%

7. Maysa ran 7 out of 10 days. What percent of the days did he run? (Example 5)
70%

8. **Building on the Essential Question** When is it helpful to write a fraction as a percent?
Sample answer: When fractions are written as percents, it is easier to compare the values.

Rate Yourself!
How confident are you
percents and fractions?
Check the box that appl

FOLDABLES Time to update your Folde

Name _____ My Homework _____

Independent Practice

Write each percent as a fraction in simplest form.

1. 2% = $\frac{1}{50}$
2. 20% = $\frac{1}{5}$
3. 85% = $\frac{17}{20}$
4. 4% = $\frac{1}{25}$

Write each fraction as a percent. Use a model if needed.

5. $\frac{2}{10}$ = 20%
6. $\frac{3}{4}$ = 75%
7. $\frac{7}{20}$ = 35%
8. $\frac{11}{25}$ = 44%

9. During his workout, Hiro spent 28% of the time on the treadmill. What fraction of his workout was on the treadmill?
$\frac{7}{25}$

10. A cat spends about 7 of every 10 hours sleeping. About what percent of a cat's day is spent sleeping?
70%

11. A survey showed that 82% of youth most often use the Internet at home. What fraction of youth surveyed most often use the Internet somewhere else?
$\frac{9}{50}$

12. Jalal collects state quarters. He has 42 out of 50 available quarters. What is 42 out of 50 as a percent?
84%

13. Use the table to determine what percent of students prefer school uniforms and what percent do not prefer school uniforms. What is the relationship between these two percents?
Do not prefer: 80%, prefer: 20%; the sum of the percents is 100%.

Prefer School Uniforms	
No	Yes
𝍸 𝍸	𝍸

3 Practice and Appl

Independent Practice and Extra
The Independent Practice pages are
homework assignment. The Extra Pra
for additional reinforcement or as a s

Levels of Complexity
The levels of the exercises progress
indicating the lowest level of complex

Exercise

	1–10, 20–29	11–14, 30-
Level 3		
Level 2		
Level 1		

Suggested Assignments
You can use the table below that inc
complexity levels to select appropri
students' needs.

	Differentiated Homewo	
AL	Approaching Level	1–11, 13, 15, 17
OL	On Level	1–9 odd, 11–15, 17
BL	Beyond Level	11–19, 32, 33

Watch Out!
Common Error In Exercise 11, students
and percent of students that use the
that is the information given. Remind
remaining percent or fraction will be
or the difference between fractions w

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	16, 18
3 Construct viable arguments and critique the reasoning of others.	14, 15, 17, 19
5 Use appropriate tools strategically.	30

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

Have students write 35% as a fraction in simplest form. $\frac{7}{20}$

14. **Multiple Representations** The table shows the percent of Earth's atmosphere that is each element.

Element	Percent
Nitrogen	78
Oxygen	21
Other	1

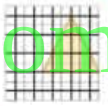
a. **Bar Diagram** Model 21% using a bar diagram.

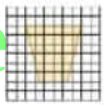
b. **Number** Write the percent of Earth's atmosphere that is nitrogen as a fraction in simplest form. $\frac{39}{50}$

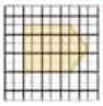
H.O.T. Problems Higher Order Thinking

15. **Reason Inductively** Write three fractions that can be written as percents between 50% and 75%. Justify your solution.
Sample answer: $\frac{11}{20} = \frac{55}{100}$ or 55% $\frac{3}{5} = \frac{60}{100}$ or 60% $\frac{7}{10} = \frac{70}{100}$ or 70%

16. **Persevere with Problems** For each model below, write the portion of the grid that is shaded as a percent and as a fraction.

a.  18% $\frac{9}{50}$

b.  27% $\frac{27}{100}$

c.  30% $\frac{3}{10}$

17. **Which One Doesn't Belong?** Identify the number that does not belong with the other three. Explain your reasoning.

$\frac{9}{20}$ $\frac{45}{100}$ 45% $\frac{9}{45}$

$\frac{8}{45}$; The other numbers are equivalent to $\frac{9}{20}$.

18. **Persevere with Problems** Complete each blank to find an expression that is equal to 16%.

a. 16 for every 100 b. 8 for every 50

c. 1 for every 6.25 d. 0.5 for every 3.125

19. **Reason Inductively** Explain the difference between $\frac{1}{3}$ and 33%.
Sample answer: When written as a fraction, $\frac{1}{3}$ is $\frac{1}{3}$ and 33% is $\frac{33}{100}$ which does not simplify.

Name _____ My Homework _____

Extra Practice

Write each percent as a fraction in simplest form.

20. 14% = $\frac{7}{50}$

14% = $\frac{14}{100}$ ÷2 → $\frac{7}{50}$ ÷2

21. 47% = $\frac{47}{100}$

22. 86% = $\frac{43}{50}$

23. 88% = $\frac{22}{25}$

Write each fraction as a percent. Use a model if needed.

24. $\frac{7}{10}$ = 70%

25. $\frac{21}{25}$ = 84%

26. $\frac{3}{5}$ = 60%

27. $\frac{18}{25}$ = 72%

28. In a recent year, 22% of email users said they spend less time using email because of spam. What fraction of email users is this?

$\frac{11}{50}$

29. About $\frac{19}{20}$ of celery is water. What percent is this?

95%

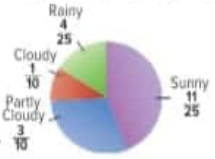
30. **Use Math Tools** Mrs. Madiha took a survey of the types of pants her students were wearing. She collected the data at the right. What percent of her students were wearing cotton?

36%

Type of Pants	Number of Students
Jeans	14
Cotton	9
Silk	2

31. STEM The circle graph shows the fraction of each type of weather during September.

Weather During September



a. What percent of the days were sunny? 44%

b. What percent of the days were rainy? 16%

c. What percent of the days were sunny or rainy? 60%

d. What percent of the days were cloudy or partly cloudy?

40%

Power Up! Test Practice

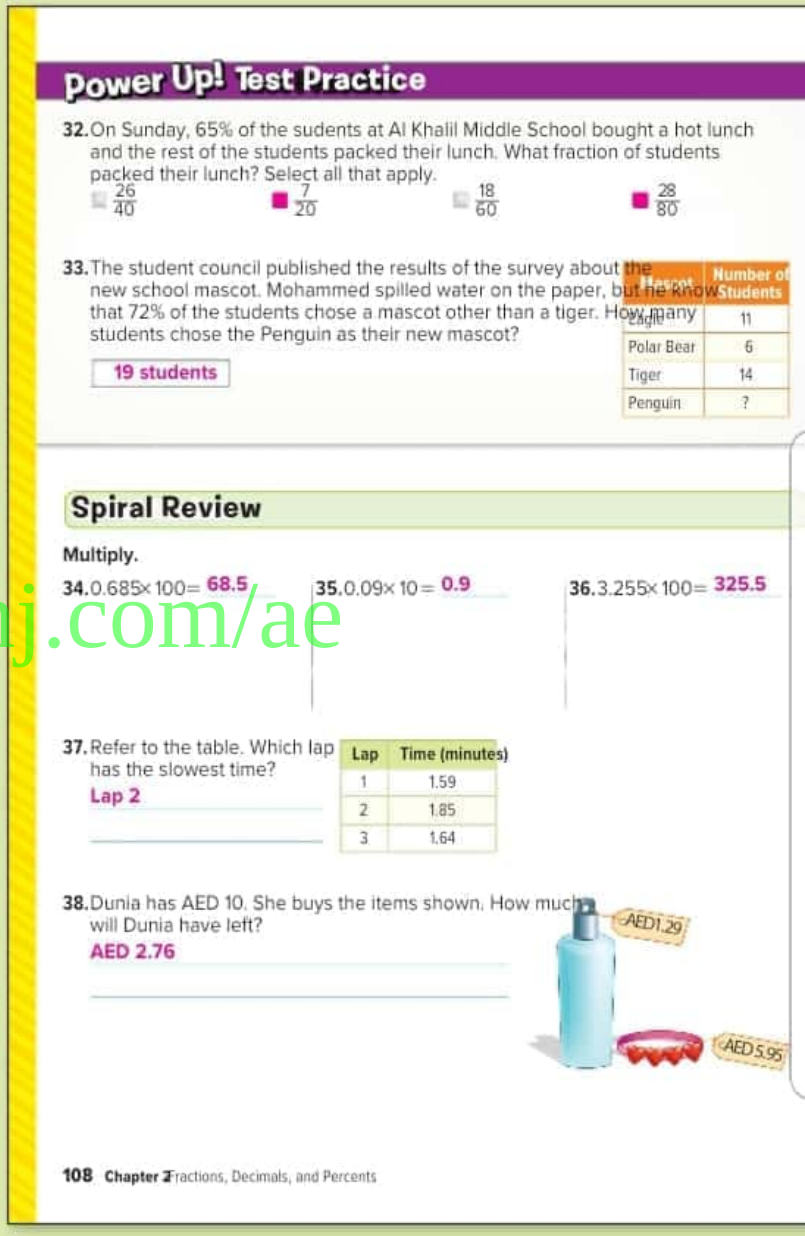
Exercises 32 and 33 prepare students for more rigorous thinking needed for the assessment.

32.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP6
Scoring Rubric	
1 point	Students correctly answer each part of the question.

33.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP6
Scoring Rubric	
1 point	Students correctly answer the question.



Power Up! Test Practice

32. On Sunday, 65% of the sudents at Al Khalil Middle School bought a hot lunch and the rest of the students packed their lunch. What fraction of students packed their lunch? Select all that apply.

- ☐ $\frac{26}{40}$
- ■ $\frac{7}{20}$
- ☐ $\frac{18}{60}$
- ■ $\frac{28}{80}$

33. The student council published the results of the survey about the new school mascot. Mohammed spilled water on the paper, but he knows that 72% of the students chose a mascot other than a tiger. How many students chose the Penguin as their new mascot?

19 students

Mascot	Number of Students
Eagle	11
Polar Bear	6
Tiger	14
Penguin	?

Spiral Review

Multiply.

34. 0.685 × 100 = 68.5

35. 0.09 × 10 = 0.9

36. 3.255 × 100 = 325.5

37. Refer to the table. Which lap has the slowest time?

Lap 2

Lap	Time (minutes)
1	1.59
2	1.85
3	1.64

38. Dunia has AED 10. She buys the items shown. How much will Dunia have left?

AED 2.76

Lesson 3

Percents and Decimals

Real-World Link

School A recent survey tells the favorite subjects of students at Al Islah Primary School.

Math: 28%
Art: 16%
Science: 21%
English: 13%
Social Studies: 15%
Other: 7%

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

MP **Mathematical Practices** 1, 3, 4, 5, 6

1. Write a fraction with a denominator of 100 to represent the percent for each subject.

Math: $\frac{28}{100}$ Science: $\frac{21}{100}$

Art: $\frac{16}{100}$ Social Studies: $\frac{15}{100}$

English: $\frac{13}{100}$ Other: $\frac{7}{100}$

2. Write each fraction from Exercise 1 as a decimal.

Math: 0.28 Science: 0.21

Art: 0.16 Social Studies: 0.15

English: 0.13 Other: 0.07

3. MP **Make a Conjecture** Look back at Exercise 2. Compare the decimals to the percents. Explain how to write a percent as a decimal. Sample answer: Take off the percent sign to show a whole number. Move the decimal point two places to the left.

Which MP **Mathematical Practices** do you use? Shade the circle(s) that applies.

- ① Persevere with Problems
- ② Reason Abstractly
- ③ Construct an Argument
- ④ Model with Mathematics
- ⑤ Use Math Tools
- ⑥ Attend to Precision
- ⑦ Make Use of Structure
- ⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Write percents as decimals

Coherence onnecting within and

Previous Students generated equivalent forms of percents and fractions.

Now Students write equivalent forms of percents and decimals.

Rigor pursuing concepts, fluency

See the Levels of Complexity chart o

ENGAGE EXPLORE EXPLAIN ELABO

1 Launch the Lesso

Ideas for Use

You may wish to launch the lesson u group, think-pair-share activity, or in

LA **Think-Pair-Share** Give st minutes to think through th Exercises 1–3. Then have them discu partner. The group should compare methods. Call on students from each responses with the cla MP 1, 3

Alternate Strategy

AL Have students write each fracti example $\frac{28}{100}$ is *twenty-eight hundredth* how writing the fraction in words he fraction as a decim MP 1, 3, 4

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

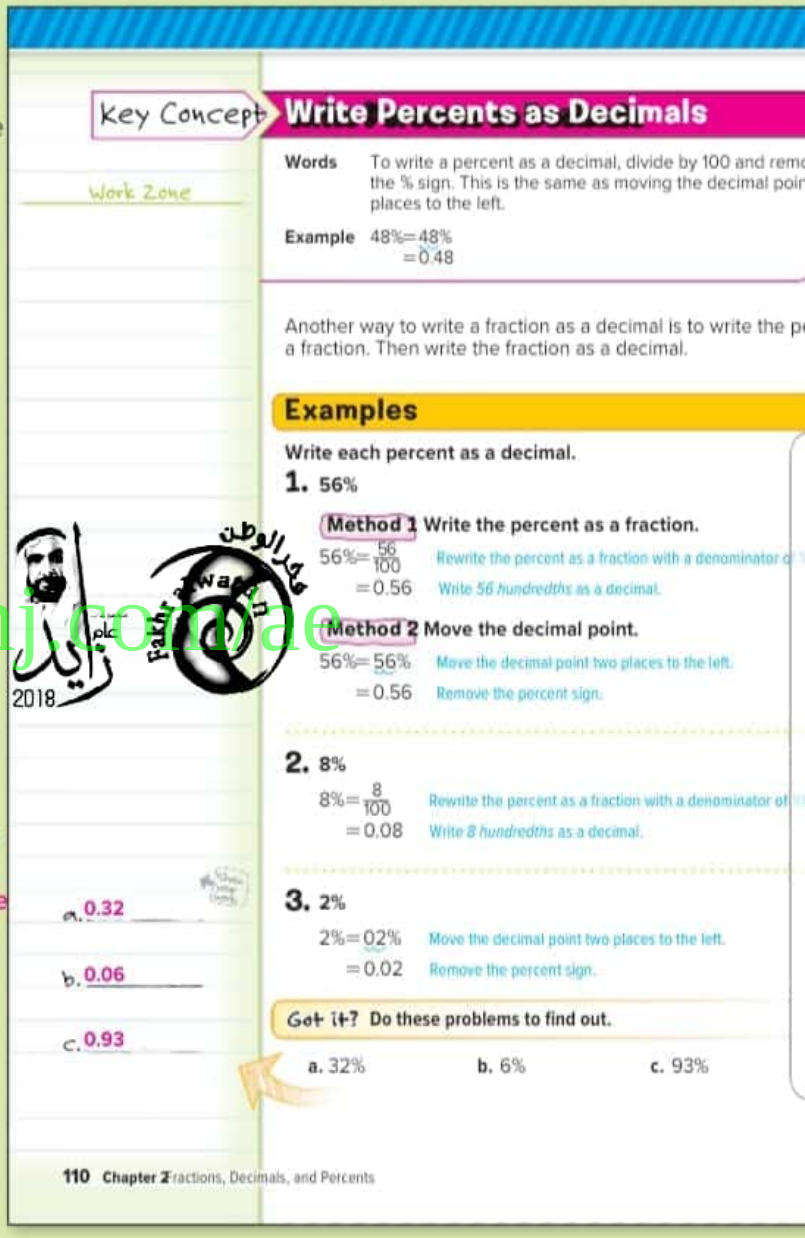
1–3. Write a percent as a decimal.

AL
- *To write each percent as a decimal, we will first write each percent as a fraction. What denominator will we use for each fraction? Explain.* 100; Percent means "per 100".
- *What numerator will we use for Example 1? Example 2? Example 3?* 56 8 2

OL
- *After writing each percent as a fraction with a denominator of 100, why do we not need to simplify each fraction in order to write it as a decimal?* Sample answer: The denominator of 100 represents hundredths. The numerator will represent the digits to the hundredths place. If we simplify, the denominator will no longer represent hundredths.
- *What is $\frac{56}{100}$ in word form? $\frac{8}{100}$? $\frac{2}{100}$?* fifty-six hundredths eight hundredths two hundredths
- *What is fifty-six hundredths written as a decimal? eight hundredths? two hundredths?* 0.56 0.08 0.02

BL
- *Why is there a zero in the tenths place for the decimal equivalents of 8% and 2%?* Sample answer: 8% is eight hundredths. The 8 is the digit in the hundredths place. Since 8%=08%, the digit in the tenths place is 0. The same is true for 2%.
- *For which percents between 0% and 100% will have a zero in the tenths place for their decimal equivalents? Explain.* 1%, 2%, 3%, 4%, 5%, 6%, 7%, 8%, and 9%; Sample answer: These percents are less than 10% and 0.10%

Need Other Examples?
Write each percent as a decimal.
a. 86% 0.86 **b.** 7% 0.07 **c.** 4% 0.04



Key Concept **Write Percents as Decimals**

Work Zone

Words To write a percent as a decimal, divide by 100 and remo the % sign. This is the same as moving the decimal poir places to the left.

Example 48%=48%
=0.48

Another way to write a fraction as a decimal is to write the pe a fraction. Then write the fraction as a decimal.

Examples

Write each percent as a decimal.

1. 56%

Method 1 Write the percent as a fraction.

56%=$\frac{56}{100}$ Rewrite the percent as a fraction with a denominator o
=0.56 Write *56 hundredths* as a decimal.

Method 2 Move the decimal point.

56%=56% Move the decimal point two places to the left.
=0.56 Remove the percent sign.

2. 8%

8%=$\frac{8}{100}$ Rewrite the percent as a fraction with a denominator of
=0.08 Write *8 hundredths* as a decimal.

3. 2%

2%=02% Move the decimal point two places to the left.
=0.02 Remove the percent sign.

Got it? Do these problems to find out.

a. 32% b. 6% c. 93%

a. 0.32
b. 0.06
c. 0.93

110 Chapter 2 Fractions, Decimals, and Percents

Write Decimals as Percents

Key Concept

Words To write a decimal as a percent, multiply by 100 and add a % sign. This is the same as moving the decimal point two places to the right.

Example 0.36 = 0.36%
= 36%

Another way to write a decimal as a percent is to write the decimal as a fraction with a denominator of 100. Then write the fraction as a percent.

STOP and Reflect

Why does it help to write a decimal as a fraction with a denominator of 100 when writing decimals as percents?

A percent is a rate per 100. When a decimal has a denominator of 100, it is easily converted to a percent.

Examples

4. Write 0.38 as a percent.

Method 1 Write the decimal as a percent.

$0.38 = \frac{38}{100}$ Write 38 hundredths as a fraction.

$= 38\%$ Write the fraction as a percent.

Method 2 Move the decimal point.

$0.38 = 0.38$ Move the decimal point two places to the right.

$= 38\%$ Add the percent sign.

5. Write 0.2 as a percent.

$0.2 = \frac{2}{10}$ Write 2 tenths as a fraction.

$\frac{2}{10} = \frac{20}{100}$ (×10, ×10) Write the equivalent fraction with a denominator of 100.

$= 20\%$ Write the fraction as a percent.

Got It? Do these problems to find out.

Write each decimal as a percent.

d. 0.47 e. 0.73 f. 0.5

d. 47%

e. 73%

f. 50%

Examples

4. Write a decimal as a percent.

AL • What is 0.38 in word form? thirty-eight hundredths

• What is thirty-eight hundredths written as a fraction? $\frac{38}{100}$

OL • How do we write $\frac{38}{100}$ as a percent? The denominator is already 100, so the numerator becomes the percent. Write the numerator, without the denominator, and add a percent symbol; $\frac{38}{100} = 38\%$.

• Why do we write 38 hundredths as a fraction with a denominator of 100? Sample answer: A percent is a ratio per 100, so we need to find the numerator of the fraction with a denominator of 100.

BL • How would you express 0.09 as a percent? Sample answer: 0.09 is nine hundredths, or $\frac{9}{100}$. So, 0.09 = 9%.

Need Another Example?
Write 0.44 as a percent. 44%

5. Write a decimal as a percent.

AL • What is 0.2 in word form? two tenths

• What is two tenths written as a fraction? $\frac{2}{10}$

OL • How would you write $\frac{2}{10}$ as a fraction with a denominator of 100? Multiply the numerator and denominator by 10.

• When you multiply the numerator and denominator by 10, what does the numerator become? 20

BL • If you drew a bar diagram to represent 0.2, into how many equal sections will you divide the bar? Sample answer: 10
How many will be shaded? Sample answer: 2

• How would you write 0.02 as a percent? 0.002? Sample answer: 0.02 is two hundredths, $\frac{2}{100}$, or So, 0.02 = 2%; 0.002 is two thousandths, or $\frac{2}{1,000} = \frac{0.2}{100}$.
So, 0.002 = 0.2%.

Need Another Example?
Write 0.3 as a percent. 30%

Example

6. Write the decimal as a percent.

AL • *What do you need to do first?* Write 0.4 as a percent.

• *What does 0.4 become when you annex a 0 to the right?* 0.40

OL • *What is 0.40 in word form?* forty hundredths

• *What is forty hundredths written as a fraction?* $\frac{40}{100}$

BL • *What percent of corn is produced by all of the other countries combined?* 60%

• *Suppose your friend told you that to write a decimal as a percent, you simply move the decimal point two places to the right and add the percent sign. Does this method work? Explain.* yes; Sample answer: A digit in one place is 10 times the value of that same digit in the place to its right. So, multiplying by 100, or 10 × 10, results in the decimal point being moved two places to the right.

Need Another Example?
About 0.51 of a city's population is female. Write 0.51 as a percent. 51%

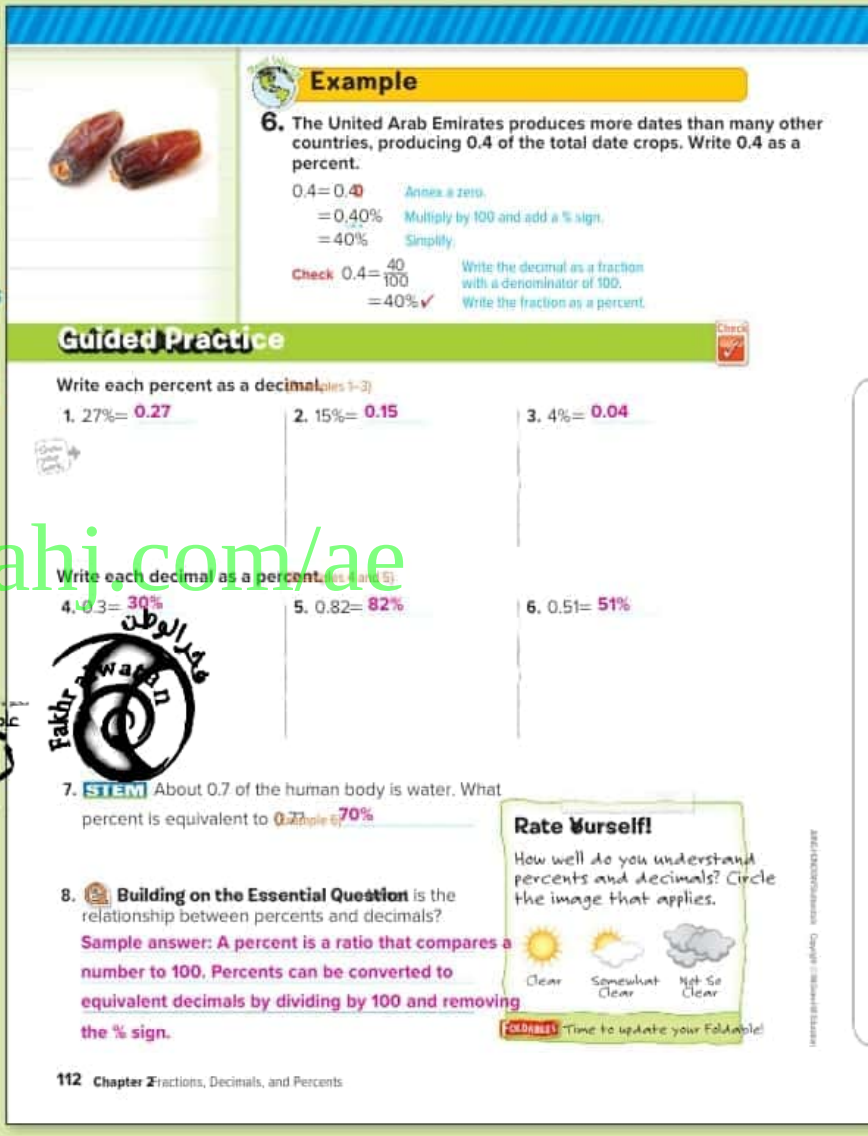
Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Roundrobin** Have the students complete Exercises 1–8 in pairs. For each exercise, have one student contribute a step. Then the next student contributes the next step. For example, in Exercise 1, Student 1 writes the percent as a fraction. Student 2 writes the fraction as a decimal. Have students alternate roles until all exercises have been completed. MP 1, 4

BL LA **Pairs Discussion** Students may choose to simply move the decimal point to the right two places to write a decimal as a percent and to the left two places to write a percent as a decimal. Ask students to use multiplication and division by a power of 10 to explain why this method works. MP 1, 3, 4



Example

6. The United Arab Emirates produces more dates than many other countries, producing 0.4 of the total date crops. Write 0.4 as a percent.

$0.4 = 0.40$ Annex a zero.
$= 0.40\%$ Multiply by 100 and add a % sign.
$= 40\%$ Simplify.

Check $0.4 = \frac{40}{100}$ Write the decimal as a fraction with a denominator of 100.
$= 40\%$ ✓ Write the fraction as a percent.

Guided Practice

Write each percent as a decimal. (Examples 1–3)

1. 27% = 0.27
2. 15% = 0.15
3. 4% = 0.04

Write each decimal as a percent. (Examples 4–6)

4. 0.3 = 30%
5. 0.82 = 82%
6. 0.51 = 51%

7. STEM About 0.7 of the human body is water. What percent is equivalent to 0.7? (Example 6) 70%

8. **Building on the Essential Question** What is the relationship between percents and decimals?
Sample answer: A percent is a ratio that compares a number to 100. Percents can be converted to equivalent decimals by dividing by 100 and removing the % sign.

Rate Yourself!
How well do you understand percents and decimals? Circle the image that applies.

Clear | Somewhat Clear | Not So Clear

FOLDABLES Time to update your Foldable!

Name________________________ My Homework________________

Independent Practice

Write each percent as a decimal. (Examples 1–3)

1. 35% = **0.35**
2. 2% = **0.02**
3. 31% = **0.31**
4. 95% = **0.95**

Write each decimal as a percent. (Examples 4 and 5)

5. 0.22 = **22%**
6. 0.79 = **79%**
7. 0.1 = **10%**
8. 0.16 = **16%**

9. **Financial Literacy** A bank offers an interest rate of 4% on a savings account. Write 4% as a decimal. (Examples 1–3)
0.04

10. When making a peanut butter and jelly sandwich, 96% of people put the peanut butter on first. Write 96% as a decimal. (Examples 1–3)
0.96

11. In a recent year, 0.12 of school students downloaded a podcast from the Internet. What percent is equivalent to 0.12? (Example 6)
12%

12. In a recent year, the number of homes with digital cameras grew 0.44 from the previous year. Write 0.44 as a percent. (Example 6)
44%

13. **Financial Literacy** The formula $I = prt$ gives the simple interest I earned on an account where an amount p is deposited at an interest rate r for a certain number of years t. Use the table to order the accounts from least to greatest interest earned after 5 years.
C: AED 59.50, A: AED 70, B: AED 87.50

Accounts at First Savings Bank		
Account	p (AED)	r (%)
A	350	4
B	500	3.5
C	280	4.25

ENGAGE EXPLORE **EXPLAIN** **ELABORATE** **EVALUA**

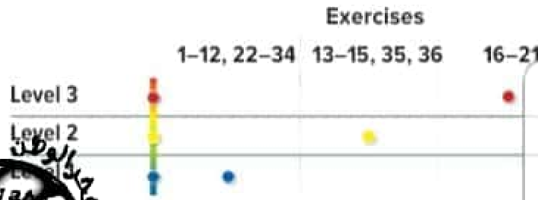
3 Practice and Apply

Independent Practice and Extra Practice

The Independent Practice pages are meant to be homework assignment. The Extra Practice page for additional reinforcement or as a second-day a

Levels of Complexity

The levels of the exercises progress from 1 to 3, indicating the lowest level of complexity.



Suggested Assignments

You can use the table below that includes exercis complexity levels to select appropriate exercise students' needs.

Differentiated Homework Options		
AL	Approaching Level	1–13, 15, 16, 18–21, 35, 36
OL	On Level	1–11 odd, 13–16, 18–21, 35, 36
BL	Beyond Level	13–21, 35, 36

Watch Out!

Common Error Remind students that they may hav zeros to properly place the decimal point when r percent as a decimal.

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	14, 17
2 Reason abstractly and quantitatively.	21
3 Construct viable arguments and critique the reasoning of others.	15, 19
4 Model with mathematics.	18, 20
6 Attend to precision.	34

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

Have students explain the steps to writing a percent as a decimal and vice versa. Use the writing prompts below.
See students' work.
- To write a percent as a decimal, ...
- To write a decimal as a percent, ...

14. **Persevere with Problems** Hannah wants to buy a coat that costs AED 80. The store that sells the coat has multiple locations. The sales tax in each city is shown in the table. How much more would the coat cost in City A than City B?

City	Tax Rate (%)
A	7.25
B	6.5
C	6.75

AED 0.60

15. Mahmoud took three tests on Thursday. He got a 92% on his English test, an 88% on his math test and a 90% on his science test. Write each percent as a decimal in order from least to greatest.
0.88, 0.90, 0.92

H.O.T. Problems Higher Order Thinking

16. **Reason Inductively** Write a decimal between 0.5 and 0.75. Then write it as a fraction in simplest form and as a percent.
Sample answer: 0.56; $\frac{3}{5}$; 60%

17. **Persevere with Problems** How would you write $\frac{3}{4}$ as a decimal?
Sample answer: Since $\frac{3}{4}$ is equal to 0.75, write $\frac{3}{4}$ as 43.75%. Then change 43.75% to the decimal 0.4375.

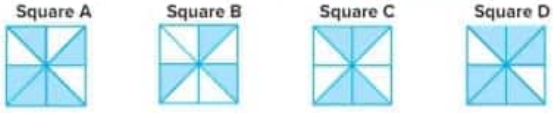
18. **Model with Mathematics** Write a percent between 25% and 50%. Then write it as a decimal and as a fraction in simplest form.
Sample answer: 26%; 0.26; $\frac{13}{50}$

19. **Reason Inductively** Explain why percents are rational numbers.
Sample answer: Every percent can be written as a fraction with a denominator of 100, and since every fraction is a rational number, every percent is a rational number.

20. **Model with Mathematics** Write a problem about a real-world situation in which you would either write a percent as a decimal or write a decimal as a percent.
Sample answer: A student scored a 92% on his math test. Express this percent as a decimal.

21. **Reason Abstractly** Each square below is divided into sections of equal size. In which square is 25% of the square *not* shaded?
Square D

Square A | Square B | Square C | Square D



Name _______________ My Homework

Extra Practice

Write each percent as a decimal.

22. 17% = 0.17

17% = $\frac{17}{100}$ = 0.17

23. 3% = **0.03**

24. 1% = **0.01**

25. 11% = **0.11**

Write each decimal as a percent.

26. 0.99 = **99%**

27. 0.62 = **62%**

28. 0.6 = **60%**

29. 0.87 = **87%**

30. In one day at a store, 7% of the sales were from shoes. Write 7% as a decimal.
0.07

31. In one hour on a certain street, 65% of the cars that passed were black. Write 65% as a decimal.
0.65

32. In a recent year, 0.57 of those registered to vote in the United States voted in an election. Write 0.57 as a percent.
57%

33. In a recent study, 0.82 of UAE residents own a cell phone. What percent is equivalent to 0.82?
82%

34. **Be Precise** In some countries, sales tax is added to items that you purchase. The rate of sales tax varies by country. Use the table to order the countries from least to greatest sales tax.
Country B, Country A, Country C

Country Sales Tax	
Country	Sales Tax
A	6.75%
B	0.0625
C	$\frac{7}{100}$

Power Up! Test Practice

Exercises 35 and 36 prepare students for more rigorous thinking needed for the assessment.

35.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practices	MP1, MP4
Scoring Rubric	
1 point	Students correctly answer each part of the question.

36.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK2
Mathematical Practices	MP1, MP6
Scoring Rubric	
2 points	Students correctly order the three counties AND identify the rate in each county.
1 point	Students correctly order the three counties but fail correctly to identify the rate OR students correctly identify 2 counties and correctly identify the rates in these two counties.

Power Up! Test Practice

35. At baseball practice, Nael caught 16 out of 20 hits to the outfield. Select all the ways of expressing 16 out of 20.

- [ ] 0.16
- [x] 0.8
- [x] 80%
- [ ] 0.08

36. The Mumtaz family wants to purchase a television that costs AED 449. The store that sells the television has multiple locations in different cities. The sales tax for each city is shown. Complete the table below by arranging the cities from least to greatest sales tax rate. Write each sales tax as a percent.

City	Tax Rate
A	$7\frac{3}{4}\%$
B	$\frac{13}{200}$
C	0.0675

	City	Sales Tax Rate (%)
Least	B	6.5
	C	6.75
Greatest	A	7.75

Spiral Review

Fill in each ○ with <, >, or = to make a true statement.

37. 2.50 = 2.5

38. 0.006 < 0.1

39. 0.015 > 0.005

40. The table shows results for the 100 meter sprint. Who had the fastest time?

Yousef

Athlete	Time (s)
Jalal	12.14
Yousef	11.84
Ali	11.94
Marwan	12.44

41. Rodina ate 0.75 sandwich. Her brother ate 1.5 sandwiches. Who ate more?

Rodina's brother

Lesson 4

Percents Greater than 100% and Percents Less than 1%

Real-World Link

Plants There are over 220,000 species of plants on Earth. Of those, 590 are carnivorous. Plants such as a Venus Flytrap catch their prey as food.

1. Write the fraction of species of carnivorous plants in simplest form.

$\frac{590}{220,000} \div \frac{10}{10} = \frac{59}{22,000}$

2. Write your answer to Exercise 1 as a decimal rounded to the nearest thousandth. Use division to find your answer.

$$\begin{array}{r} 0.0026 \\ 22000\overline{)59.0000} \\ -44000 \\ \hline 150000 \\ -132000 \\ \hline 18000 \end{array}$$

$0.0026 \approx 0.003$

3. Write your answer to Exercise 2 as a fraction.

$\frac{3}{1,000}$

4. **Make a Conjecture** Since 0.3 = 30% and 0.03 = 3%, what percent is equal to 0.003? Explain.

0.3%; Sample answer: Since the decimal 0.03 is written as 3%, the decimal 0.003 is written as 0.3%.

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

Mathematical Practices
1, 3, 4, 5

Which **Mathematical Practices** did you use? Shade the circle(s) that applies.

1 Persevere with Problems
2 Reason Abstractly
3 Construct an Argument
4 Model with Mathematics
5 Use Math Tools
6 Attend to Precision
7 Make Use of Structure
8 Use Repeated Reasoning

Focus narrowing the scope

Objective Write equivalent forms of fractions, deci… percents that are greater than 100% and less than…

Coherence connecting within and across gra…

Previous
Students wrote equivalent forms of percents and decimals.

Now
Students write equivalent forms of fractions, decimals, and percents.

Next
Students will com… and order fractio… decimals, and pe…

Rigor pursuing concepts, fluency, and applic…

See the Levels of Complexity chart on page 121.

ENGAGE EXPLORE EXPLAIN ELABORATE EVAL…

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson using a whol… group, think-pair-share activity, or independent …

LA Numbered Heads Together Have stud… groups of 3 or 4 work to complete Exe… ensuring that each group member understands. … student to a number. Call on one numbered stu… group to explain each exercise to the class. MP 3

Alternate Strategy

AL Ask students to use number sense and esti… verify that 590 out of 220,000 is about 0.3%, no… example, 590 out of 220,000 ≈ 600 of 240,000. By … the common zeros, this becomes 6 of 2,400. On… 2,400 is 24 and 6 is less than 24, so 6 of 2,400 … MP 1, 3

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

1. **Write a percent less than 1% as a decimal and a fraction.**

AL • *Is 0.2% less than or greater than 1%?* less than

• *Why do we divide by 100?* Percent means "per 100", which indicates division.

OL • *What is 0.2% written as a decimal?* 0.002

• *What is 0.002 in word form?* two thousandths

BL • *When dividing by 100, why do we move the decimal point two places to the left?* Each decimal place represents dividing by 10. So, dividing by 100 is the same result as moving the decimal point two places to the left.

Need Another Example?

Write 0.6% as a decimal and as a fraction in simplest form.

$0.006 = \frac{3}{500}$

2–3. **Write a percent greater than 100% as a mixed number and a decimal.**

AL • *In Example 2, will 170% equal a number greater than or less than 1?* greater than

OL • *In Example 2, what is 170% expressed as a fraction with a denominator of 100? What mixed number, in simplest form, represents this fraction?* $\frac{170}{100}$; $1\frac{7}{10}$

BL • *Refer to Example 3. If Jimmy's account is now 3 times as much as it was originally, what percent would represent this number?* 300%

Need Other Examples?

a. Write 230% as a mixed number in simplest form and as a decimal. $2\frac{3}{10}$; 2.3

b. A company's profit increased by 110%. Write 110% as a mixed number in simplest form and as a decimal. $1\frac{1}{10}$; 1.1

Work Zone

Percents

A percent less than 1 is equivalent to a number less than $\frac{1}{100}$. A percent greater than 100% equals a number greater than 1.

Percents as Decimals and Fractions

Percents greater than 100% or less than 1% can also be written as decimals or as fractions.

Examples

1. **Write 0.2% as a decimal and as a fraction in simplest form.**

$0.2\% = \frac{0.2}{100}$ Divide by 100 and remove % symbol.

$= 0.002$ Decimal form

$= \frac{2}{1{,}000}$ or $\frac{1}{500}$ Fraction form

2. **Write 170% as a mixed number in simplest form and as a decimal.**

$170\% = \frac{170}{100}$ Definition of percent

$= 1\frac{70}{100}$ or $1\frac{7}{10}$ Mixed number form

$= 1.7$ Decimal form

Got it? **Do these problems to find out.**

Write each percent as a decimal and as a mixed number or fraction in simplest form.

a. 0.25% **b.** 300% **c.** 530%

Example

Hamza's savings increased by 250%. Write 250% as a mixed number in simplest form and as a decimal.

$250\% = \frac{250}{100}$ Definition of a percent

$= 2\frac{50}{100}$ or $2\frac{1}{2}$ Mixed number form

$= 2.5$ Decimal form

So, Hamza more than doubled his savings.

Got it? **Do this problem to find out.**

d. The stock price for a corporation increased by 0.11%. Write 0.11% as a decimal and as a fraction in simplest form.

a. 0.0025; $\frac{1}{400}$

b. 3; 3

c. 5.3; $5\frac{3}{10}$

d. 0.0011; $\frac{11}{10{,}000}$

Mixed Numbers and Decimals as Per

To write a decimal as a percent, multiply by 100 and add a percent sign. To write a mixed number as a percent, first write the mixed number as an improper fraction.

Example

4. Write $1\frac{1}{4}$ as a percent.

$1\frac{1}{4} = \frac{5}{4}$ Write $1\frac{1}{4}$ as an improper fraction.

$\frac{5}{4} = \frac{\blacksquare}{100}$ Find an equivalent fraction.

$\frac{5}{4} = \frac{125}{100}$ (×25) Since 4 × 25 = 100, multiply 5 by 25 to find an equivalent fraction.

So, $1\frac{1}{4}$ is $\frac{125}{100}$ or 125%.

Alternative Method

1 = 100%

$\frac{1}{4}$ = 25%

So, $1\frac{1}{4}$ = 125%.

Got it? Do these problems to find out.

Write each mixed number as a percent.

e. $2\frac{9}{10}$ f. $3\frac{2}{5}$

e. 290%

f. 340%

Examples

5. Write 1.68 as a percent.

1.68 = 1.68 Multiply by 100.

= 168% Add % symbol.

6. Write 0.0075 as a percent.

0.0075 = 0.0075 Multiply by 100.

= 0.75% Add % symbol.

Stop and Reflect

Is the decimal 6.7 equal to 67%? Explain below.

No; Sample answer: The decimal 6.7 is equal to 670% when you multiply 6.7 × 100 and remove the percent sign.

Got it? Do these problems to find out.

g. 2.5 h. 0.004 i. 0.0016

g. 250%

h. 0.4%

i. 0.16%

Examples

4. Write a mixed number as a percent.

AL • *How do we write $1\frac{1}{4}$ as an improper fraction?* Think of 1 as $\frac{4}{4}$. Then add the like fractions: $\frac{4}{4} + \frac{1}{4} = \frac{5}{4}$

• *Will the percent be less than 100% or greater than 100%? Explain.* greater than; The mixed number is greater than 1, and 1 represents 100%.

OL • *How would you rewrite $\frac{5}{4}$ as a fraction with a denominator of 100?* Multiply the numerator and denominator by 25.

• *What is $\frac{1}{4}$ written as a percent?* 25%

BL • *What is another way you can write this mixed number as a percent?* Sample answer: The whole number 1 represents 100% and $\frac{1}{4}$ represents 25%; 100% + 25% = 125%.

Need Another Example?

Write $\frac{3}{5}$ as a percent. 160%

5–6. Write a decimal as a percent.

AL • *In Example 5, will the percent be less than 100% or greater than 100%? Explain.* greater than; The decimal is greater than 1. *Example 6?* less than; The decimal is less than 1.

OL • *In both examples, why do we multiply by 100?* Percent means "per 100". Since we have the decimal values, we need to multiply by 100 to find the percent.

• *How do we know that our answers are reasonable?* Sample answer: In Example 5, the percent should be greater than 100% but less than 200% because 1.68 is greater than 1, but less than 2. In Example 6, the percent should be less than 1% because the decimal is less than 0.01.

BL • *Is 0.75% equivalent to 0.75? Explain.* no; 0.75% = 0.0075

• *Give an example of a decimal whose percent equivalent is between 450% and 475%.* Sample answer: 4.65

Need Other Examples?

Write each decimal as a percent.

a. 1.09 109% b. 0.0008 0.08%

Example

7. Write a decimal as a percent.

AL
- *What is the problem asking you to do?* Write 2.1 as a percent.
- *Which animal has the greater speed, the cheetah or the peregrine falcon?* peregrine falcon

OL
- *What do you need to do to write a decimal as a percent?* Multiply by 100, which is the same as moving the decimal point two places to the right.
- *What is 2.1 written as a percent?* 210%

BL
- *If a cheetah's speed is 70 miles per hour, what is a peregrine falcon's speed? How did you find this?* 147 mph; Multiply 70 by 2.1.

Need Another Example?
The smallest planet is Mercury. Its mass is about 0.00058 the mass of Saturn. Write this number as a percent. 0.058%

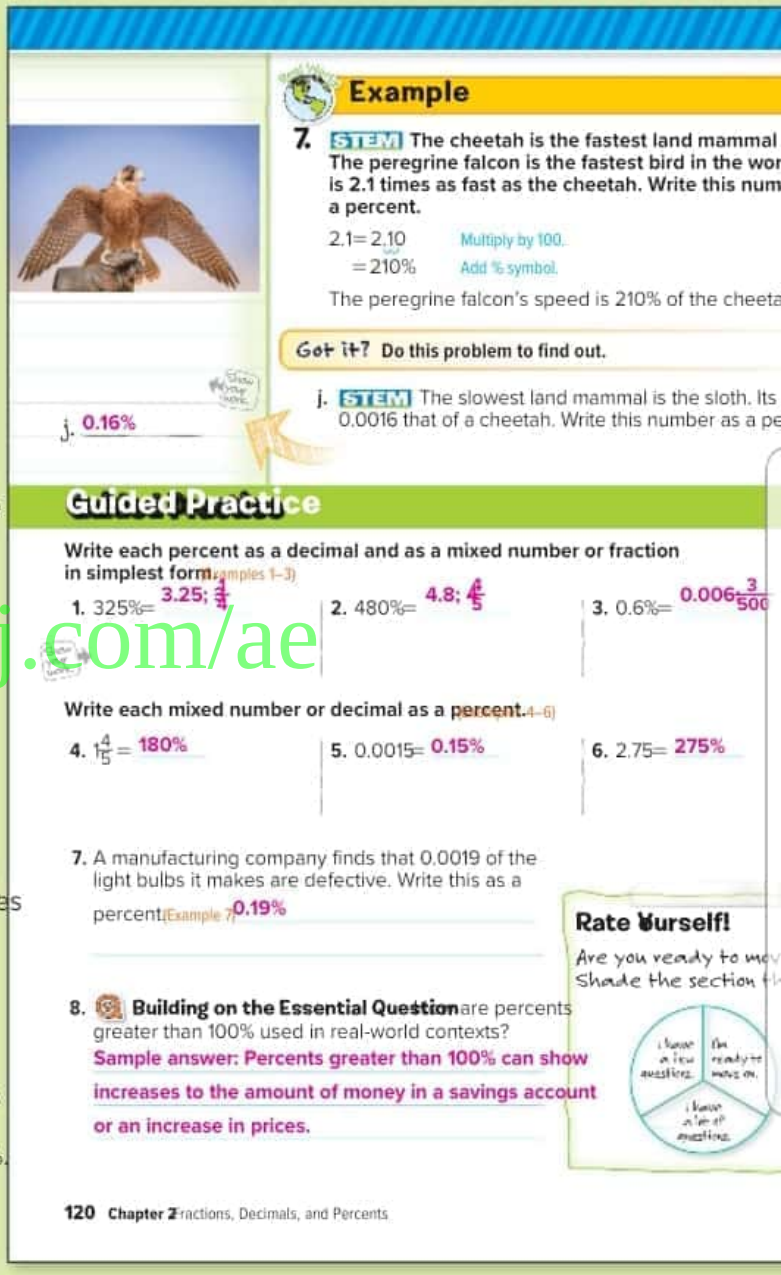
Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Team-Pair-Solo** Have students complete Exercises 1 and 4 as a small group, ensuring that each group member understands. Then have groups divide into pairs to complete Exercises 2, 5, and 7. Finally, have students complete Exercises 3, 6, and 8 individually. Have students rejoin their groups to compare solutions and discuss and resolve any differences.
MP 1, 3

BL LA **Trade-a-Problem** Ask students to write a real-world problem involving a percent greater than 100% or less than 1%, and trade with a partner to solve each other's problems. Ask them to discuss the kinds of situations that involve a percent greater than 100% or a percent less than 1%.
MP 1, 3, 4



Example

7. STEM The cheetah is the fastest land mammal The peregrine falcon is the fastest bird in the wor is 2.1 times as fast as the cheetah. Write this num a percent.

2.1 = 2.10 Multiply by 100.
= 210% Add % symbol.

The peregrine falcon's speed is 210% of the cheeta

Got it? Do this problem to find out.

j. STEM The slowest land mammal is the sloth. Its 0.0016 that of a cheetah. Write this number as a pe

j. 0.16%

Guided Practice

Write each percent as a decimal and as a mixed number or fraction in simplest form. (Examples 1–3)

1. 325% = 3.25; $3\frac{1}{4}$
2. 480% = 4.8; $4\frac{4}{5}$
3. 0.6% = 0.006; $\frac{3}{500}$

Write each mixed number or decimal as a percent. (Examples 4–6)

4. $1\frac{4}{5}$ = 180%
5. 0.0015 = 0.15%
6. 2.75 = 275%

7. A manufacturing company finds that 0.0019 of the light bulbs it makes are defective. Write this as a percent. (Example 7) 0.19%

8. **Building on the Essential Question** How are percents greater than 100% used in real-world contexts?
Sample answer: Percents greater than 100% can show increases to the amount of money in a savings account or an increase in prices.

Rate Yourself!
Are you ready to mo
Shade the section

Name _____ My Homework _____

Independent Practice

Write each percent as a decimal and as a mixed number or fraction in simplest form. (Examples 1–w3)

1. 350% = 3.5; $3\frac{1}{2}$
2. 600% = 6; 6
3. 0.15% = 0.0015; $\frac{3}{2{,}000}$
4. 0.55% = 0.0055; $\frac{11}{2{,}000}$

Write each mixed number as a percent. (Example 4)

5. $2\frac{1}{2}$ = 250%
6. $9\frac{3}{4}$ = 975%
7. $4\frac{1}{5}$ = 420%
8. $7\frac{3}{10}$ = 730%

Write each decimal as a percent. (Examples 5 and 6)

9. 8.5 = 850%
10. 2.64 = 264%
11. 0.009 = 0.9%
12. 0.0034 = 0.34%

13. The size of a large milkshake is 1.4 times the size of a medium milkshake. Write 1.4 as a percent. (Example 7)
    140%

14. STEM Fresh water from lakes accounts for only 0.001 of the world's water supply. Write this decimal as a percent. (Example 7)
    0.1%

15. In a recent year, the United States Census Bureau reported that 0.3% of the population in the United States was Japanese. Write this percent as a decimal and as a fraction. Then interpret its meaning as a ratio of the United States population.
    0.003; $\frac{3}{1{,}000}$; 3 out of every 1,000 people are Japanese.

16. Mariam answered all 2[illegible]-choice questions correctly on a science test. If her teacher decided to let only the questions count as a bonus, worth the same number of points as the other problems on the test, what was Mariam's test score? Write your answer as a decimal and as a percent.
    1.05; 105%

ENGAGE EXPLORE EXPLAIN EL

3 Practice and Ap

Independent Practice and Ex

The Independent Practice pages homework assignment. The Extra for additional reinforcement or as

Levels of Complexity

The levels of the exercises progr indicating the lowest level of com

Exe

	1–14, 22–31	15–17
Level 3		
Level 2		
Level 1		

Suggested Assignments

You can use the table below that complexity levels to select appro students' needs.

	Differentiated Hom	
AL	Approaching Level	1–15, 17, 1
OL	On Level	1–13 odd, 15
BL	Beyond Level	15–21, 36, 37

Watch Out!

Common Error Remind students th decimals means dividing by 100 a decimal two places to the left. Re means multiplying by 100 and res two places to the right.

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	19
3 Construct viable arguments and critique the reasoning of others.	18, 21
4 Model with mathematics.	20
5 Use appropriate tools strategically.	17, 34, 35

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment

Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

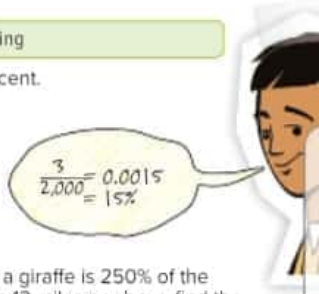
Have students write 112% as a decimal and as a mixed number in simplest form. 1.12; $1\frac{3}{25}$

17. **Use Math Tools** Refer to the table at the right.
   a. Write the percent of magnesium found in the human body as a decimal.
   0.0005
   b. Which element makes up $\frac{1}{400}$ of the human body?
   sulfur

Elements in the Human
Element	Percent
Magnesium	0.05
Potassium	0.35
Sodium	0.15
Sulfur	0.25

H.O.T. Problems Higher Order Thinking

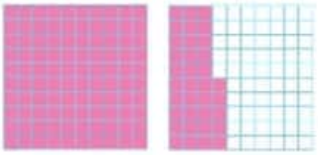
18. **Find the Error** Ali is writing $\frac{3}{2,000}$ as a percent. Find his mistake and correct it.
Ali multiplied by 10,000 when he changed the decimal to a percent. $\frac{3}{2,000} = 0.0015 = 0.15\%$



19. **Persevere with Problems** The speed of a giraffe is 250% of the speed of a squirrel. If a squirrel's speed is 12 miles per hour, find the speed of a giraffe.
30 mph

20. **Model with Mathematics** Write a real-world problem involving a percent greater than 100%. Then solve the problem.
Sample answer: An engineer's weekly salary is 110% of his previous salary. What is this pe as a decimal? 1.10

21. **Reason Inductively** Explain how you would show 135% on a 10-by-10 grid. Then use the grids below to show 135%.
Sample answer: Since 135% > 100%, two 10-by-10 grids will be used. The first will be completely shaded and the second will have 35 of the sections shaded.



Name _____ My Homework _____

Extra Practice

Write each percent as a decimal and as a mixed number or fraction in simplest form.

22. 475% = 4.75; $4\frac{3}{4}$

475% = $\frac{475}{100}$ = $4\frac{75}{100}$ or $4\frac{3}{4}$ = 4.75

23. 400% = 4; 4

24. 0.05% = 0.0005; $\frac{1}{2,000}$

25. 0.04% = 0.0004; $\frac{1}{2,500}$

Write each decimal as a percent.

26. 1.07 = 107%

27. 35 = 3,500%

28. 0.003 = 0.3%

29. 0.0077 = 0.77%

30. A collectible action figure sold for 193% of its original price. Write this percent as a decimal and as a mixed number or fraction in simplest form.
1.93; $1\frac{93}{100}$

31. A car's tire pressure decreased by 0.098 of its original pressure. Write 0.098 as a percent.
9.8%

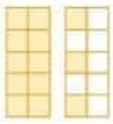
Write each percent as a decimal.

32. $\frac{3}{4}\%$ = 0.0075

33. $\frac{3}{25}\%$ = 0.0012

Use Math Tools One complete figure represents 100%. Write a percent to represent the shaded portion of each figure below.

34. 130%



35. 125%

Power Up! Test Practice

Exercises 36 and 37 prepare students for more rigorous thinking needed for the assessment.

36.

This test item requires students to analyze and solve complex real-world problems through the use of mathematical tools and models.	
Depth of Knowledge	DOK2
Mathematical Practices	MP4, MP6
Scoring Rubric	
1 point	Students correctly shade 7 pieces of the diagram.

37.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP7
Scoring Rubric	
2 points	Students select both correct answers AND write $\frac{9}{25,000}$ in the box.
1 point	Students select both correct answers OR write $\frac{9}{25,000}$ in the box.

Power Up! Test Practice

36. Shade the model to show 140%.

37. About 0.036% of the water on Earth is found in lakes and rivers. Which of the following show 0.036% written as a fraction? Select all that apply.

- ☐ $\frac{9}{25}$
- ☐ $\frac{36}{100}$
- ■ $\frac{18}{50,000}$
- ■ $\frac{27}{75,000}$

What is 0.036% written as a fraction in simplest form? $\frac{9}{25,000}$

Spiral Review

Compare the fractions using >, or =.

38. $\frac{3}{6} > \frac{1}{8}$

39. $\frac{10}{17} < \frac{11}{12}$

40. $\frac{7}{9} > \frac{5}{11}$

41. Suad walked $\frac{3}{10}$ of a kilometer on Monday, $\frac{5}{10}$ of a kilometer on Tuesday, and $\frac{25}{100}$ of a kilometer on Wednesday. Plot each distance on the number line.

42. The flute players are $\frac{3}{10}$ of the band and the trumpet players are $\frac{1}{12}$ of the band. Is a greater fraction of the band flute players or trumpet players?

flute players

Ratios and Proportional Relationships

Problem-Solving Investigation

Solve a Simpler Problem

Mathematical Practices 1, 3, 4

Case #1 First Place Pizza

The daily lunch report indicated that 80% of the 300 students at Al Khulafaa Al Rashideen School chose pizza for lunch.

How many students bought pizza for lunch?

1 Understand *What are the facts?*

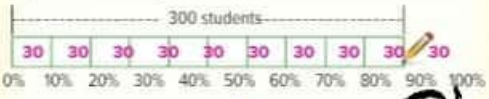
- The lunch report says 80% chose pizza.
- There are 300 students at the school.

2 Plan *What is your strategy to solve this problem?*

Solve a simpler problem by finding 10% of the total students. Then use the result to find 80% of the total students.

3 Solve *How can you apply the strategy?*

Complete the bar diagram. Fill in the value of each section.



There are 30 | 10, or 10 groups with 30 students in each group.

Multiply. 30 × 8 = 240

So, 240 students chose pizza for lunch.

4 Check *Does the answer make sense?*

You know that 80% is close to 75%, which is $\frac{3}{4}$. Since $\frac{1}{4}$ of 300 is 75, $\frac{3}{4}$ of 300 is 225. So, my answer is reasonable.

Analyze the Strategy

Reason Inductively Explain when you would use the *solve a simpler problem* strategy. Sample answer: Use this strategy when there is a way to solve the problem using simpler numbers.

Focus narrowing the scope

Objective Solve problems by solving a simpler problem. This lesson emphasizes **Mathematical Practice 3** Construct an Argument.

Solve a Simpler Problem Sometimes it is helpful to break a complex problem down to solve a simpler one. Doing this can involve doing one step of the problem, using smaller numbers or rounding numbers.

Coherence connecting within and across grades

Now Students solve non-routine problems.

Next Students will apply the solve a simpler problem strategy to solve problems.

Rigor pursuing concepts, fluency, and applications

See the Levels of Complexity chart on page 127.

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

1 Launch the Lesson

The problems on pages 125 and 126 are intended to be used as a whole-group discussion on how to solve non-routine problems and are designed to provide scaffolded guidance.

Case #1 First Place Pizza

BL Extend the problem by asking the questions below.

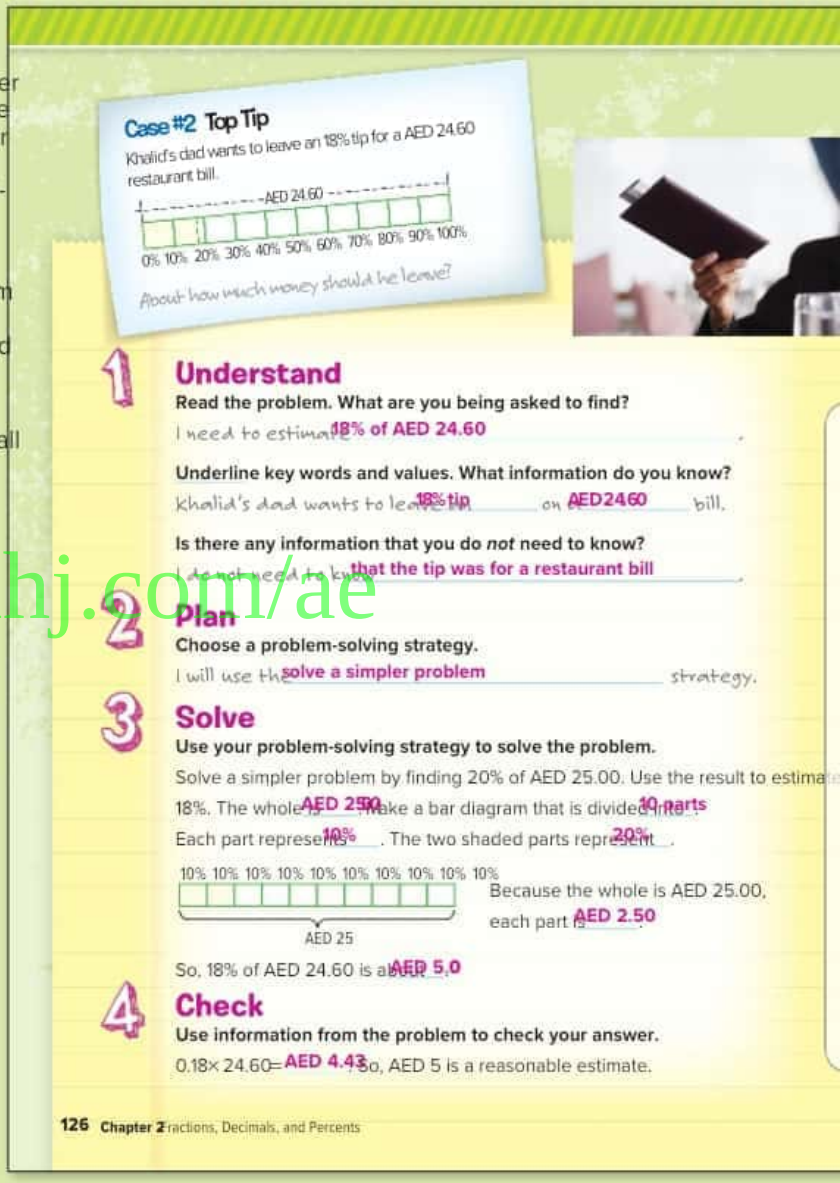
- *How could you use this strategy if the problem asked how many students did not choose pizza?* Sample answer: Since 80% chose pizza, 20% did not choose pizza. I can still find 10% of the students, 30, and multiply by 2 to find that 60 students did not choose pizza.
- *Is there another way you can find how many students did not choose pizza?* Sample answer: I can find the number of students that chose pizza and subtract that number from 300.

Case #2 Arabic Grills Restaurant

AL LA **Paired Heads Together** Have students solve the problem individually. Then have students pair up with a partner and share their answers. If either answer is incorrect, have the students alternate to go back through the steps to check their answers. For example, one student completes the odd-numbered steps, while the other student completes the even-numbered steps. MP 1, 3, 7

BL LA **Trade-a-Problem** Have students work in pairs to solve the problem. Then have them write a real-world problem that is similar to *Top Tip*. Students trade their problem and solve. Give them time to discuss and correct any mistakes and information. MP 1, 3, 4

Need Another Example?
The Emirates Al Ahli scored 380 baskets in their last basketball season. If 15% of the baskets were free throws, how many baskets did they make on free throws? 57 baskets



Work with a small group to solve the following cases.
Show your work on a separate piece of paper.

Case #3 Time

Three 24-hour clocks show the time to be 12 noon. One of the clocks is always correct, one loses a minute every 24 hours, and one gains a minute every 24 hours.

How many days will pass before all three clocks show the correct time again?

1,440 days

Case #4 Number Sense

The number 272 is a palindrome because it reads the same forward or backward.

How many numbers from 10 to 1,000 are palindromes?

99 numbers

Case #5 Sandwiches

In one day, a restaurant made the sandwiches shown in the table.

Type	Number	Percent
Veggie	60	5
Cheese	204	17
Turkey	348	29
Chicken	?	35
Roast Beef	168	14

How many sandwiches are chicken?

420 sandwiches

Case #6 Border

Part of a strip of border for a bulletin board is shown. All of the sections of the border are the same width.

If the first shape on the strip is a triangle and the strip is 74 inches long, what is the last shape on the strip?

circle

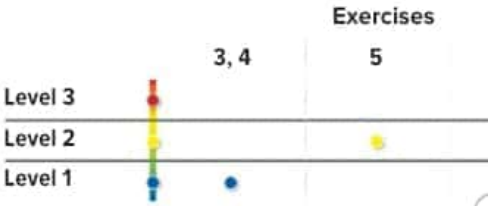
Use any strategy.

ENGAGE EXPLORE **EXPLAIN** ELABORATE

2 Collaborate

Levels of Complexity

The levels of the exercises progress from 1 indicating the lowest level of complexity.



AL LA **Teammates Consult** Place students in four to complete Cases 3–6. Each student 3–6, which represents the case discussion Teammates discuss the first case with Stud discussion. All members of the team contrib agree upon one answer. Continue by rotati until all the cases are compl MP 1, 3

BL LA **Pairs Discussion** Have students cho cases and write an extension of that proble Case 4, students may choose to find how m 10 to 5,000 are palindromes. Have them di how solving a simpler problem helps them extension proble MP 1, 3, 4

Mid-Chapter Check

If students have trouble with Exercises 1–10, they may need help with the following concepts.

Concept	Exercise(s)
fractions and decimals (Lesson 1)	2, 3, 4
percents and decimals (Lessons 3 and 4)	5–9
percents and fractions (Lesson 2)	1, 9, 10

Vocabulary Activity

LA Numbered Heads Together Have students work in a small group to complete Exercise 1. Each student is assigned a number. Students are responsible for ensuring that each group member understands the meaning of a percent. Students should ask each other for clarification and assistance, as needed. Call on one numbered student to share their definition with the class. MP 3, 6

Alternate Strategies

AL LA Have students break apart the term *percent* into two words that help them remember what the term means. Then have them use a 10×10 grid or bar diagram to model the fraction given in Exercise 1 in order to help them write the fraction as a percent and as a decimal. MP 1, 3, 6

BL Have students verbally explain the difference between 0.3% and 3%. MP 1, 3

Mid-Chapter Check

Vocabulary Check

1. Define *percent*. Write $\frac{25}{100}$ as a percent then write $\frac{25}{100}$ as a decimal. (Lesson 2)
   A percent is a ratio that compares a number to 100. 25%; 0.25

Skills Check and Problem Solving

Write each fraction as a decimal and each decimal as a fraction in simplest form. (Lesson 1)

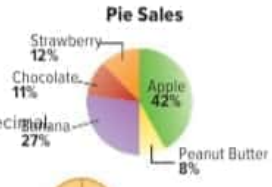
2. $\frac{8}{20}$ = 0.4
3. 0.64 = $\frac{16}{25}$
4. $\frac{3}{100}$ = 0.03

Write each percent as a decimal and each decimal as a percent. (Lessons 3 and 4)

5. 73% = 0.73
6. 0.01 = 10%
7. 254% = 2.54

8. The number of chorus students increased by a factor of 1.2 from the previous year. Write 1.2 as a percent.
   120%

9. MP **Use Math Tools** The graph shows the pie sales during one week. (Lessons 2 and 3)



   a. What fraction of the pies sold was apple?
      $\frac{21}{50}$
   b. Write the percent of strawberry pies sold as a decimal.
      0.12

10. MP **Persevere with Problems** The circle at the right is divided into sections of equal size. What percent of the circle is not shaded? (Lesson 2)

    25%

Ratios and Proportional Relationships

Lesson 5

Compare and Order Fractions, Decimals, and Percents

Vocabulary Start-Up

The **least common denominator**, LCD, is the least common multiple of the denominators of two or more fractions.

Complete the graphic organizer. Write the meaning of each word in the appropriate box. Provide examples. Sample answers are given.

Least	Common
the smallest of a set of values; Of the numbers 3, 4, and 5, 3 is the least in value.	the usual; often seen; it is common for Maya to receive an A in math class.
Denominator	**Multiple**
the bottom number in a fraction; it represents the number of parts in the whole. In $\frac{5}{6}$, the denominator is 6.	A multiple of a number is the product of that number and any whole number. 15 is a multiple of 3 because $3 \cdot 5 = 15$.

least common denominator

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

Vocabulary

least common denominator (LCD)

Mathematical Practices

1, 2, 3, 4, 5, 6

Real-World Link

- Ahmed is baking, but he wants to use only one measuring cup. He needs $\frac{1}{2}$ cup of sugar and $\frac{3}{4}$ cup of flour. What is the least common multiple of the denominators? 4
- What size measuring cup should he use: $\frac{1}{2}$ cup, $\frac{1}{3}$ cup, or $\frac{1}{4}$ cup? Explain. He should use the $\frac{1}{4}$ cup measuring cup because the least common denominator of $\frac{1}{2}$ and $\frac{3}{4}$ is 4 and the fraction $\frac{1}{4}$ has a denominator of 4.

Which Mathematical Practices do you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Compare and order fractions, dec... percents.

Coherence connecting within and acros...

Previous	Now	Nex...
Students wroted equivalent forms of fractions, decimals, and percents.	Students compare and order fractions, decimals, and percents.	Students estimati... percent...

Rigor pursuing concepts, fluency, and a...

See the Levels of Complexity chart on pag...

ENGAGE EXPLORE EXPLAIN ELABORATE

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson using a ... group, think-pair-share activity, or indepen...

LA Numbered Heads Together ... to 3- or 4-person learning teams. ... assigned a number from 1 to 4. Each team ... graphic organizer and Real-World Link, ma... member understands each of the four ent... specific number from a team to present th... the class MP 1, 5

Alternate Strategy

AL If students are having difficulty, remind ... can always find a common multiple for the ... multiplying the denominators together. How... isn't necessarily going to be the *least* comm...

2 Teach the Concept

Ask the scaffolded questions to differentiate instruction.

Examples

1. Compare fractions.

AL • *Do the two fractions have the same denominator?* no

• *Can you just compare the numerators to determine which fraction is greater? Explain.* no; Sample answer: The fractions have different denominators. Just because 7 is greater than 5 does not necessarily mean that 7 out of 12 is a greater fraction than 5 out of 8.

OL • *What do you need to do to be able to easily compare $\frac{5}{8}$ and $\frac{7}{12}$?* Find the LCD of the fractions, and then rewrite each fraction using the LCD.

• *What is the LCD of 8 and 12?* 24

• *What are the fractions rewritten with the LCD?* $\frac{15}{24}$ and $\frac{14}{24}$

BL • *Is there another denominator you could use? Explain.* Yes; 24 is the least common denominator, but you could use any multiple of 24 as a denominator.

Need Another Example?

Is $\frac{8}{21}$ less than, greater than, or equal to $\frac{6}{14}$? less than

2. Order fractions.

AL • *What must be done first to be able to order the fractions?* Rewrite each fraction using the LCD.

OL • *What is the LCD?* 28

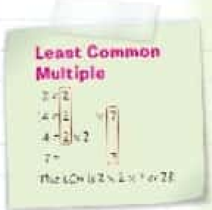
• *What are the fractions rewritten with a denominator of 28?* $\frac{14}{28}, \frac{18}{28}, \frac{21}{28}, \frac{20}{28}$

BL • *What is the last step in ordering the fractions?* Compare the numerators to put them in order from least to greatest.

Need Another Example?

Order the fractions $\frac{2}{3}, \frac{4}{5}, \frac{8}{15}$, and $\frac{3}{5}$ from least to greatest. $\frac{8}{15}, \frac{3}{5}, \frac{2}{3}, \frac{4}{5}$

Work Zone



Compare and Order Fractions

To compare fractions, you can follow these steps.

1. Find the least common denominator (LCD) of the fractions. That is, find the least common multiple of the denominators.
2. Write an equivalent fraction for each fraction using the LCD.
3. Compare the numerators.

Example

Fill in each ◯ with <, >, or = to make a true statement.

1. $\frac{5}{8}$ ◯ $\frac{7}{12}$

The LCM of the denominators, 8 and 12, is 24. So, the LCD is 24. Write an equivalent fraction with a denominator of 24 for each fraction.

$\frac{5}{8} = \frac{15}{24}$ (×3) $\quad \frac{7}{12} = \frac{14}{24}$ (×2)

$\frac{15}{24} > \frac{14}{24}$ since 15 > 14. So $\frac{5}{8} > \frac{7}{12}$.

Got it? Do these problems to find out.

a. $\frac{2}{3}$ (>) $\frac{4}{9}$ b. $\frac{5}{12}$ (<) $\frac{7}{8}$ c. $\frac{1}{6}$ (<) $\frac{5}{18}$

Example

2. Order the fractions $\frac{1}{2}, \frac{9}{14}, \frac{3}{4}$, and $\frac{5}{7}$ from least to greatest.

Rewrite each fraction using the LCD of 28.

$\frac{1}{2} = \frac{14}{28}$ (×14) $\quad \frac{9}{14} = \frac{18}{28}$ (×2) $\quad \frac{3}{4} = \frac{21}{28}$ (×7) $\quad \frac{5}{7} = \frac{20}{28}$ (×4)

Since $\frac{14}{28} < \frac{18}{28} < \frac{20}{28} < \frac{21}{28}$, the order of the original fractions from least to greatest is $\frac{1}{2}, \frac{9}{14}, \frac{5}{7}, \frac{3}{4}$.

Got it? Do this problem to find out.

d. Order $\frac{1}{2}, \frac{5}{6}, \frac{2}{3}$, and $\frac{3}{5}$ from least to greatest.

d. $\frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{5}{6}$

Compare Fractions, Decimals, and Pe

It may be easier to compare fractions, decimals, and percents when they are all written as decimals.

$\frac{1}{5} = 0.2 = 20\%$	$\frac{2}{5} = 0.4 = 40\%$	$\frac{3}{5} = 0.6 = 60\%$	$\frac{4}{5} = 0.8 = 80\%$
$\frac{1}{8} = 0.125 = 12.5\%$	$\frac{3}{8} = 0.375 = 37.5\%$	$\frac{1}{3} = 0.\overline{3} = 33.\overline{3}\%$	$\frac{2}{3} = 0.\overline{6} = 66.\overline{6}\%$

Examples

Fill in each ◯ with <, >, or = to make a true statement.

3. $\frac{3}{4}$ ◯ **0.7**

$\frac{3}{4}$ ◯ 0.7 — Write the sentence.

0.75 ◯ 0.70 — Write $\frac{3}{4}$ as a decimal. Annex a zero to 0.7

0.75 > 0.70 — Compare the hundredths place. 5 > 0

0.5 0.6 0.7 0.75 0.8 0.9 1

Since 0.75 is to the right of 0.7 on the number line, $\frac{3}{4}$ > 0.7.

4. **Salem made 85% of his free throws. Khalid made $\frac{7}{8}$ of his free throws. Who has the better average? Explain.**

85% ◯ $\frac{7}{8}$ — Write the sentence.

0.850 ◯ 0.875 — Write each number as a decimal. Annex a zero to 0.85.

0.850 < 0.875 — Compare the hundredths place. 5 < 7

Since 0.850 < 0.875, Khalid has the better average.

Check

0.84 0.85 0.86 0.87 0.88

Since 0.85 is to the left of 0.875, the answer is correct.

Got it? Do these problems to find out.

e. $\frac{2}{3}$ (>) 0.6 f. 0.7 (<) $\frac{8}{11}$ g. $\frac{1}{5}$ (=) 0.2

h. 42% (<) 0.44 i. 7% (<) $\frac{7}{10}$ j. 6.5 (=) 650%

Examples

3. Compare fractions and decimals.

AL • *Are the numbers written in the same form?* no

• *What must you do to compare the two numbers?* Write them in the same form.

OL • *How do you write $\frac{3}{4}$ as a decimal?* Divide 3 by 4.

• *Is 0.75 greater than or less than 0.7?* greater

BL • *Is it easier to write $\frac{3}{4}$ as a decimal than to write 0.7 as a fraction in order to compare the two? Explain.* Sample answer: Yes; decimals are easier to compare since their "denominators" are multiples of 10.

Need Another Example?

Is $\frac{2}{5}$ less than, greater than, or equal to 0.2? greater than

4. Compare rational numbers.

AL • *Are the numbers written in the same form?* no

• *What must you do to compare the two numbers?* Write them in the same form.

OL • *How do you write $\frac{7}{8}$ as a decimal?* Divide 7 by 8.

• *Why do we annex a zero to 0.85?* so that both numbers have the same number of decimal places for easier comparison

• *Is 0.850 greater than or less than 0.875?* less than

BL • *Could you have written both numbers as fractions and then compared the fractions? Explain.* yes; Sample answer: Writing both numbers as fractions and then comparing the fractions is a valid method because the fractions would be equivalent forms of the numbers.

• *If you wrote both numbers as fractions, what would be an additional step that you may have to take?* may have to find the LCD and rewrite both fractions so that they have the same denominator in order to compare the fractions

Need Another Example?

At Games Plus, 35% of the games are board games. At Mo Games, $\frac{3}{8}$ of the games are board games. Which store has a greater portion of board games? Mo's Games

Example

5. Order rational numbers.

AL • *Are the numbers written in the same form?* no

• *What must you do to find the greatest number?* Write the numbers in the same form. Then order the numbers.

OL • *What is each value written as a decimal?* $\frac{5}{8} = 0.625$; $0.5 = 0.500$; $58.3\% = 0.583$

BL • *How does using a number line help to determine the greatest number?* Sample answer: The number farthest to the right is the greatest number.

Need Another Example?

The table shows tryouts for the school volleyball team. Which grade had the least portion of students trying out for the team? Grade 6

Grade	Tryouts
6	$\frac{1}{4}$
7	35%
8	0.4

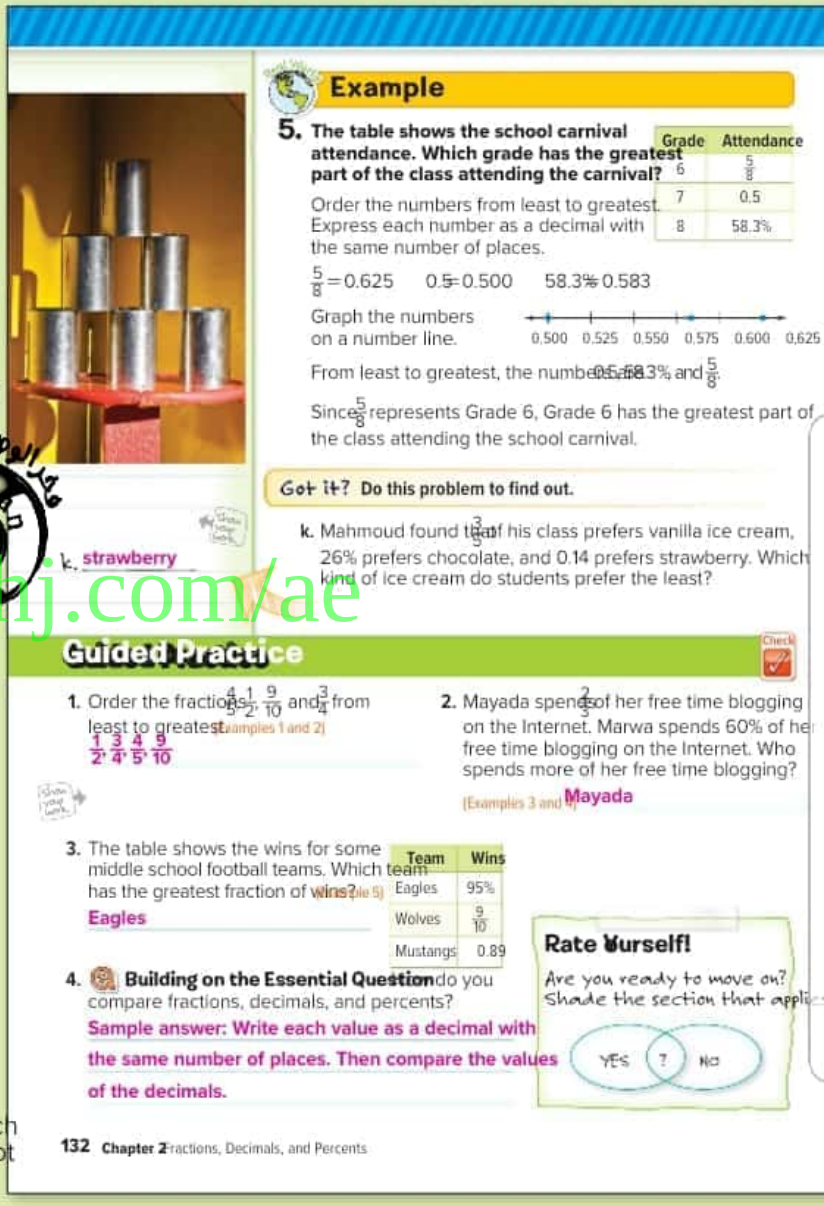
Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Think-Pair-Share** Have students work in pairs. Give students one minute to think through their responses to Exercises 1–4. Have them share their responses with their partner. Then call on one student to share their responses within a small group or large group discussion. MP 3

BL LA **Trade-a-Problem** Each student creates a problem to be solved that involves three or more different numbers similar to Exercise 2. Students trade their problems, solve each other's problem, and compare solutions. If the solutions do not agree, students work together to find the error. MP 1, 3, 4



Example

5. The table shows the school carnival attendance. Which grade has the greatest part of the class attending the carnival?

Grade	Attendance
6	$\frac{5}{8}$
7	0.5
8	58.3%

Order the numbers from least to greatest. Express each number as a decimal with the same number of places.

$\frac{5}{8} = 0.625$ $0.5 = 0.500$ $58.3\% = 0.583$

Graph the numbers on a number line.

0.500 0.525 0.550 0.575 0.600 0.625

From least to greatest, the numbers are 0.583, 0.5, and $\frac{5}{8}$.

Since $\frac{5}{8}$ represents Grade 6, Grade 6 has the greatest part of the class attending the school carnival.

Got it? Do this problem to find out.

k. Mahmoud found that $\frac{3}{5}$ of his class prefers vanilla ice cream, 26% prefers chocolate, and 0.14 prefers strawberry. Which kind of ice cream do students prefer the least? strawberry

Guided Practice

1. Order the fractions $\frac{4}{5}$, $\frac{1}{2}$, $\frac{9}{10}$, and $\frac{3}{4}$ from least to greatest. (Examples 1 and 2) $\frac{1}{2}, \frac{3}{4}, \frac{4}{5}, \frac{9}{10}$

2. Mayada spends $\frac{2}{3}$ of her free time blogging on the Internet. Marwa spends 60% of her free time blogging on the Internet. Who spends more of her free time blogging? (Examples 3 and 4) Mayada

3. The table shows the wins for some middle school football teams. Which team has the greatest fraction of wins? (Example 5) Eagles

Team	Wins
Eagles	95%
Wolves	$\frac{9}{10}$
Mustangs	0.89

4. **Building on the Essential Question** How do you compare fractions, decimals, and percents? Sample answer: Write each value as a decimal with the same number of places. Then compare the values of the decimals.

Rate Yourself!

Are you ready to move on? Shade the section that applies.

YES ? NO

Name _____ My Homework _____

Independent Practice

Fill in each ◯ with <, >, or = to make a true statement. (Examples 1 and 3)

1. $\frac{1}{3}$ ◯ $\frac{3}{5}$ — $<$
2. $\frac{7}{12}$ ◯ $\frac{1}{2}$ — $>$
3. $\frac{1}{4}$ ◯ 0.4 — $<$
4. 0.7 ◯ $\frac{7}{9}$ — $<$

Order the fractions from least to greatest. (Example 2)

5. $\frac{1}{2}, \frac{2}{3}, \frac{1}{4}, \frac{5}{6}$ → $\frac{1}{4}, \frac{1}{2}, \frac{2}{3}, \frac{5}{6}$
6. $\frac{2}{3}, \frac{2}{9}, \frac{5}{6}, \frac{11}{18}$ → $\frac{2}{9}, \frac{11}{18}, \frac{2}{3}, \frac{5}{6}$

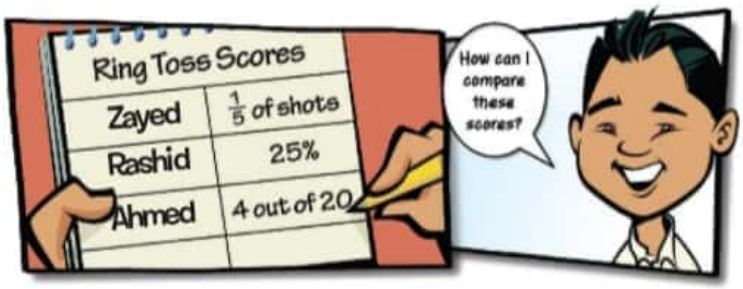
7. Samir spends 35% of his time doing math homework. Ali spends $\frac{2}{5}$ of his time doing math homework. Who spends more homework time on math? Explain. (Example 4)

   Ali; $0.35 < 0.40$

8. Three snack bars contain $\frac{1}{9}$, 0.22, and 19% of their Calories from fat. Which snack bar contains the least amount of Calories from fat? (Example 5)

   the snack bar with 19% Calories from fat

9. **Model with Mathematics** Use the graphic novel frame below for Exercises a–b.



a. Write each score as a decimal. 0.20, 0.25, 0.20

b. Compare the three scores. Two are the same; 0.25 is the greatest score.

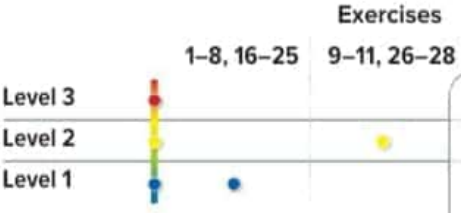
3 Practice and Apply

Independent Practice and Extra Pra

The Independent Practice pages are me homework assignment. The Extra Practic for additional reinforcement or as a seco

Levels of Complexity

The levels of the exercises progress fron indicating the lowest level of complexity.



Suggested Assignments

You can use the table below that include complexity levels to select appropriate e students' needs.

	Differentiated Homework O	
AL	Approaching Level	1–9, 11, 12, 15, 27,
OL	On Level	1–7 odd, 9–12, 15, 27
BL	Beyond Level	9–15, 27, 28

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	13, 14
2 Reason abstractly and quantitatively.	12
3 Construct viable arguments and critique the reasoning of others.	15
4 Model with mathematics.	9
5 Use appropriate tools strategically.	26
6 Attend to precision.	10

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

Ask students to order $\frac{5}{8}$, 60%, and 0.62 from least to greatest. 60%, 0.62, $\frac{5}{8}$

10. **Be Precise** Complete the graphic organizer. Write the original numbers to complete the statement.

Number	Steps to write the number as a decimal with hundredths	Decimal
$\frac{3}{8}$	Divide the numerator by the denominator.	0.375
0.3	The number is a decimal. Annex two zeros.	0.300
38.7%	Move the decimal point two places to the left. Remove the percent symbol.	0.387

So, 0.3 < $\frac{3}{8}$ < 38.7%

11. Order the portion of responses listed in the table from least to greatest.
8%, 17%, 0.2, $\frac{11}{20}$

Number of Times Eating Fast Food per Week	0	1–2	3–4	5+
Portion of Responses	17%	$\frac{11}{20}$	0.2	8%

H.O.T. Problems Higher Order Thinking

12. **Reason Abstractly** Identify three fractions with different denominators that have an LCD of 24. Then arrange the fractions in order from least to greatest.
Sample answer: $\frac{3}{8}$, $\frac{2}{3}$, $\frac{5}{6}$

13. **Persevere with Problems** Consider $\frac{3}{8}$, $\frac{3}{7}$, and $\frac{3}{9}$. from least to greatest without writing equivalent fractions with a common denominator. Explain your strategy.
$\frac{3}{9}$, $\frac{3}{8}$, and $\frac{3}{7}$; Because the numerators are the same, the larger the denominator, the smaller the fraction.

14. **Persevere with Problems** Are the fractions $\frac{3}{9}$, $\frac{3}{10}$, $\frac{3}{11}$, and $\frac{3}{12}$ arranged in order from least to greatest or from greatest to least? Explain.
greatest to least; Sample answer: When fractions have the same numerator, the fraction with the larger denominator will be the smaller fraction.

15. **Construct an Argument** Is 0.4 less than, greater than, or equal to 44%? Explain your reasoning.
less than; Sample answer: 0.4 is equivalent to 0.40, and 44% is equivalent to 0.44. Zero is less than 4 when you compare the hundredths.

Name _____ My Homework _____

Extra Practice

Fill in each ◯ with <, >, or = to make a true statement.

16. $\frac{7}{8}$ ◯ $\frac{5}{6}$ (>)

Homework Help → $\frac{7}{8}=\frac{21}{24}$, $\frac{5}{6}=\frac{20}{24}$

$\frac{21}{24}>\frac{20}{24}$ so $\frac{7}{8}>\frac{5}{6}$

17. $\frac{14}{18}$ ◯ $\frac{7}{9}$ (=)

18. 0.75 ◯ $\frac{1}{2}$ (>)

19. $\frac{1}{3}$ ◯ 0.33 (>)

Order the fractions from least to greatest.

20. $\frac{1}{6}, \frac{2}{5}, \frac{3}{5}, \frac{3}{7}$

$\frac{1}{6}, \frac{2}{5}, \frac{3}{7}, \frac{3}{5}$

21. $\frac{5}{8}, \frac{3}{4}, \frac{1}{2}, \frac{9}{16}$

$\frac{1}{2}, \frac{9}{16}, \frac{5}{8}, \frac{3}{4}$

22. Shop Rite has jeans on sale for $\frac{3}{10}$ off. Save More has jeans on sale for 33% off. Which store has a better sale on jeans? Explain.

Save More; 0.300.33

23. A city's population rose 3% one year, $\frac{2}{50}$ the next year, and 0.08 the next year. Order these increases from least to greatest.

3%, $\frac{2}{50}$, 0.08

Order each set of values from least to greatest.

24. 0.4, $\frac{5}{8}$, 38%

38%, 0.4, $\frac{5}{8}$

25. $\frac{1}{2}$, 0.55, $\frac{5}{7}$

$\frac{1}{2}$, 0.55, $\frac{5}{7}$

26. MP **Use Math Tools** The table shows the favorite subjects of students in a recent survey.

Favorite Subject	
Subject	**Portion of Students**
Art	$\frac{4}{25}$
English	13%
Math	0.28
Other	7%
Science	$\frac{21}{100}$
Social Studies	0.15

a. Did more students choose art or math? Explain.

math; 0.28, $\frac{4}{25}$

b. Which subject did most students choose? Explain.

math; 0.28 is greater than other values in the table.

c. Order the subjects from least to greatest.

other, English, social studies, art, science, math

Power Up! Test Practice

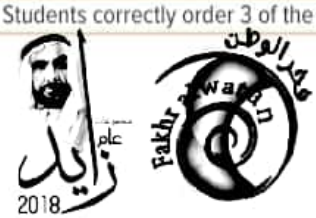
Exercises 27 and 28 prepare students for more rigorous thinking needed for the assessment.

27.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practices	MP2, MP6
Scoring Rubric	
1 point	Students correctly answer the question.

28.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK2
Mathematical Practices	MP1, MP2, MP6
Scoring Rubric	
2 points	Students correctly order all 4 items.
1 point	Students correctly order 3 of the 4 items.



Power Up! Test Practice

27. A plumber needs to drill a hole that is just slightly larger than $\frac{3}{16}$ inch in diameter. Which measure is the smallest but still larger than $\frac{3}{16}$ inch?

- $\frac{5}{32}$ inch
- $\frac{5}{16}$ inch
- ■ $\frac{13}{64}$ inch
- $\frac{9}{32}$ inch

28. Al Farouq Elementary started a recyling program. The display shows the portion of the each item that is recycled at the school. Sort the items from least to greatest amount.

	Recycled Item
Least	glass
	plastic
	aluminum
Greatest	paper

Spiral Review

Round each decimal to the nearest hundredth.

29. 0.623 ≈ 0.62

30. 4.288 ≈ 4.29

31. 5.105 ≈ 5.11

32. In a survey, $\frac{9}{25}$ of students ride the bus to school and $\frac{19}{50}$ walk to school. What fraction of students ride the bus or walk to school?

$\frac{37}{50}$

33. The student council bought 7 bags of apples for their fall celebration. How much did they pay for the apples?

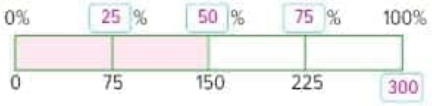
AED 24.15

Lesson 6

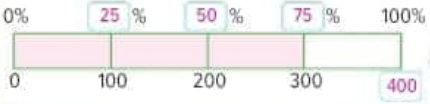
Estimate with Percents

Real-World Link

Movies Seham surveyed 298 students and found that 52% like scary movies. Estimate the number of students that like scary movies.



1. Write the common percents from 0% to 100% at the top of the bar diagram.
2. What common percent is 52% close to? 50%
   Shade the bar diagram above to show your answer.
3. Round 298 to the nearest hundred. 300
   Write your answer in the box below 100%.
4. Use the bar diagram to estimate 52% of 298. Explain.
   Since 52% is close to 50% and 298 is close to 300, I can use the numbers in the bar diagram. Since 150 is 50% of 300, I can estimate that 150 is about 52% of 298.
5. Use the bar diagram below to estimate 73% of 400.



Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

MP Mathematical Practices 1, 3, 4, 5

Which MP Mathematical Practices do you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Estimate the percent of a numb

Coherence onnecting within and ac

Previous	Now	Ne
Students compared and ordered fractions, decimals, and percents.	Students estimate the percent of a number.	Stud perc

Rigor pursuing concepts, fluency, and

See the Levels of Complexity chart on p

ENGAGE EXPLORE EXPLAIN ELABORA

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson using group, think-pair-share activity, or indep

LA **Roundrobin** In groups of 3 reads Exercise 1 aloud and lea complete that exercise. Have Student 2 and lead the discussion to complete tha until all the exercises have been compl group share their responses with the MP

Alternate Strategies

AL Have students explain why finding 2 the same as dividing the number by 4. MP 1, 4

BL Have students explain why finding 7 same as multiplying the number by 3, th by 4. MP 1, 3

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

1. Estimate the percent of a number.

AL • *47% is close to what common percent?* 50%

• *To what value can we round 692?* Sample answer: 700

OL • *Into how many equal sections should we divide the bar diagram? Why?* 2; 50% is half which means two equal parts

• *What percent labels should be across the top of the bar diagram?* 0%, 50%, 100%

• *What values should be across the bottom of the bar diagram?* 0, 350, 700

BL • *Is there another way to generate a different estimate? Explain.* Sample answer: yes; Round 692 to 690. 50% of 690 is 345.

Need Another Example?

Estimate 49% of 302. Sample answer: $\frac{1}{2}$ of 300 is 150.

2. Estimate the percent of a number.

AL • *To what value can we round 77?* Sample answer: 25

OL • *Into how many equal sections should we divide the bar diagram? Why?* 5; 60% is a multiple of 20% and there are five 20%-sections in one whole, 100%

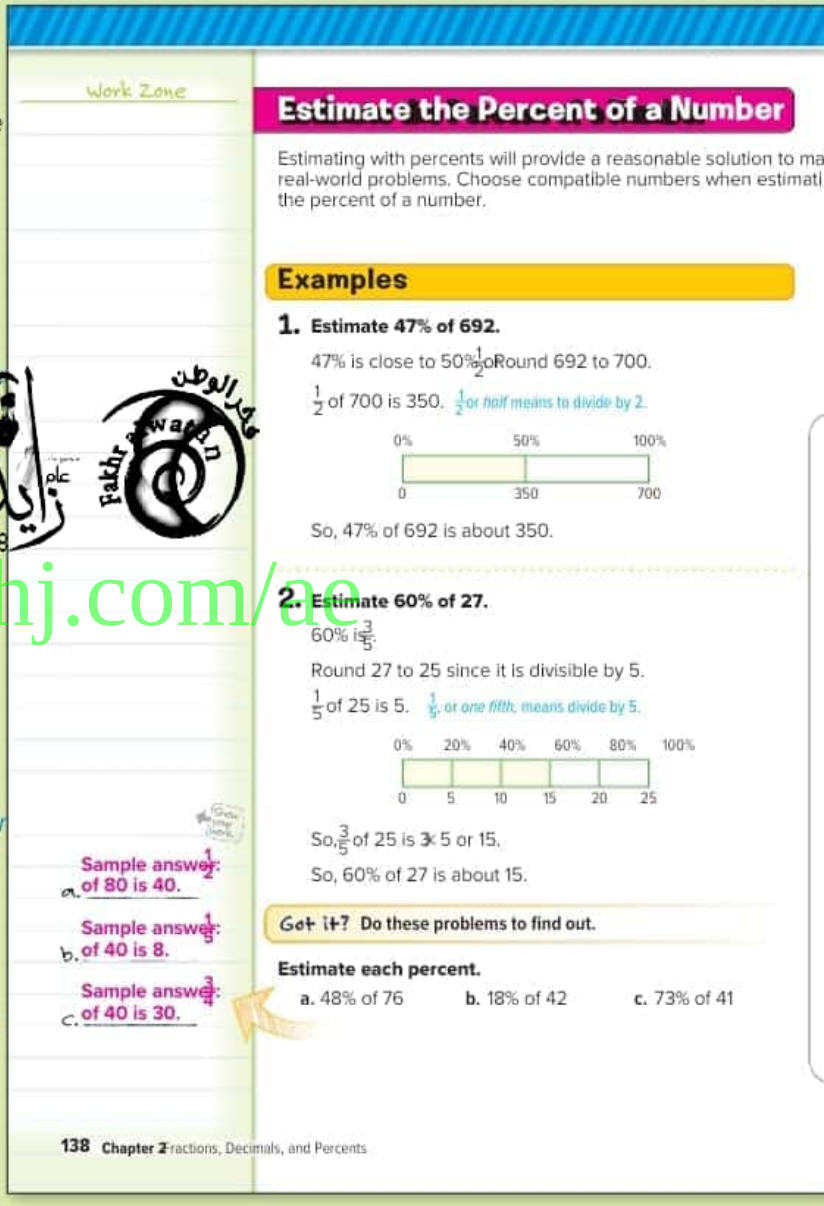
• *What percent labels should be across the top of the bar diagram?* 0%, 20%, 40%, 60%, 80%, 100%

• *What values should be across the bottom of the bar diagram?* 0, 5, 10, 15, 20, 25

BL • *Is there another way to generate a different estimate? Explain.* Sample answer: yes; Round 27 to 30. 60% of 30 is 18.

Need Another Example?

Estimate 80% of 1,635. Sample answer: $\frac{1}{5}$ of 1,500 = 300; $4 \times 300 = 1{,}200$



Work Zone

Estimate the Percent of a Number

Estimating with percents will provide a reasonable solution to ma real-world problems. Choose compatible numbers when estimati the percent of a number.

Examples

1. **Estimate 47% of 692.**

47% is close to 50% or $\frac{1}{2}$. Round 692 to 700.

$\frac{1}{2}$ of 700 is 350. $\frac{1}{2}$ or *half* means to divide by 2.

So, 47% of 692 is about 350.

2. **Estimate 60% of 27.**

60% is $\frac{3}{5}$.

Round 27 to 25 since it is divisible by 5.

$\frac{1}{5}$ of 25 is 5. $\frac{1}{5}$ or *one fifth*, means divide by 5.

So, $\frac{3}{5}$ of 25 is 3×5 or 15.

So, 60% of 27 is about 15.

Got it? Do these problems to find out.

Estimate each percent.

a. 48% of 76 b. 18% of 42 c. 73% of 41

a. Sample answer: $\frac{1}{2}$ of 80 is 40.

b. Sample answer: $\frac{1}{5}$ of 40 is 8.

c. Sample answer: $\frac{3}{4}$ of 40 is 30.

138 Chapter 2 Fractions, Decimals, and Percents

Example

3. STEM **Polar bears can eat as much as 10% of their body weight in less than one hour. If an adult male polar bear weighs 715 pounds, about how much food can he eat in one hour?**

To determine how much food a polar bear can eat in one hour, you need to estimate 10% of 715.

Method 1 **Find equivalent ratios.**

$10\% = \frac{1}{10}$ and $715 \approx 700$

$\frac{1}{10} = \frac{■}{700}$ Write the equivalent ratios.

$\frac{1}{10} \overset{\times 70}{=} \frac{■}{700}$ Since $10 \times 70 = 700$, multiply 1 by 70.

The unknown value is 70.

Method 2 **Use mental math.**

$10\% = \frac{1}{10}$ and $715 \approx 700$

$\frac{1}{10}$ of 700 is 70.

So, a polar bear can eat about 70 pounds of food in one hour.

Got it? Do this problem to find out.

d. Safiya decided to donate 30% of her savings. If she has AED 238 in her savings account, about how much will she donate?

d. about AED 70

Estimate Using the Rate per 100

You can also estimate with percents using a rate per 100.

Examples

4. **Estimate 17% of 198.**

$17\% = 17$ out of 100 Write the percent as a rate per 100.

$198 \approx 200$ Round to the nearest hundred.

Since 200 is 2×100, add $17 + 17$ to estimate 17% of 198.

34 is about 17% of 198.

Stop and Reflect

When would you use mental math to estimate the percent of a number? Explain below.

Sample answer: You might use mental math to find the amount discounted at a sale.

Examples

3. Estimate part of a whole to solve a real-world example.

AL
- *What is the problem asking you to find?* how many pounds of food a polar bear can eat in one hour
- *What information are you given?* the weight of the polar bear

OL
- *To what number can we round 715?* Sample answer: 700
- *What is 10% of 700?* 70

BL
- *Without using a bar diagram, is there another method you could use to find 10% of 700?* Sample answer: To find 10% of a number, divide by 10 or move the decimal point one place to the left. So, 10% of 700 is 70.

Need Another Example?

A CD that originally cost $11.90 is on sale for 25% off. About how much will you save by buying the CD on sale? about $3

4. Estimate the percent of a number using a rate per 100.

AL
- *To what value could we round 198?* Sample answer: 200
- *How many 100s are in 200?* 2
- *What is 17% of 100?* 17

OL
- *How can you write 17% as a rate per 100?* 17 out of 100
- *Write an addition expression you can use to estimate 17% of 198.* 17 + 17

BL
- *Is there another method you could use to solve this problem? Explain.* Sample answer: Round 17% to 20%. Find 10% of 200, which is 20. Then add to find 20%: 20 + 20 = 40. So, 17% of 198 is about 40.
- *Write a real-world problem that could represent this example.* Sample answer: A store is selling an MP3 player that sells for $198 at 17% off. By about how much is the price reduced for the sale? $34

Need Another Example?

Estimate 27% of 512. Sample answer: 27 + 27 + 27 + 27 + 27 = 135

Example

5. Estimate the percent of a number using a rate per 100.

AL
- *To what value could we round 398?* Sample answer: 400
- *How many 100s are in 400?* 4
- *What is 9% of 100?* 9

OL
- *How can you write 9% as a rate per 100?* 9 out of 100
- *Write a multiplication expression you can use to estimate 9% of 408.* 9 × 4

BL
- *Is there another method you could use to solve this problem? Explain.* Sample answer: Round 9% to 10%. Find 10% of 400, which is 40.

Need Another Example?

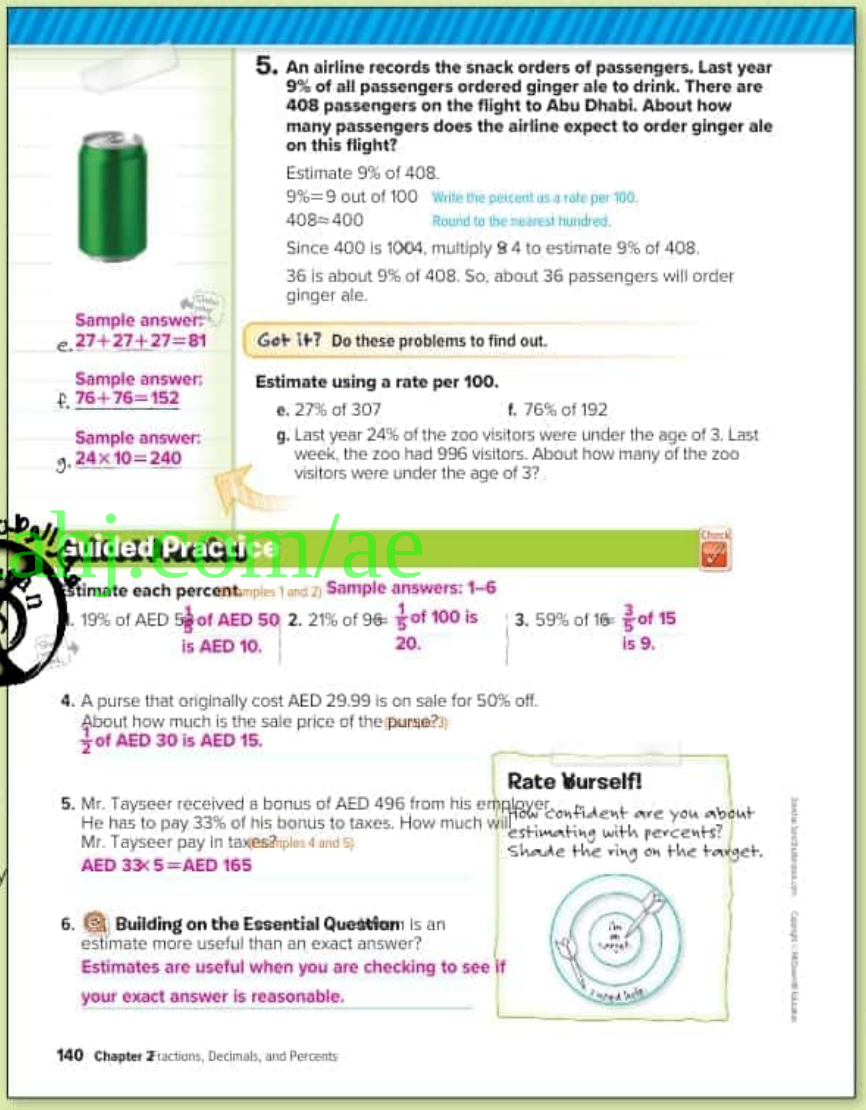
Marcie surveyed the students in her grade and learned that 64% of them have a pet. If there are 279 students in sixth grade, about how many have a pet? Sample answer: 64 3 = 192 students

Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in the lesson.

If some of your students are not ready for assignments, use the differentiated activity below.

AL LA **Find the Fib** Have students work in pairs to write three different estimates for one chosen exercise. Two of the estimates should be reasonable and the third should be a "fibbed" estimate, an unreasonable estimate. Have students trade papers with another pair of students to correctly identify the reasonable estimates and the fibbed estimate. MP 1, 3



5. An airline records the snack orders of passengers. Last year 9% of all passengers ordered ginger ale to drink. There are 408 passengers on the flight to Abu Dhabi. About how many passengers does the airline expect to order ginger ale on this flight?

Estimate 9% of 408.

9% = 9 out of 100 Write the percent as a rate per 100.

408 ≈ 400 Round to the nearest hundred.

Since 400 is 100 4, multiply 9 4 to estimate 9% of 408.

36 is about 9% of 408. So, about 36 passengers will order ginger ale.

Sample answer: e. 27 + 27 + 27 = 81

Sample answer: f. 76 + 76 = 152

Sample answer: g. 24 × 10 = 240

Get It? Do these problems to find out.

Estimate using a rate per 100.

e. 27% of 307 f. 76% of 192

g. Last year 24% of the zoo visitors were under the age of 3. Last week, the zoo had 996 visitors. About how many of the zoo visitors were under the age of 3?

Guided Practice Check

Estimate each percent. (Examples 1 and 2) Sample answers: 1–6

1. 19% of AED 50 $\frac{1}{5}$ of AED 50 is AED 10.
2. 21% of 96 $\frac{1}{5}$ of 100 is 20.
3. 59% of 16 $\frac{3}{5}$ of 15 is 9.

4. A purse that originally cost AED 29.99 is on sale for 50% off. About how much is the sale price of the purse? (Example 3) $\frac{1}{2}$ of AED 30 is AED 15.

5. Mr. Tayseer received a bonus of AED 496 from his employer. He has to pay 33% of his bonus to taxes. How much will Mr. Tayseer pay in taxes? (Examples 4 and 5) AED 33 × 5 = AED 165

6. **Building on the Essential Question** How is an estimate more useful than an exact answer? Estimates are useful when you are checking to see if your exact answer is reasonable.

Rate Yourself!

How confident are you about estimating with percents? Shade the ring on the target.

Name _____ My Homework _____

Independent Practice

Estimate each percent (Examples 1 and 2) **Sample answers: 1–7**

1. 47% of AED 118: $\frac{1}{2}$ of AED 120 is AED 60.
2. 19% of 72: $\frac{1}{5}$ of 70 is 14.
3. 42% of 16: $\frac{2}{5}$ of 15 is 6.
4. 67% of 296: $\frac{2}{3}$ of 300 is 200.

Estimate using a rate per 100. (Example 4)

5. 24% of 289: 24+24+24=72
6. 67% of 208: 67+67=134

7. STEAM Penguins spend almost 75% of their lives in the sea. An Emperor Penguin in the wild has a life span of about 18 years. About how many years does this penguin spend in the sea? (Example 3) $\frac{3}{4}$ of 20 yr is 15 yr.

8. In Mohsen's baseball card collection, 58% of the cards are players from the National League. He has 702 baseball cards. About how many baseball cards are players from the National League? Use a rate per 100 to estimate. (Example 5) about 406; 587=406

9. MP **Model with Mathematics** Refer to the graphic novel frame below for Exercises a–b.

a. Suppose Jalal is shooting baskets and makes 40% of the 15 shots. Does he win a prize? Explain your reasoning.
no; 40% if $\frac{2}{5}$, and $\frac{2}{5}$ of 15 is 6. He needs 7 baskets to win a prize.

b. About what percent of the baskets need to be made in order to win a prize? about 50%

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

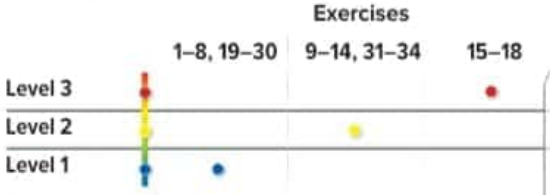
3 Practice and Apply

Independent Practice and Extra Practice

The Independent Practice pages are meant to be use homework assignment. The Extra Practice page can for additional reinforcement or as a second-day assig

Levels of Complexity

The levels of the exercises progress from 1 to 3, with indicating the lowest level of complexity.



Suggested Assignments

You can use the table below that includes exercises complexity levels to select appropriate exercises fo students' needs.

Differentiated Homework Options		
AL	Approaching Level	1–9, 11, 13, 15, 17, 18, 33, 34
OL	On Level	1–9 odd, 10–15, 17, 18, 33, 34
BL	Beyond Level	9–18, 33, 34

Watch Out!

Common Error Watch for students who use incorrect for percents, such as $\frac{1}{2}$ for 20% or $\frac{1}{4}$ for 40%. Suggest that students create and use a chart with common fractio equivalents.

MATHEMATICAL PRACTICES	
Emphasis On	**Exercise(s)**
1 Make sense of problems and persevere in solving them.	16
3 Construct viable arguments and critique the reasoning of others.	15, 17
4 Model with mathematics.	9, 18
5 Use appropriate tools strategically.	12–14, 31, 32

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET Out the Door

Have students find a reasonable estimate for 78% of 39.
Sample answer: $\frac{4}{5} \times 40 = 32$

10. About 42% of Alaska's population lives in the city of Anchorage. If Alaska has a total population of 648,818, about how many people live in Anchorage?
Sample answer: about 260,000; $\frac{2}{5}$ of 650,000 is 260,000.

11. During the basketball season, Fahd made 37 baskets out of 71 attempts. About what percent of his shots did he miss?
Sample answer: 71 − 37 = 34 missed shots and $\frac{34}{71}$ is about $\frac{35}{70}$ or $\frac{1}{2}$. Since $\frac{1}{2} = 50\%$, he missed about 50% of his shots.

Use Math Tools Estimate the percent that is shaded in each figure.

12.  about 25%

13.  about 75%

14.  about 40%

H.O.T. Problems Higher Order Thinking

15. **Reason Inductively** Noura wants to buy a shirt regularly priced at AED 32. It is on sale for 40% off. Noura estimates that she will save $\frac{2}{5}$ of AED 30 or AED 12. Will the actual amount be more or less than AED 12? Explain.
more; Noura rounded AED 32 down to AED 30, so the actual amount she will save will be more than AED 12.

16. **Persevere with Problems** Order 10% of 20, 20% of 20, $\frac{1}{5}$ of 20 from least to greatest. $\frac{1}{5}$% of 20, 10% of 20, 20% of 20

17. **Construct an Argument** A classmate is trying to estimate 42% of AED 122. Explain how your classmate should solve the problem.
Sample answer: First, round 42% to 40%, and AED 122 to AED 125. Next, rewrite 40% as $\frac{2}{5}$. Then find $\frac{1}{5}$ of AED 125. Finally, multiply this result by 2 to find $\frac{2}{5}$ of AED 125.

18. **Model with Mathematics** Marwa's homeroom has raised 63% of its goal for the school fundraiser. Marwan's homeroom has raised 48%. Create a situation in which Marwan's homeroom raised more money than Marwa's homeroom. Sample answer: Marwa's homeroom has raised 63% of its goal to raise AED 500 for the school fundraiser. Marwan's homeroom has raised 48% of its AED 1,000 goal. How much has each homeroom raised? Marwa's homeroom: AED 315; Marwan's homeroom: AED 480

Name _____ My Homework _____

Extra Practice

Estimate each percent. Sample answers: 19–30

19. 53% of 59
$\frac{1}{2}$ of 60 is 30.
53% is close to 50% or $\frac{1}{2}$. Round 59 to 60.

20. 35% of 147
$\frac{1}{3}$ of 150 is 50.

21. 26% of 125
$\frac{1}{4}$ of 120 is 30.

22. 79% of 82
$\frac{4}{5}$ of 80 is 64.

Estimate using a rate per 100.

23. 19% of 288
19 + 19 + 19 = 57

24. 74% of 315
74 + 74 + 74 = 222

25. 61% of 407
61 + 61 + 61 + 61 = 244

26. 89% of 195
89 + 89 = 178

27. Hamdan spent 8 hours and 15 minutes at an amusement park yesterday. He spent 75% of the time at the park on rides. About how much time did he spend on rides?
$\frac{3}{4}$ of 8 h is 6 h.

28. A group of friends went on a hiking trip. They planned to hike a total of 38 kilometers. They want to complete 25% of the hike by the end of the first day. About how many kilometers should they hike the first day?
about 10 kilometers

29. Sara has just finished her sixth grade scrapbook. In her scrapbook, 47% of the pages include her twin sister, Sana. The scrapbook has 896 photos. About how many photos include Sana? Use a rate per 100 to estimate.
about 423; 479 = 423

30. The community garden has 596 vege... In the garden, 64% of the vegetables ... green vegetables. About how many vegetables in the garden are green? Use a rate per 100 to estimate.
about 384; 646 = 384

Use Math Tools Estimate the percent that is shaded in each figure.

31. about 75%

32. about 60%

Power Up! Test Practice

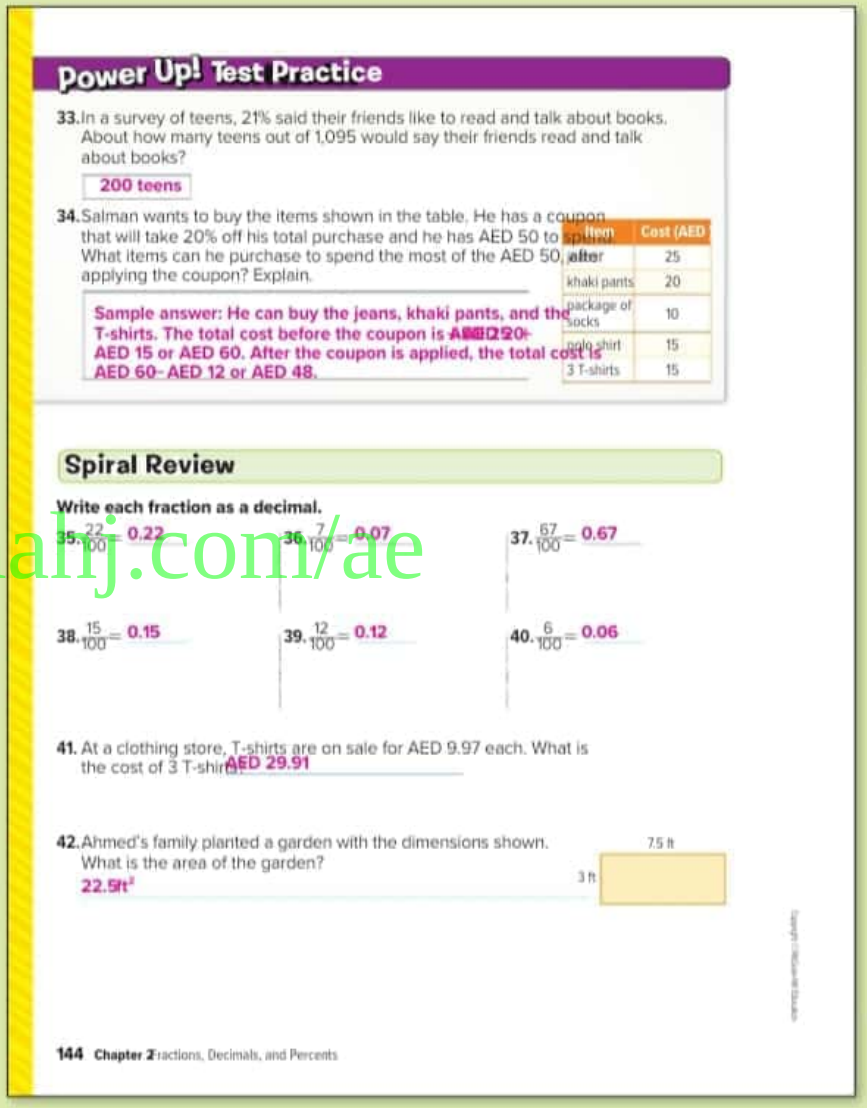
Exercises 33 and 34 prepare students for more rigorous thinking needed for the assessment.

33.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP1
Scoring Rubric	
1 point	Students correctly answer the question.

34.

This test item requires students to support their reasoning or evaluate the reasoning of others by justifying their response and constructing arguments.	
Depth of Knowledge	DOK3
Mathematical Practices	MP2, MP3
Scoring Rubric	
2 points	Students determine the items that can be purchased AND explain the process.
1 point	Students select the appropriate items, but fail to explain.



Power Up! Test Practice

33. In a survey of teens, 21% said their friends like to read and talk about books. About how many teens out of 1,095 would say their friends read and talk about books?

200 teens

34. Salman wants to buy the items shown in the table. He has a coupon that will take 20% off his total purchase and he has AED 50 to spend. What items can he purchase to spend the most of the AED 50, after applying the coupon? Explain.

Item	Cost (AED)
jeans	25
khaki pants	20
package of socks	10
polo shirt	15
3 T-shirts	15

Sample answer: He can buy the jeans, khaki pants, and the T-shirts. The total cost before the coupon is AED 25+ AED 15 or AED 60. After the coupon is applied, the total cost is AED 60− AED 12 or AED 48.

Spiral Review

Write each fraction as a decimal.

35. $\frac{22}{100} = 0.22$ **36.** $\frac{7}{100} = 0.07$ **37.** $\frac{67}{100} = 0.67$

38. $\frac{15}{100} = 0.15$ **39.** $\frac{12}{100} = 0.12$ **40.** $\frac{6}{100} = 0.06$

41. At a clothing store, T-shirts are on sale for AED 9.97 each. What is the cost of 3 T-shirts?

AED 29.91

42. Ahmed's family planted a garden with the dimensions shown. What is the area of the garden?

22.5 ft²

Inquiry Lab
Percent of a Number

Inquiry **HOW can you model the percent of a number?**

MP Mathematical Practices 1, 3, 4

There were 180 people in a movie theater. Twenty percent of them received the student discount and 10% received the senior citizen discount. The rest did not receive a discount. How many people did not receive a discount?

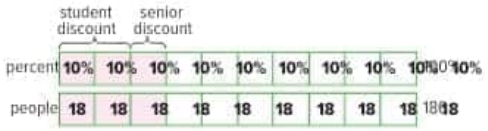
What do you know? Of 180 people, 20% received student discounts and 10% received senior citizen discounts.

What do you need to find? the number of people who did not receive a discount

Hands-On Activity

Model the situation using two bar diagrams.

Step 1 Use a bar diagram to represent 100%. Then use another bar diagram of equal length to represent 180 people.



Step 2 Divide each bar into 10 equal parts. Think: 180 ÷ 10 = 18

So, each part of 180 represents 18 people.

Step 3 Determine how many people did not receive a discount. Shade 2 sections of each bar diagram to represent the student discount. Shade 1 section of each bar diagram to represent the senior discount.

There are 7 unshaded sections in each bar diagram.

7 × 18 = 126

So, 126 people at the movie did not receive a discount.

Focus narrowing the scope

Objective Model the percent of a number.

Coherence connecting within and across grades

Now Students use models to find the percent of a number.

Next Students will find the percent of a number.

Rigor pursuing concepts, fluency, and application

See the Levels of Complexity chart on page 146.

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

1 Launch the Lab

The activity is intended to be used as a whole-group

Hands-On Activity

AL BL LA **Circle the Sage** Poll students to determine who has a solid understanding of using models, such as diagrams, to model percents. Have those students (the sages) spread out around the room. Create teams with the remaining students. Send team members to work with a sage, making sure there are no two team members work with the same sage. If possible. Have the sages lead the activity, making sure that everyone in the group understands and can explain the concepts to others. When the activity is complete, send the students back to their original teams to discuss solutions and differences in how the activity was taught by the sages.

MP 1, 3, 5

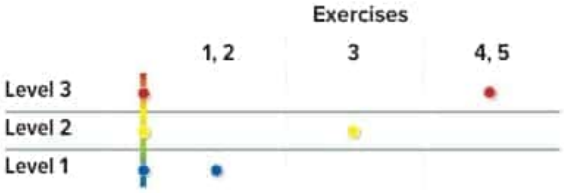
ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

2 Collaborate

The **Investigate** and **Analyze and Reflect** sections are intended to be used as small-group investigations. The **Create** section is intended to be used as independent exercises.

Levels of Complexity

The levels of the exercises progress from 1 to 3, with Level 1 indicating the lowest level of complexity.



Analyze and Reflect

AL LA **Think-Pair-Share** Give students one minute to think through their response to Exercise 3. Have them verbally share their response with their partner, making sure to speak clearly and then listen carefully while their partner speaks. Have students correct any errors. Then call on students to share their response with the whole class.

Create

BL LA **Trade-a-Problem** Have students omit their answer to the problem they wrote in Exercise 4. Then have them trade their problems with a partner. Each partner solves the other student's problem. Upon completion, have them discuss and resolve any differences in the solutions.

Inquiry Students should be able to answer "How can you model the percent of a number?" Check for student understanding and provide guidance, if needed.

Investigate

Model with Mathematics Work with a partner. Find the part of each whole using two bar diagrams.

1. 50% of 80 children 40 children

50%	50%	100%
40	40	children

2. 25% of $32 $8

25%	25%	25%	25%	100%
8	8	8	8	$32

Analyze and Reflect

3. **Reason Inductively** Explain how to use two bar diagrams to find 45% of AED 60.
Sample answer: Divide each bar into 20 sections. Each section represents 5%. Nine sections will be shaded since 9 × 5 = 45. Since 60 ÷ 20 = 3, each section also represents AED 3. So, 45% of AED 60 is AED 27 because 9 × 3 = 27.

Create

4. **Model with Mathematics** Write and solve a real-world problem about finding the percent of a number.
Sample answer: A survey showed that 70% of middle school students buy their lunch. There are 280 students at a school. How many students buy their lunch? 196 students

5. Inquiry HOW can you model the percent of a number?
Sample answer: You can use two bar diagrams of equal length. Divide each bar diagram into equal parts to find your answer.

Ratios and Proportional Relationships

Lesson 7

Percent of a Number

Real-World Link

Snacks In a survey, 200 students chose their favorite snacks. Use the table to find the number of students who chose each snack.

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

MP Mathematical Practices 1, 3, 4, 5

Snack	Percent	Fraction	Equivalent Fraction	Number of Responses
Fruit	23%	$\frac{23}{100}$	$\frac{46}{200}$	46 out of 200
Cheese	15%	$\frac{15}{100}$	$\frac{30}{200}$	30 out of 200
Veggies	17%	$\frac{17}{100}$	$\frac{34}{200}$	34 out of 200
Cookies	15%	$\frac{15}{100}$	$\frac{30}{200}$	30 out of 200
Chips	18%	$\frac{18}{100}$	$\frac{36}{200}$	36 out of 200
No Snack	12%	$\frac{12}{100}$	$\frac{24}{200}$	24 out of 200

Check Add the number of responses in the last column.

46 + 30 + 34 + 30 + 36 + 24 = 200 ✓

1. How does finding the percent as a rate per 100 help you find the number of responses out of 200?

Sample answer: You can use the fraction with a denominator of 100 to find an equivalent fraction with a denominator of 200, the total number of responses.

Which MP Mathematical Practices do you use? Shade the circle(s) that applies.

- ① Persevere with Problems
- ② Reason Abstractly
- ③ Construct an Argument
- ④ Model with Mathematics
- ⑤ Use Math Tools
- ⑥ Attend to Precision
- ⑦ Make Use of Structure
- ⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Find the percent of a number.

Coherence connecting within and across grades

Previous	Now	Next
Students used models to find the percent of a number.	Students find the percent of a number.	Students will solve percent problems.

Rigor pursuing concepts, fluency, and application

See the Levels of Complexity chart on page 151.

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson using a whole group, think-pair-share activity, or independent activity.

LA **Pairs Discussion** Have students work in pairs to complete the table. Have them discuss how they would alter the table if there were a total of 300 students. MP 1, 3, 5

Alternate Strategies

AL LA Remind the students that they find equivalent fractions by multiplying the numerator and denominator by the same number. Ask them why they used the factor 2 in all of the problems. MP 1

BL Ask the students how they would alter the table if there were 250 students. Have them complete the table for a total of 250 students. MP 1, 5

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Example

1. Find the percent of a number.

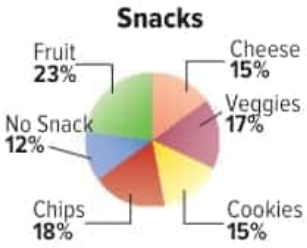
AL
- *What percent of students bring cheese as a snack?* 15%
- *How many students are at the middle school?* 300

OL
- *What is 15% written as a fraction in simplest form?* $\frac{3}{20}$
- *To find $\frac{3}{20}$ of 300, what operation must you perform?* multiplication
- *Explain the steps in finding $\frac{3}{20} \times 300$.* Sample answer: Write 300 as an improper fraction. Then divide 20 and 300 by their GCF, 20. Then find 15, which is 45.

BL
- *Compare and contrast Method 1 and Method 2. Which do you prefer?* Method 1 uses the percent written as a fraction. Method 2 uses the percent written as a decimal; See students' preferences.

Need Another Example?

Refer to the circle graph below. Suppose there are 300 students at York Middle School. Find the number of students that have veggies as a snack. 51 students



Work Zone

STOP and Reflect

If 50 students were surveyed, how many students chose no snack?

6 students

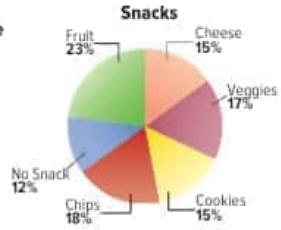
54 students

Find the Percent of a Number

You can use fractions and decimals to find the percent of a number. To find the percent of a number, write the percent as a fraction with a denominator of 100. Then multiply the fraction by the number.

Example

1. Refer to the circle graph. Suppose there are 300 students at Ajyad Middle School. Find the number of students that have cheese as a snack.



Method 1 Write the percent as a fraction.

$15\% = \frac{15}{100} = \frac{3}{20}$ Write the percent as a rate per 100.

$\frac{3}{20}$ of $300 = \frac{3}{20} \times 300$ Multiply.

$= 45$

Method 2 Write the percent as a decimal.

$15\% = 0.15$

0.15 of $300 \rightarrow 0.15 \times 300$

$= 45$

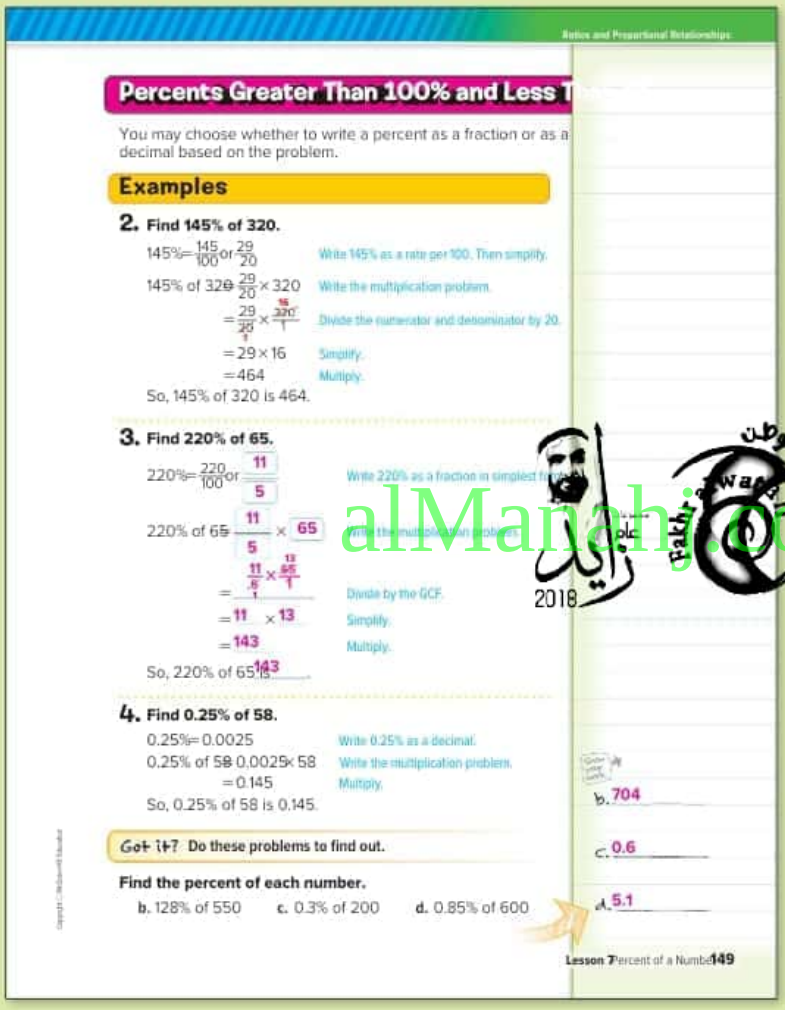
So, 45 students have cheese as a snack.

Check Use a bar diagram.

$30 + \frac{1}{2} \times 30 = 30 + 15$ or 45 ✓

Got it? Do this problem to find out.

a. Find the number of students at Ajyad Middle School that have chips as a snack.



Ratios and Proportional Relationships

Percents Greater Than 100% and Less T

You may choose whether to write a percent as a fraction or as a decimal based on the problem.

Examples

2. **Find 145% of 320.**

$145\% = \frac{145}{100}$ or $\frac{29}{20}$ — Write 145% as a rate per 100. Then simplify.

145% of 320 $\frac{29}{20} \times 320$ — Write the multiplication problem.

$= \frac{29}{\cancel{20}_{1}} \times \frac{\cancel{320}^{16}}{1}$ — Divide the numerator and denominator by 20.

$= 29 \times 16$ — Simplify.

$= 464$ — Multiply.

So, 145% of 320 is 464.

3. **Find 220% of 65.**

$220\% = \frac{220}{100}$ or $\frac{11}{5}$ — Write 220% as a fraction in simplest form.

220% of 65 $\frac{11}{5} \times 65$ — Write the multiplication problem.

$= \frac{11}{\cancel{5}_{1}} \times \frac{\cancel{65}^{13}}{1}$ — Divide by the GCF.

$= 11 \times 13$ — Simplify.

$= 143$ — Multiply.

So, 220% of 65 is 143.

4. **Find 0.25% of 58.**

$0.25\% = 0.0025$ — Write 0.25% as a decimal.

0.25% of 58 0.0025×58 — Write the multiplication problem.

$= 0.145$ — Multiply.

So, 0.25% of 58 is 0.145.

Got It? Do these problems to find out.

Find the percent of each number.

b. 128% of 550 c. 0.3% of 200 d. 0.85% of 600

b. 704

c. 0.6

d. 5.1

Examples

2. **Find the percent of a number.**

AL • *Is $\frac{145}{100}$ in simplest form?* no

OL • *How do you simplify $\frac{145}{100}$?* Divide 145 and 100 by their GCF, 5.

• *What is 145% written as a fraction in simplest form?* $\frac{29}{20}$

• *How would you find $\frac{29}{20}$ of 320?* Multiply $\frac{29}{20}$ by 320.

BL • *How do you know that the answer is reasonable?* 145% is almost 150%. 100% of 320 is 320 and 50% of 32 is 160; 320 + 160 = 480 and 464 is close to 480.

Need Another Example?
Find 125% of 140. 175

3. **Find the percent of a number.**

AL • *What is 220% written as an improper fraction in simplest form?* $\frac{11}{5}$

OL • *Write an equation to find 220% of 65.* $\frac{11}{5} \times 65 = 143$ or $\frac{11}{5} \times \frac{65}{1} = 143$

BL • *How can you check the reasonableness of the answer?* Sample answer: 220% will be more than twice the value. $65 \times 2 = 130$, so an answer of 143 is reasonable.

Need Another Example?
Find 275% of 60. 165

4. **Find the percent of a number.**

AL • *To write 0.25% as a decimal, do you move the decimal point two places to the right or two places to the left?* two places to the left

OL • *How would you find 0.0025 of 58?* Multiply 0.0025 by 58.

BL • *How can you check the reasonableness of the answer?* Sample answer: 0.25% is less than 1% of the value. 1% of 58 is 0.58. So, an answer of 0.145 is reasonable.

Need Another Example?
Find 0.45% of 50. 0.2475

Example

5. Solve a real-world problem involving the percent of a number.

AL • *What is the problem asking you to find?* how many athletes competed in soccer

• *How many total players were on the Special Olympics team?* 70 *What percent of the team played soccer?* 20%

OL • *What decimal is equivalent to 20%?* 0.20 or 0.2

BL • *Explain another method to solve the problem.* Sample answer: Change 20% to the fraction $\frac{1}{5}$ and multiply by 70.

Need Another Example?
A sandwich shop sold 75 sandwiches at lunchtime. Twelve percent of the sandwiches were grilled cheese. How many grilled-cheese sandwiches did the shop sell? 9

Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Think-Pair-Share** Have pairs of students work on each exercise, with one student using a bar diagram to find the percent of each number, and the other student writing each percent as a fraction or decimal and multiplying by the number. Ask the pair to discuss the advantages and disadvantages of each method. MP 1, 3, 5

BL LA **Pairs Consult** Have pairs of students use the Internet, or another source, to locate an item that can be purchased for a certain amount and with a certain percent of discount. Have pairs find the amount that is discounted. Then have them determine the final price of the item, not including tax. MP 1, 5

Example

5. In a recent state Special Olympics meet, Abu Dhabi s a team of 70 players. Twenty percent of the team co soccer. How many athletes competed in soccer?

20% = 0.20 Write 20% as a decimal.
20% of 70 = 0.2 × 70 Write the multiplication problem.
= 14 Multiply.

So, 14 team members were soccer players.

Got it? Do this problem to find out.

e. In the same meet, 15% of the team from Sharjah compe tennis. If there were 20 members on the team, how many competed in tennis? e. 3

Guided Practice

Find the percent of each number. Examples 1–4

1. 32% of 60 = 19.2
2. 0.55% of 220 = 1.21
3. 275% of 4 = 11

4. Hassan wants to buy a jersey of his favorite team. The jersey is 30% off the original price. If the original price of the jersey is AED 35, what is the amount Hassan will save? AED 10.50

5. **Building on the Essential Question** How do you find a percent of a number?
Sample answer: Write the percent as a decimal. Multiply the decimal by the whole to find the part.

Rate Yourself!
Are you ready to move on? Shade the section that

YES ? NO

FOLDABLES Time to update your Fold

150 Chapter 2 Fractions, Decimals, and Percents

Name _____ My Homework _____

Independent Practice

The cafeteria at a middle school surveyed 575 students about their favorite food. Find the number of students that responded for each of the following. (Example 1)

1. chicken: 8% — 46
2. salad: 20% — 115
3. burgers: 16% — 92
4. fruit: 24% — 138

Find the percent of each number. (Examples 2–4)

5. 0.9% of 1,000 — 9
6. 0.46% of 80 — 0.368
7. 350% of 96 — 336
8. 222% of 55 — 122.1

9. The original price of a pair of shoes is AED 42. The sale price is 20% off the original price. What is the amount off the original price? (Example 5) — AED 8.40

10. Ibtisam had AED 20 to buy a birthday present for her dad. She decided to buy a DVD for AED 18. The sales tax is 7%. Does she have enough money? Explain your reasoning. — yes; Sample answer: The total price with sales tax is AED 19.26.

11. Twenty-four students in Jamal's class are wearing tennis shoes. There are thirty students in his class. Jamal says that 70% of his class is wearing tennis shoes. Is Jamal correct? Explain your reasoning. — no; 70% of 30 is 21, not 24. 80% of 30 is 24.

12. **Use Math Tools** Mariam keeps track of her weekly quiz grades as shown in the table.

Test	Number Correct	Score	Total
Math	68	80%	85
Science	63	90%	70

a. Complete the table.

b. In which class did Mariam have the higher score? — science

c. Suppose Mariam scored a 96% on an English test. There were 50 questions on the test. How many did Mariam answer correctly? — 48 questions

3 Practice and Appl

Independent Practice and Extra

The Independent Practice pages are homework assignment. The Extra Pr for additional reinforcement or as a

Levels of Complexity

The levels of the exercises progress indicating the lowest level of comple

Exercis

	1–9, 18–31	10–13, 32
Level 3		
Level 2		
Level 1		

Suggested Assignments

You can use the table below that in complexity levels to select appropri students' needs.

	Differentiated Homewo	
AL	Approaching Level	1–9, 11, 13–15
OL	On Level	1–9 odd, 10–15,
BL	Beyond Level	10–17, 33, 34

Watch Out!

Common Error Watch for students wh incorrect decimals, especially when decimals, have more than two digits. Remind students to divide by 100 or two places to the left when changing

MATHEMATICAL PRACTICES	
Emphasis On	**Exercise(s)**
1 Make sense of problems and persevere in solving them.	16, 17
3 Construct viable arguments and critique the reasoning of others.	15
4 Model with mathematics.	14
5 Use appropriate tools strategically.	12, 13, 32

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET
Out the Door

Ask students to find 17% of 193.

13. **Use Math Tools** Use the graphic organizer to compare and contrast percents and fractions. Use the phrases *less than*, *equal to*, and *greater than* to complete each statement. Write an example in the space provided.
Sample answers given for examples.

Percent	Shared Concept	Fraction
A whole is represented by a percent that is **equal to** 100%. Example: **100%**	whole	A whole is represented by a fraction with a numerator that is **equal to** the denominator. Example: $\frac{3}{3}$
Part of a whole is represented by a percent that is **less than** 100%. Example: **25%**	part of a whole	Part of a whole is represented by a fraction with a numerator that is **less than** the denominator. Example: $\frac{1}{3}$
An amount that is greater than one is represented by a percent that is **greater than** 100%. Example: **125%**	more than one	An amount that is greater than one is represented by a fraction with a numerator that is **greater than** the denominator. Example: $\frac{4}{3}$

H.O.T. Problems Higher Order Thinking

14. **Model with Mathematics** Write and solve a real-world problem in which the part of a whole results in a number greater than the whole itself.
Sample answer: The population of goldfish in a backyard pond grew by 150% over the summer. If there were originally 46 fish, what was the population at the end of the summer? 115 goldfish

15. **Justify Conclusions** Is 16% of 40 the same as 40% of 16? Explain your reasoning.
yes; 16% of 40 is 6.4 and 40% of 16 is 6.4.

16. **Persevere with Problems** Find 15% of 15% of 15% of 500. How does this compare to finding 45% of 500?
1.6875; It is less than 45% of 500, which is 225.

17. **Persevere with Problems** A number n is 25% of some number a and 35% of a number b. Is $a > b$, $a < b$, or is it impossible to determine the relationship? Explain.
Sample answer: If a number n is 25% of a and 35% of b, it is a greater part of b than it is of a. So, a

Name _____ My Homework _____

Extra Practice

Find the percent of each number.

18. 6% of 95
5.7

6% = 0.06
0.06 × 95 = 5.7

19. 15% of 110
16.5

20. 75% of 260
195

21. 28% of 575
161

22. 0.6% of 36
0.216

23. 108% of 148
159.84

24. 102% of 750
765

25. 0.03% of 1,500
0.45

26. Khuloud completes 65% of her first serves. If she attempted 80 first serves last match, how many did she complete?
52

27. Masoud is mixing a cleaning solution that is 12% bleach. After mixing the solution, Masoud has 150 ounces of cleaning solution. How many ounces of bleach did Masoud use?
18 ounces of bleach

28. What is 38% of 250?
95

29. 76% of 524 is what number?
398.24

30. What is 26% of 360?
93.6

31. 55% of 387 is what number?
212.85

32. **Use Math Tools** Mr. Abdalla tracks sales of ski equipment each week for a month. Complete the table to determine which week had the highest percent of ski equipment sales.
Week 2

Week Number	Ski Equipment Sales (AED)	Percent of Total Sales	Total Sales (AED)
1	200	50	400
2	175	70	250
3	195	65	300
4	110	40	275

Power Up! Test Practice

Exercises 33 and 34 prepare students for more rigorous thinking needed for the assessment.

33.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practices	MP4, MP7
Scoring Rubric	
1 point	Students correctly answer the question.

34.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK2
Mathematical Practices	MP2, MP6
Scoring Rubric	
1 point	Students determine the number of cars for each of the three types of vehicles.

Power Up! Test Practice

33. What expression can be used to find the total discount? Select all that apply.

- ■ 0.3×42
- ■ $\frac{3}{10} \times 42$
- □ 0.03×42
- ■ 3×4.2

34. There are 450 vehicles in a car lot. Select the correct value for the number of vehicles of each type that are in the lot.

Type of Vehicle	Percent of All Cars	Number Cars
hybrid	28	126
sport utility	20	90
sedan	38	171

90	171
95	180
126	200
135	

Spiral Review

Multiply.

35. $1.63 \times 20 =$ 32.6

36. $7.5 \times 12 =$ 90

37. $0.6 \times 15 =$ 9

38. Hala has 4 trading cards. Khuloud has 8 trading cards. How many times more cards does Khuloud have than Hala?

2 times

39. The art club had the members vote on three places to take a field trip. The results are in the table. If all of the members voted, what part of the club voted for the Sharjah Museum of Islamic Culture?

Trip	Part of Club
Sharjah Museum	0.32
Al Ain Palace Museum	0.20
Dubai Museum	0.48

Ratios and Proportional Relationships

Lesson 8

Solve Percent Problems

Vocabulary Start-Up

A **proportion** is an equation that shows that two ratios are equivalent.
In a **percent proportion** one ratio compares a part to the whole.
The other ratio is the equivalent percent written as a fraction with a denominator of 100.

How do you compare part to whole?

fraction	ratio	percent
$\frac{2}{5}$ $\frac{\text{part}}{\text{whole}}$	Using the information in the first ratio, fill in the others.	$\frac{2}{5} = \frac{40}{100}$
What do you call the part? numerator	$\frac{2}{5}$	40 % of 5 = 2
the whole? denominator	2 to 5 2 : 5	

Essential Question

WHEN is it better to use a fraction, a decimal, or a percent?

Vocabulary

proportion
percent proportion

Mathematical Practices
1, 2, 3, 4, 7

Real-World Link

Basketball Manal is on her school basketball team. She has completed 9 out of 12 free throw shots successfully. Write the ratio as a percent and as a fraction in simplest form.

75%, $\frac{3}{4}$

Which **Mathematical Practices** do you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Focus narrowing the scope

Objective Solve percent problems to find the whole

Coherence connecting within and across grade

Previous	Now	Next
Students found the percent of a number.	Students solve percent problems to find the whole, given the part and the percent.	Students will use percent proportion percent equation the percent of a n

Rigor pursuing concepts, fluency, and applicat

See the Levels of Complexity chart on page 159.

ENGAGE EXPLORE EXPLAIN ELABORATE EVALU

1 Launch the Lesson

Ideas for Use

You may wish to launch the lesson using a whole group, think-pair-share activity, or independent a

LA **Pairs Consult** Have students comple graphic organizer individually. Then hav share their responses with a partner. Call on one students to share their responses with the class.

Alternate Strategies

AL LA Remind students that percent is a ratio to 100. Point out that the 100 always represents is placed in the denominator of the fraction.

BL Have the students consider the meaning of like 220% using the ratio and part/whole desc

ENGAGE EXPLORE **EXPLAIN** ELABORATE EVALUATE

2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

Examples

1. Use a number line to find the whole.

AL • *What number is the part? What number is the percent?* 10; 25

• *Into how many parts should the number line be divided? Why?* 4; 25% is one fourth which indicates four equal parts

OL • *What should be the percent labels on the number line?* 0%, 25%, 50%, 75%, 100%

• *What percent should be placed at 10 on the number line? Why?* 25%, 10 is the part

BL • *Explain another method you could use to find the whole.* Sample answer: You could divide the part, 10, by the percent as a decimal, 0.25; $10 \div 0.25 = 40$.

Need Another Example?
30 is 60% of what number? 50

2. Use a number line to find the whole.

AL • *How many country songs does Landon have?* 90

• *What percent of his music library do these songs make up?* 75%

OL • *Into how many sections should the number line be divided? Explain.* We are looking for 75%, so the number line is divided into 4 sections, so that each represents 25%.

BL • *Explain how you can check the reasonableness of the answer.* Sample answer: We know that 75% of Landon's music library is 90 songs. All of his songs, or 100%, will be greater than 90. An answer of 120 seems reasonable to include the other 25% of his songs.

Need Another Example?
Forty percent of the students in Miguel's class have blue eyes. If there are 10 students with blue eyes, how many are in the class? 25 students

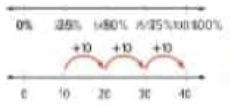
Use Number Lines to Find the Who

If you know the part and the percent, you can find the whole, or the total. You have used bar diagrams to solve percent problems. Double number lines are another way to illustrate percents.

Examples

1. **10 is 25% of what number?**

Use double number lines to model 25% and 10.



To model 25%, divide the number line into four parts.

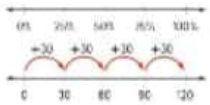
Write 10 at the 25% mark. Add 10 at each mark to find the whole.

The number 40 is at the 100% mark.

So, 10 is 25% of 40.

2. **UAE songs make up 75% of Abdalla's collection. If he has downloaded 90 UAE songs, how many songs does Abdalla have in his collection?**

Use double number lines to model 75% and 90.



To model 75%, divide the number line into four parts.

90 ÷ 3 = 30. Add 30 at each mark to find the whole.

The number 120 is at the 100% mark.

So, Abdalla has 120 songs in his collection.

Check Look back at the number lines. The number 90 should line up with 75%. ✓

Get it? **Do these problems to find out.**

a. 30 is 50% of what number? **b.** 60 is 20% of what number?

c. Suad spent 60% of her money to buy a new television. If the television cost AED 300, how much money did she have?

a. 60

b. 300

c. AED 500

Use the Percent Proportion

The diagram uses a percent proportion to show that 75% of 32 is 24.

$$\underset{\text{whole}\rightarrow}{\overset{\text{part}\rightarrow}{\frac{24}{32}}} = \frac{75}{100}\ \text{percent}$$

Stop and Reflect

Write a percent proportion below to show how 50 is 25% of 200.

$\frac{50}{200} = \frac{25}{100}$

Examples

3. 15 is 30% of what number?

Words	15 is 30% of what number?
Proportion	$\frac{\text{part}\rightarrow}{\text{whole}\rightarrow}\ \frac{15}{\blacksquare} = \frac{30}{100}$ } percent

$\frac{15}{\blacksquare} = \frac{30}{100}$ Write the proportion.

$\frac{15}{50} = \frac{30}{100}$ Since 15 is one half of 30, divide 100 by 2.

So, 15 is 30% of 50.

4. 225 is 75% of what number?

$\frac{225}{\blacksquare} = \frac{75}{100}$ Write the proportion.

$\frac{225}{300} = \frac{75}{100}$ Since 75 × 3 = 225, multiply 100 by 3.

So, 225 is 75% of 300.

Got it? Do these problems to find out.

d. 75 is 15% of what number?
e. 9 is 36% of what number?
f. 7 is 70% of what number?
g. 7 is 35% of what number?

d. 500
e. 25
f. 10
g. 20

Examples

3. Use the percent proportion.

AL • *Are you asked to find the percent, the part, or the whole?* the whole
• *What is the part?* 15 *What is the percent?* 30%

OL • *How would you set up the percent proportion?* $\frac{15}{\blacksquare} = \frac{30}{100}$
• *How are the two numerators related to each other?* Sample answer: The first numerator is half the second numerator.

BL • *Explain how you could check your answer.* Sample answer: $\frac{15}{50}$ simplifies to $\frac{3}{10}$, and $\frac{30}{100}$ also simplifies to $\frac{3}{10}$.
• *How could you solve this problem mentally?* Sample answer: Use the common percent 10%. Since 30% is 10% and there are ten 10%s in 100%, divide 15 by 3, which is 5. Then multiply 5 by 10 to obtain 50.

Need Another Example?
110 is 55% of what number? 200

4. Use the percent proportion.

AL • *Are you asked to find the percent, the part, or the whole?* the whole
• *What is the part?* 225 *What is the percent?* 75%

OL • *How would you set up the percent proportion?* $\frac{225}{\blacksquare} = \frac{75}{100}$
• *How are the two numerators related to each other?* Sample answer: The second numerator is one-third the first numerator.

BL • *Explain how you could check your answer.* Sample answer: Divide the part, 225, by the whole, 300: 225 ÷ 300 = 0.75. The decimal 0.75 is 75%. I could also draw a bar diagram to check my answer.
• *How could you solve this problem mentally?* Sample answer: 225 is three times 75. So, multiply 100 by 3 also which yields 300.

Need Another Example?
310 is 40% of what number? 775

Example

5. Use the percent proportion.

AL
- *What is the problem asking you to find?* the total mass of 100 pennies
- *What percent of a penny was copper?* 5%
- *What is the mass of the copper in 100 pennies?* 15 grams

OL
- *What is the part?* 15 *What is the percent?* 5%
- *How would you set up the percent proportion?* $\frac{15}{\blacksquare}=\frac{5}{100}$

BL
- *How many grams of the 100 pennies would be zinc? Explain.* 285 g; 95% of 300 grams is 285 grams

Need Another Example?
A horse consumes approximately 2% of its body weight in hay each day. If a horse consumes 18 pounds of hay each day, how much does the horse weigh? 900 lb

Guided Practice

Formative Assessment Use these exercises to assess students' understanding of the concepts in this lesson.

If some of your students are not ready for assignments, use the differentiated activities below.

AL LA **Pairs Discussion** For Exercises 1 and 2, have one student label the number line for the percent and the other label the number line for the parts of the whole. Then have them discuss how the solution to the problem aligns with the number line. For Exercises 3–5, have one student write the ratio for percent, and the other the part and whole. Then have them combine their ratios to create a proportion and discuss how to use the proportion to determine the answer. MP 5

BL LA **Pairs Present** Have pairs of students prepare a brief oral presentation showing how the double number line and proportion are related and how one can be determined from the other. MP 1, 3

Example

5. **Before 1982, coins were 95% zinc and 5% copper. If 100 coins minted in 1980 have an approximate mass of 15 grams of copper, what is the total mass of 100 coins?**

The percent is 5 and the part is 15. You need to find the whole.

$\frac{15}{\blacksquare}=\frac{5}{100}$ Write the proportion.

$\frac{15}{300}=\frac{5}{100}$ (×3) Since 5 × 3 = 15, multiply 100 by 3.

The total mass of 100 coins is 300 grams.

Guided Practice

Use double number lines to find the whole.

1. 40 is 20% of what number? 200

2. 90 is 25% of what number? 360

Write a percent proportion and solve each problem.

3. 120 is 30% of what number? $\frac{120}{\blacksquare}=\frac{30}{100}$ 400

4. 60 is 15% of what number? $\frac{60}{\blacksquare}=\frac{15}{100}$ 400

5. In the first year of ownership, a new car can lose 20% of its value. If a car lost AED 4,200 of value in the first year, how much did the car originally cost? AED 21,000

6. **Building on the Essential Question** How can you use proportions to solve percent problems?
Sample answer: You can use a percent proportion to find the whole given the part and the percent.

Rate Yourself!
How well do you understand percent problems? Circle the image that applies.

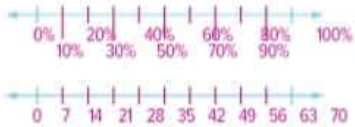
FOLDABLES Time to update your Foldable!

Name _____ My Homework _____

Independent Practice

Use double number lines to find the missing number.

1. 63 is 90% of what number? 70



2. 80 is 25% of what number? 320

Write a percent proportion and solve each problem. (Examples 3 and 4)

3. 22 is 44% of what number? $\frac{22}{\blacksquare} = \frac{44}{100}$; 50

4. 450 is 75% of what number? $\frac{450}{\blacksquare} = \frac{75}{100}$; 600

5. A store is having a sale where winter clothes are 60% of the original price. A sweater is on sale for AED 30. What was the original price of the sweater? (Examples 2 and 4) AED 50

6. Ali calculates that he spends 15% of a school day in science class. If he spends 75 minutes in science class, how many minutes does Ali spend in school? (Examples 2 and 4) 500 minutes

For Exercises 7–9, use the table.

Punch Recipe	
Ginger Ale	40%
Orange Juice	25%
Pineapple Juice	20%
Sorbet	15%

7. If you have 3 cups of pineapple juice, how many total cups of punch can you make? 15 cups

8. How many cups of sorbet are used in 8 cups of punch? 1.2 cups

9. Maysa does not like sorbet, so she omits that ingredient and adds 5 percent of each of the other ingredients. How many cups of punch will she have if she uses 6 cups of orange juice? 20 cups

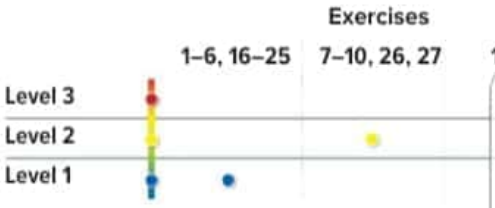
3 Practice and Apply

Independent Practice and Extra Practice

The Independent Practice pages are meant to homework assignment. The Extra Practice pa for additional reinforcement or as a second-d

Levels of Complexity

The levels of the exercises progress from 1 to indicating the lowest level of complexity.



Suggested Assignments

You can use the table below that includes ex complexity levels to select appropriate exerc students' needs.

Differentiated Homework Option		
AL	Approaching Level	1–7, 9, 11, 13, 14, 26, 27
OL	On Level	1–5 odd, 7–11, 13, 14, 26, 2
BL	Beyond Level	7–15, 26, 27

MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	12, 15
2 Reason abstractly and quantitatively.	11
3 Construct viable arguments and critique the reasoning of others.	13, 14, 20
7 Look for and make use of structure.	10

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

Formative Assessment
Use this activity as a closing formative assessment before dismissing students from your class.

TICKET
Out the Door

Have students find the whole if the part is 126 and the percent is 90%. 140

Watch Out!

Common Error Students may incorrectly write one of the ratios in the percent proportion. Remind students that the percent proportion is written as a rate or ratio per 100. If the percent ratio is a proper fraction, the other ratio must also be a proper fraction.

10. **Identify Structure** Complete the following graphic organizers. Identify the missing information.

a. $\frac{3}{4}$ | part: 3 | whole: 4

b. 47% | part: 47% | whole: 100%

c. 12% of 225 | part: 12% | whole: 225

d. 120 out of 400 | part: 120 | whole: 400

e. How does identifying the part and the whole help you to write the percent proportion? Sample answer: In a percent proportion one ratio compares a part to the whole. The other ratio is the equivalent percent written as a fraction with a denominator of 100.

H.O.T. Problems Higher Order Thinking

11. **Reason Abstractly** Write a percent proportion where the part and the whole are known. Solve the problem to find the percent. Sample answer: $\frac{21}{25} = \frac{\blacksquare}{100}$; 84

12. **Persevere with Problems** Using what you know about percents, explain why a commercial that says "80% of dentists use this toothpaste" might be misleading. Sample answer: The commercial would be misleading because only the percent is known. In order for the statement to have meaning, either the part or the whole must be known. Without knowing either of these, it could be 4 of 5 dentists, or 80 of 100 dentists surveyed.

13. **Reason Inductively** The purity of gold is listed in karats. Refer to the table. If a necklace is 75% gold, what karat is it? Explain your reasoning. 18 karats; 24 is the whole and 75 is the percent, so $\frac{18}{24} = \frac{75}{100}$

Karats	Pure Gold (%)
24	100
12	50

14. **Construct an Argument** Omar scored an 82% on his first test of the quarter. Will a score of 38 out of 50 on the second test help or hurt his grade? Explain your reasoning. It will hurt his grade. 38 out of 50 is 76%. If 76% and 82% are averaged, Omar's average grade is 79%, which is less than 82%.

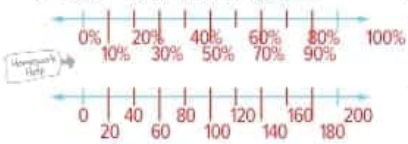
15. **Persevere with Problems** At the zoo, an Asian elephant is about 3000 kg and eats about 150 kg of food a day. What percentage of its body weight does the elephant eat each day? 5%

Name _____ My Homework _____

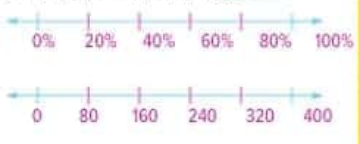
Extra Practice

Use double number lines to find the missing number.

16. 140 is 70% of what number? 200



17. 240 is 60% of what number? 400



Write a percent proportion and solve each problem.

18. 95 is 95% of what number?
$\frac{95}{■} = \frac{95}{100}$ 100

19. 270 is 90% of what number?
$\frac{270}{■} = \frac{90}{100}$ 300

20. MP **Justify Conclusions** Action movies make up 85% of Daoud's movie collection. If he has 20 movies, how many action movies are in Daoud's collection? Explain your reasoning to a classmate.
17 movies $\frac{■}{20} = \frac{85}{100}$ Since 100 ÷ 5 = 20, divide 85 by 5. 85 ÷ 5 = 17

21. The art club held a car wash on Saturday and Sunday. They washed a total of 60 cars. If they washed 40% of the cars on Sunday, how many cars did they wash on Sunday?
24 cars

22. A tiger can eat food that weighs up to 15% of its body weight. If a tiger can eat 36 kilograms of food, how much does a tiger weigh?
240 kg

23. According to the school survey, 12% of the students at Al Tala'eh Junior High School speak English. There are 36 students in the school who speak English. How many students were surveyed?
300 students

24. A music shop has a sale on music CDs. All music CDs are discounted 15%. Mariam's receipt indicates that she saved AED 3 on her CD purchase. What is the full price of her music CD before the discount?
AED 20

25. The interior paint color, Melon Madness, is 30% yellow. Raouf used 72 ounces of yellow paint to mix the last batch. How many ounces of Melon Madness did he make in the last batch?
240 ounces

Power Up! Test Practice

Exercises 26 and 27 prepare students for more rigorous thinking needed for the assessment.

26.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practices	MP1, MP2
Scoring Rubric	
1 point	Students correctly answer each part of the question.

27.

This test item requires students to explain and apply mathematical concepts and solve problems with precision, while making use of structure.	
Depth of Knowledge	DOK1
Mathematical Practice	MP5
Scoring Rubric	
1 point	Students correctly answer the question.

Power Up! Test Practice

26. Al Jumairah club held a canned food drive. On Wednesday, they collected 63 cans, which was 21% of the total cans collected during the food drive. Complete the table to show the number of cans collected on Thursday and Friday.

Day	Percent of Total Collected	Number Cans
Wednesday	21	63
Thursday	46	138
Friday	33	99

27. Refer to the survey results shown. Suppose 150 students were surveyed. How many students chose math as their favorite subject? 30 students

Favorite Subject	
English	23%
Science	30%
Social Studies	15%
Math	■
Music	12%

Spiral Review

Find the equivalent fraction.

28. $\frac{84}{120} = \frac{7}{10}$

29. $\frac{60}{98} = \frac{30}{49}$

30. $\frac{40}{64} = \frac{5}{8}$

31. $\frac{32}{41} = \frac{96}{123}$

32. $\frac{13}{15} = \frac{52}{60}$

33. $\frac{24}{32} = \frac{12}{16}$

34. A store has a sale for $\frac{3}{10}$ off gloves. Write $\frac{3}{10}$ as a decimal.

0.3

35. Salman runs 1.2 kilometers each day. How far has he run at the end of 6 days?

7.2 kilometers

21ST CENTURY CAREER in Movies

Special Effects Animator

Are you fascinated by how realistic the special effects in movies are today? If you have creative talent and are good with computers, a career in special effects animation might be a great fit for you. Special effects animators use their artistic ability and expertise in computer-generated imagery (CGI) to simulate real-life objects like water and fire. They are also able to create fantastic images like flying superheroes, exploding asteroids, and monsters taking over cities.

Is This the Career for You?

Are you interested in a career as a special effects animator? Take some of the following courses in high school.

- Digital Animation
- Calculus
- Geometry
- Physics
- Art/Sculpture

Turn the page to find out how math relates to a career in Movies.

Focus narrowing the scope

Objective Apply mathematics to problems arising in the workplace.

This lesson emphasizes **Mathematical Practice 4** Model with Mathematics.

Coherence connecting within and across grades

Previous
Students found the percent of a number.

Now
Students apply the content standard to solve problems in the workplace.

Rigor pursuing concepts, fluency, and applications

See the Career Project on page 164.

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

1 Launch the Lesson

Ask students to read the information on the student page about special effects animators and answer the following questions.

Ask:

- *What kinds of abilities and interests do you need to be a special effects animator?* creativity and interest in computers
- *What do special effects animators simulate?* simulate real-world objects like water and fire; create images like monsters or superheroes

ENGAGE EXPLORE **EXPLAIN** **ELABORATE** EVALUATE

2 Collaborate

AL LA Simultaneous Roundtable Have students gather in pairs or in teams of four to complete Exercises 1–6. In teams, students each write a response for Exercises 1–6 on their own piece of paper. Students then pass their papers clockwise so each teammate can edit, or add to the prior response. After each paper returns to the original owner, have students discuss their results. MP 1, 3

BL LA Numbered Heads Together Assign students to 3- or 4-person learning teams. Each member is assigned a number from 1 to 4. Each team completes Exercises 1–6, making sure that every member understands. After they have completed the exercises, have them discuss the following questions as a team. MP 1, 3

Ask:

- *How can speaking aloud a decimal help you to write the decimal as a fraction?* Sample answer: Saying the decimal aloud helps you to correctly place the numerator and denominator of a fraction because the word form of the decimal includes the final place-value.
- *What is a method you can use to change a decimal to percent?* Sample answer: Multiply by 100. Add the % symbol.

Career Portfolio

When students complete this page, have them add it to their Career Portfolio.

MP The Effects are Amazing!

Special effects animators must specify when objects fade or change color. Table 1 shows when an object starts fading out. Table 2 shows the percent of an object's total lifetime that it has the initial color, cross-fading of colors, and the final color. Use the tables to solve each problem.

1. Express the part of total lifetime for each object in Table 1 as a fraction in simplest form. $\frac{18}{25}$; $\frac{6}{25}$; $\frac{13}{20}$
2. At what percent of the light beam's total lifetime does it begin to fade out? 65%
3. In Table 2, express the percents for the cross-fading of both objects as decimals. 0.15; 0.77
4. Which best describes the part of the robot's lifetime in which it has the initial color: $\frac{3}{100}$, $\frac{3}{10}$, or $\frac{3}{10}$? $\frac{3}{10}$
5. What fraction of the tornado's lifetime does it have the initial color? $\frac{3}{25}$
6. What fraction of the robot's lifetime does it have the final color? $\frac{11}{20}$

Table 1
Fading Out an Object

Object	Part of Total Lifetime
Explosion	0.72
Fog	0.24
Light beam	0.65

Table 2
Changing Color of an Object

Object	Percent of Total Lifetime		
	Initial Color	Cross-Fading	Final Color
Robot	30%	15%	55%
Tornado	12%	77%	11%

MP Career Project

It's time to update your career profile! Choose one of your favorite movies. Use the Internet to research how the movie's special effects were created. Write a brief description of the processes used by the special effects animators.

List several jobs that are created by the movie industry.

-
-
-
-
-

Chapter Review

Vocabulary Check

Unscramble each of the clue words. After unscrambling all of the terms, use the numbered letters to find the phrase.

INROALAT NUEMBR

R	A	T	I	O	N	A	L		N	U	M	B	E	R
10				6	9				12					1

TEEPNCR

P	E	R	C	E	N	T
					4	

LESTA MOCNOM EOMITNORNAD

L	E	A	S	T		C	O	M	M	O	N		D	E	N	O	M	I	N	A	T	O	R
			8																2				

PIONORTOPR

P	R	O	P	O	R	T	I	O	N
					5				

CTREENP ROIPPTORNO

P	E	R	C	E	N	T		P	R	O	P	O	R	T	I	O	N
	11		3													13	

F	R	A	C	T	I	O	N	S		A	R	E		F	U	N
	1	2	3	4	5	6	7	8		9	10	11			12	13

Complete each sentence using one of the unscrambled words above.

1. A percent is a ratio that compares a number to 100.
2. A proportion is an equation that shows that two ratios are equivalent.
3. In a percent proportion, one ratio compares a part to a whole.
4. A number that can be written as a fraction is a rational number.
5. The least common denominator is the least common multiple of the denominators of two or more fractions.

Vocabulary Check

LA **Pairs Check** Have students wor
complete the Vocabulary Check. O
unscrambles the clue word and completes a
the other listens and coaches. Students swit
next clue word and exercise. After every two
pairs check their answers with another pair
resolve any disagreeme

MP 1, 3, 5, 6

Alternate Strategy

AL LA To help students, you may wish to
vocabulary list from which they can choose
A vocabulary list for this activity would inclu
terms.

- least common denominator (Lesson 5)
- percent (Lesson 2)
- percent proportion (Lesson 8)
- proportion (Lesson 8)
- rational number (Lesson 1)

Key Concept Check

FOLDABLES LA A completed Foldable for this chapter should include a review of fractions, decimals, and percents.

If you choose not to use this Foldable, have students write a brief review of the Key Concepts found throughout the chapter and give an example of each.

Ideas for Use

LA **Three-Step Interview** Have students work in pairs to discuss their Foldables. Have them practice speaking in a collaborative setting by having Student 1 interview Student 2 on how they completed their Foldable thus far and how they could finish it, if needed. Then have Student 2 interview Student 1 using similar interview questions. Have them discuss and resolve any differences in how they each have completed their Foldable. MP 1, 3, 5

Got It?

If students have trouble with Exercises 1–3, they may need help with the following concept(s).

Concept	Exercise(s)
fractions as decimals (Lesson 1)	1
decimals as fractions (Lesson 1)	2
percents as fractions (Lesson 2)	3