Lesson 24: Percent and Rates per 100

Student Outcomes

- Students understand that percents are related to part-to-whole ratios and rates where the whole is 100.
- Students model percents and write a percent as a fraction over 100 or a decimal to the hundredths place.

Classwork

Example 1 (5 minutes)

Class begins with a discussion to gather prior knowledge and show relationship to real world applications.

- Imagine that you are shopping. You want to purchase an item for $\$100$, but today it is 20% off. What does this mean?
  - *It means that* $\$20$ *out of every* $\$100$ *dollars will be subtracted from the total.*
- What does this look like?
  - *It could be a tape diagram with* $\$100$ *divided into ten sections of* $\$10$. *2 of the sections are saved and* 8 *are still paid for the item. It could also be shown on a* 10×10 *grid, where* 20 *of the squares are part of the discount and* 80 *still need to be paid.*
- How is this related to ratios and rates that we have been working on throughout this unit?
  - *Answers will vary depending on prior knowledge. Some students may see that* 20% *off of* $\$100$ *is* $\$20$ *off. Other students may see that we are trying to find part of a whole.*

Use the following website on a projector to visually explore percents in a 10×10 grid model.

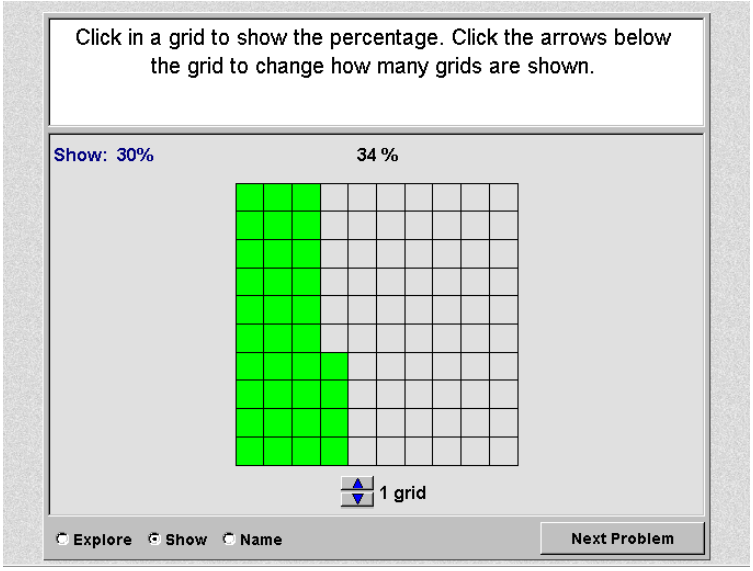
http://nlvm.usu.edu/en/nav/frames_asid_333_g_3_t_1.html?from category_g_3_t_1.html

Click the explore button on the website to be able to show 20%. This will provide students with the visual for making the connection that 20% means 20 out of 100.

- What does this grid show?
  - 100 *blocks*
- How many are shaded in?
  - 20 *blocks*
- How many are not shaded in?
  - 80 *blocks*
- How can we use this model to help us think through 20% off of $\$100$?
  - *From the grid, I can see that when I save* 20%, *I am paying* 80% *of the original value.*

Now, they can see that they would be saving the 20 and spending the 80 when a $\$100$ item is 20% off the original price.

Here is an example of what the website will look like in use:



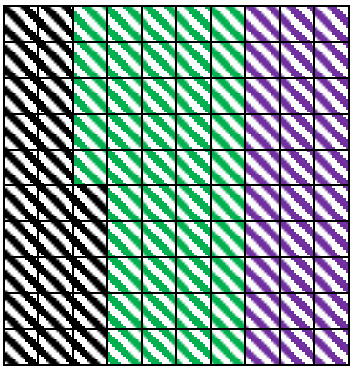
If time allows, add more grids to model percents greater than 100% so that students further build understanding.

Exercises 1–2 (8 minutes)

Solve the following two exercises with student input in order to model the process of working with percents. Students will need coloring utensils in order to complete the remaining activities.

Exercise 1

Robb's Fruit Farm consists of 100 acres, on which three different types of apples grow. On 25 acres, the farm grows Empire apples. McIntosh apples grow on 30% of the farm. The remainder of the farm grows Fuji apples. Shade in the grid below to represent the portion of the farm each apple type occupies. Use a different color for each type of apple. Create a key to identify which color represents each type of apple.



Color Key		Part-to-Whole Ratio
Empire	*Black*	25: 100
McIntosh	*Purple*	30: 100
Fuji	*Green*	45: 100

Exercise 2

The shaded portion of the grid below represents the portion of a granola bar remaining.

What percent does each square of granola bar represent?

1% of the granola bar

What percent of the granola bar remains?

80%

What other ways can we represent this percent?

$\frac{80}{100}, \frac{8}{10}, \frac{4}{5}, \frac{16}{20}, \frac{32}{40}, \frac{64}{80}, 0.8$

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01

In this example, the teacher can discuss how 0.01 is related to $\frac{1}{100}$ and 1%. There are many examples that could be used to represent this percent in the last question. Students should be listing several examples.

Exercises 3–6 (15 minutes)

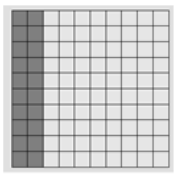
In predetermined pairs or groups, students solve the remaining problems.

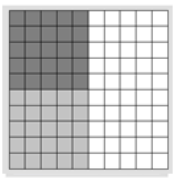
Circulate around the room. Students may have varying answers for several questions in the practice. There is more than one possible answer for several questions in order to spark conversation between pairs or small groups.

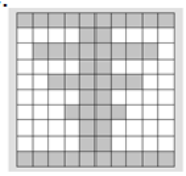
For example, the second 10×10 grid used two different colors, so students could compare colored to total: light gray to total, dark gray to total. In addition, when they are asked to describe the different scenarios, some may use part-to-part ratios while others may use part-to-whole. This is a good time for a discussion on how part-to-part can lead to part-to-whole. In addition, it is important to remember that percents are out of a total 100, so you might want to ask students which form of the ratio is most helpful for getting a percent.

A percent is just another way to show the part-to-whole ratio for each picture.

Exercise 3

a. 

b. 

c. 

a. **What percent is being modeled in each picture? Write your answer as a decimal, fraction, and percent.**

Picture a	Picture b	Picture c
20% is shaded darker than the rest, 0.20, $\frac{20}{100}$.	*Various Answers, Sample Answer (colored compared to total) – 50%, 0.50, $\frac{50}{100}$ (Students could also compare darker shading to total, lighter shading to total, light shading to darker shading, darker shading to lighter shading, etc.)*	*40%, 0.40, $\frac{40}{100}$*

b. **What ratio is being modeled in each picture?**

First Picture – 20 to 100

Second Picture – 50 to 100, or a correct answer for whichever description they chose.

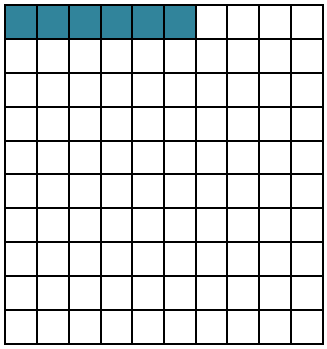
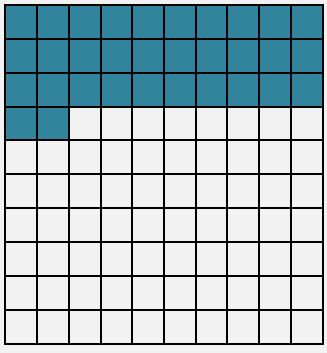
Third Picture – 40 to 100

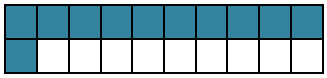
c. **How are the ratios and percents related?**

Answers will vary.

Exercise 4

Complete the table.

Percentage	Decimal	Fraction	Ratio	Model
6%	0.06	$\frac{6}{100}$	6:100	
60%	0.6	$\frac{60}{100}, \frac{6}{10}$	60:100	
600%	6	$\frac{600}{100} = \frac{6}{1}$	6:1	 *6 wholes*
32%	0.32	$\frac{32}{100}$	32:100	

55%	0.55	$\frac{55}{100}, \frac{11}{20}$	11:20	
90%	0.9	$\frac{9}{10}$	9:10	
70%	0.7	$\frac{7}{10}, \frac{70}{100}$	7:10	

Exercise 5

Mr. Brown shares with the class that 70% of the students got an A on the English vocabulary quiz. If Mr. Brown has 100 students, create a model to show how many of the students passed.

$70\% \rightarrow \frac{70}{100} = \frac{7}{10}$

What fraction of the students passed the class?

$\frac{7}{10}$ *or* $\frac{70}{100}$

How could we represent this amount using a decimal?

0.7 *or* 0.70

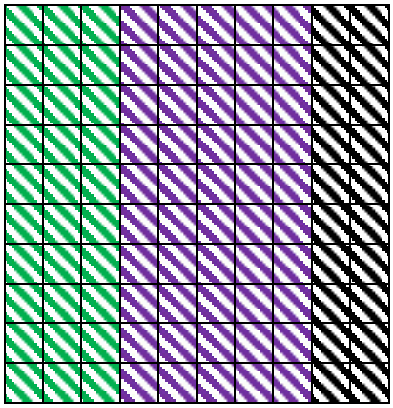
How are the decimal, the fraction, and the percent all related?

The decimal, fraction and percent all show 70 out of 100.

Exercise 6

Marty owns a lawn mowing service. He has 100 lawns to mow this week and three people to mow them. Use the 10×10 grid to model what percentage of the work each employee will complete this weekend.

Students choose how they want to separate the workload. The answers will vary. Below is a sample response.



Worker	Percentage	Fraction	Decimal
Sheila	30%	$\frac{30}{100}$	0.30
Marquis	45%	$\frac{45}{100}$	0.45
Luther	25%	$\frac{25}{100}$	0.25

Closing (12 minutes)

Students present their work. Each group presents a problem or a part of a problem in order for all groups to respond.

Students complete this closing activity.

- What are three things you learned about in this lesson?
- Share two ways that you can write 2%.
- What is one thing that you still want to know about from the lesson?

Lesson Summary

Percent means out of 100. Therefore, percents are fractions with a denominator of 100.

We can create models of percents. One example would be to shade a 10×10 grid. Each square in a 10×10 grid represents 1% or 0.01.

Exit Ticket (5 minutes)

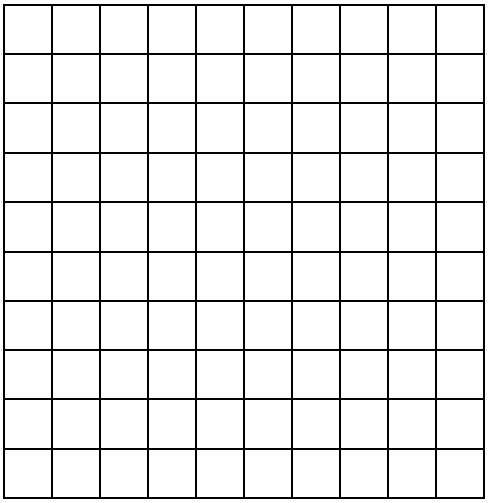
Name _____ Date_____

Lesson 24: Percents and Rates per 100

Exit Ticket

One hundred offices need to be painted. The workers choose between yellow, blue, or beige paint. They decide that 45% of the offices will be painted yellow; 28% will be painted blue, and the remaining offices will be painted beige. Create a model that shows the percent of offices that will be painted by each color. Write the amounts as decimals and fractions.

Color	%	Fraction	Decimal
Yellow			
Blue			
Beige			

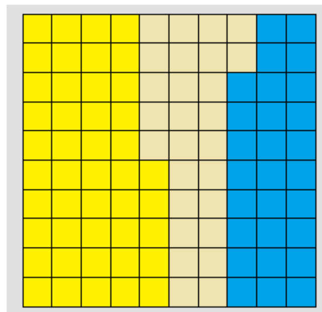


Exit Ticket Sample Solutions

The following solutions indicate an understanding of the objectives of this lesson:

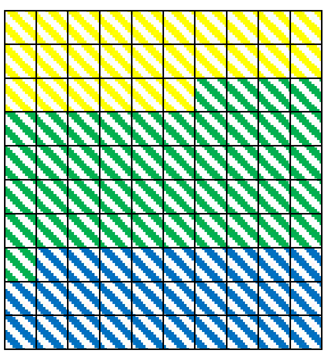
One hundred offices need to be painted. The workers choose between yellow, blue, or beige paint. They decide that 45% of the offices will be painted yellow; 28% will be painted blue, and the remaining offices will be painted beige. Create a model that shows the percent of offices that will be painted by each color. Write the amounts as decimals and fractions.

Color	%	Fraction	Decimal
Yellow	45	$\frac{45}{100}$	0.45
Blue	28	$\frac{28}{100}$	0.28
Beige	27	$\frac{27}{100}$	0.27



Problem Set Sample Solutions

1. **Marissa just bought 100 acres of land. She wants to grow apples, peaches, and cherries on her land. Color the model to show how many acres she will use for each type of tree that she will grow.**



Fruit	Percentage	Fraction	Decimal
Apple	36%	$\frac{36}{100}$	0.36
Peach	45%	$\frac{45}{100}$	0.45
Cherry	19%	$\frac{19}{100}$	0.19

Apple –Yellow, Peach – Green, Cherry - Blue

2. **After renovations on Kim's bedroom, only 30 percent of one wall is left without any décor. Shade the wall to represent the space that is left to decorate.**

   a. **What does each square represent?**

   Each square represents $\frac{1}{100}$ *of the total wall.*

   b. **What percent has been decorated?**

   70%

.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.01	.01	.01	.01