Lesson 1: Percent

Student Outcomes

- Students understand that P percent is the number $\frac{P}{100}$ and that the symbol % means percent.
- Students convert between a fraction, decimal, and percent, including percents that are less than 1% or greater than 100%.
- Students write a non-whole number percent as a complex fraction.

Classwork

Fluency Exercise (9 minutes): Fractions, Decimals, and Percents

Sprint: Students complete a two-round Sprint exercise where they practice their fluency of converting between percents, fractions, and decimals. Provide one minute for each round of the Sprint. Refer to the Sprints and Sprint Delivery Script sections in the Module Overview for directions to administer a Sprint. Be sure to provide any answers not completed by the students. The Sprint and answer keys are provided at the end of this lesson.

Opening Exercise 1 (4 minutes): Matching

Students will use mental math and their knowledge of percents to match the percent with the word problem/clue. Students share their answers with their neighbors and discuss the correct answers as a class.

Opening Exercise 1: Matching

**Match the percents with the correct sentence clues.**

|	
25%	**I am half of a half.** 5 cubic inches of water filled in a 20 cubic inch bottle.
50%	**I am less than $\frac{1}{100}$.** 25 out of 5,000 contestants won a prize.
30%	**I am the chance of birthing a boy or a girl.** Flip a coin, and it will land on heads or tails.
1%	**I am less than a half but more than one-fourth.** 15 out of 50 play drums in a band.
10%	**I am equal to 1.** 35 questions out of 35 questions were answered correctly.
100%	**I am more than 1.** Instead of the $1,200 expected to be raised, $3,600 was collected for the school's fundraiser.
300%	**I am a tenth of a tenth.** One penny is this part of one dollar.
$\frac{1}{2}$%	**I am less than a fourth but more than a hundredth.** $11 out of $110 earned is saved in the bank.

Opening Exercise 2 (3 minutes)

> **Opening Exercise 2**
>
> **Color in the grids to represent the following fractions:**
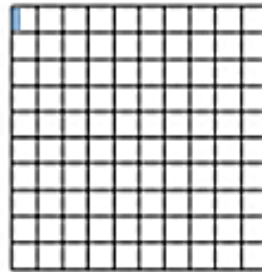>
> a. $\dfrac{30}{100}$ b. $\dfrac{3}{100}$ c. $\dfrac{\frac{1}{3}}{100}$
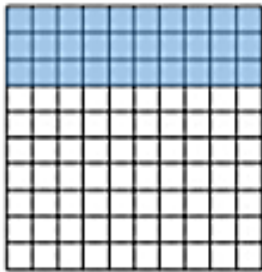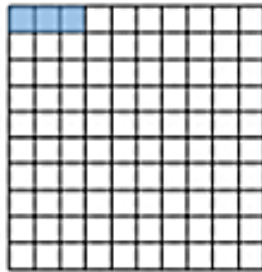
Discussion (3 minutes)

- How are these fractions and representations related to percents?
  - *Percent means out of one hundred and can be written as a fraction with a denominator of* 100.

- What are equivalent representations of $\dfrac{30}{100}$?
  - $\dfrac{3}{10}, \dfrac{15}{50}, 30\%, and\ 0.3$

- What do these have in common?
  - *They are all equal to* 30%. *The first two are equivalent fractions simplified by a common factor. The* 30% *is in percent form, and the last is in decimal form.*

- Why are these all equal to 30%?
  - *Because the numerator-denominator is a part-to-whole relationship, and* 3 *out of* 10 *is* 30%. *The decimal* 0.3 *represents three-tenths, which is also equivalent to* 30%.

- What are other equivalent representations of $\dfrac{\frac{1}{3}}{100}$?
  - $\dfrac{1}{3}\%,\ 0.\overline{3}\%,\ 0.\overline{3},\ and\ \dfrac{1}{300}$

Scaffolding:

Show students the visual representation of the equivalent expressions:
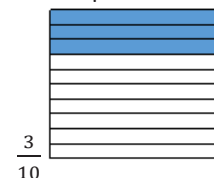
$\dfrac{3}{10}$
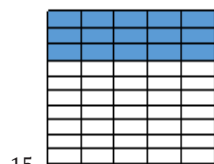
$\dfrac{15}{50}$

Example 1 (4 minutes)

Example 1

Use the definition of the word _percent_ to write each percent as a fraction and then as a decimal.

Percent	Fraction	Decimal
37.5%	$\dfrac{37.5}{100}$	0.375
100%	$\dfrac{100}{100}$	1.0
110%	$\dfrac{110}{100}$	1.10
1%	$\dfrac{1}{100}$	0.01
$\dfrac{1}{2}\%$	$\dfrac{\frac{1}{2}}{100}$	0.005

- What is the pattern or process that you recall or notice when converting percents to fractions?
  - _Place the percent value over_ 100 _and simplify if possible._
- If I gave you a number as a fraction, how could you tell me what percent the fraction represents?
  - _Find the equivalent fraction with the denominator of_ 100.
- What mathematical process is occurring for the percent to convert to a decimal?
  - _The percent is being divided by_ 100.
- If I gave you a number as a decimal, how could you tell me what percent the decimal represents?
  - _Multiply by_ 100.

Scaffolding:

For example, to convert a fraction, $\dfrac{7}{20}$, to a percent:

$$\frac{7}{20} = \frac{?}{100}$$

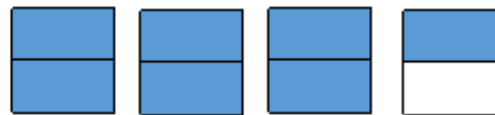$$\frac{7 \times 5}{20 \times 5} = \frac{35}{100}$$

Example 2 (4 minutes)

Example 2

Fill in the chart by converting between fractions, decimals, and percents. Show your work in the space below.

Fraction	Decimal	Percent
$\dfrac{7}{2}$	3.5	350%
$\dfrac{2\frac{1}{2}}{100}$	0.025	$2\frac{1}{2}\%$ *or* 2.5%
$\dfrac{1}{8}$	0.125	$12\frac{1}{2}\%$ *or* 12.5%

350% *as a fraction:* $350\% = \dfrac{350}{100} = \dfrac{35}{10} = \dfrac{7}{2}$
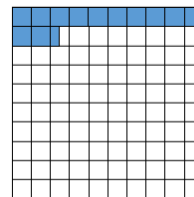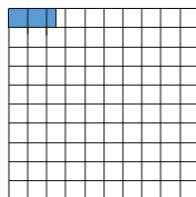
350% *as a decimal:* $350\% = \dfrac{350}{100} = 3.50$

0.025 *as a fraction:* $0.025 = \dfrac{2.5}{100}$ *or* $\dfrac{2\frac{1}{2}}{100}$

0.025 *as a percent:* $0.025 = \dfrac{2.5}{100} = 2.5\%$ *or* $2\frac{1}{2}\%$

$\dfrac{1}{8}$ *as a percent:* $\dfrac{1}{8} = \dfrac{12.5}{100} = 12.5\%$ *or* $12\frac{1}{2}\%$

$\dfrac{1}{8}$ *as a decimal:* $\dfrac{1}{8} = \dfrac{12.5}{100} = 0.125$

Exercise 1 (11 minutes): Class Card Activity

Prior to class, copy and cut out the cards found at the end of the lesson. Mix up the cards, and pass out one card per student. Ask any student to begin by asking the class the question on the card in boldface. The student with the equivalent value on his card should respond by reading his sentence and then read his question for another student to respond. Students will attend to precision when reading the clues and answers, using the correct place value terms when reading decimal numbers. Provide half sheets of blank paper or personal white boards if accessible so students can work out the problems that are being read. This will continue until the first person to read her question answers somebody's equivalent value.

MP.6

Scaffolding:

If there are less than 30 students in the class, pass out more than one card to the advanced learners.

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Exercise 1: Class Card Activity

Read your card to yourself (each student will have a different card), and work out the problem. When the exercise begins, listen carefully to the questions being read. When you have the card with the equivalent value, respond by reading your card aloud.

Examples:

0.22 should be read "twenty two-hundredths."

$\dfrac{\frac{1}{5}}{1000}$ should be read "one-fifth thousandths" or "one-fifth over one thousand."

$\dfrac{7}{300}$ should be read "seven-three hundredths" or "seven over three hundred."

$\dfrac{200}{100}$ should be read "two hundred-hundredths" or "two hundred over one hundred."

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Closing (3 minutes)

- What does *percent* mean?
    - *It means per hundred or each hundred.*

- Is the value of $\dfrac{7}{10}$ less than or greater than the value of $\dfrac{7}{10}\%$? Why?
    - *The value of $\dfrac{7}{10}$ is greater than $\dfrac{7}{10}\%$ because the percent means it is over 100, which makes $\dfrac{7}{10}\%$ equivalent to $\dfrac{\frac{7}{10}}{100}$.*

- How are the fraction and decimal representations related to the percent?
    - *They are related to $\dfrac{P}{100}$, where P is the given percent.*

- What do percents greater than 1 look like? Why?
    - *They are percents greater than 100%, improper fractions, or decimals greater than 1.*

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Lesson Summary

- *Percent* means per hundred. P percent is the same as $\dfrac{P}{100}$. Use $\%$ as a symbol for percent.
- Usually, there are three ways to write a number: a percent, a fraction, and a decimal. Fraction and decimal forms of the percent, P, are equivalent to $\dfrac{P}{100}$.

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Exit Ticket (4 minutes)

Name _____   Date _____

Lesson 1: Percent

Exit Ticket

1. Fill in the chart converting between fractions, decimals, and percents. Show work in the space provided.

Fraction	Decimal	Percent
$\dfrac{1}{8}$		
	1.125	
		$\dfrac{2}{5}\%$

2. Using the values from the chart in Problem 1, which is the least and which is the greatest? Explain how you arrived at your answers.

Exit Ticket Sample Solutions

1. Fill in the chart converting between fractions, decimals, and percents. Show work in the space provided.

Fraction	Decimal	Percent
$\dfrac{1}{8}$	$1 \div 8 = 0.125$	$0.125 \times 100 = 12.5\%$
$1\dfrac{125}{1000} = 1\dfrac{1}{8}$	1.125	$1.125 \times 100 = 112.5\%$
$\dfrac{\frac{2}{5}}{100} = \dfrac{1}{250}$	$(2 \div 5) \div 100 = 0.004$	$\dfrac{2}{5}\%$

2. Using the values from the chart in Problem 1, which is the least and which is the greatest? Explain how you arrived at your answers.

   The least of the values is $\dfrac{2}{5}\%$, and the greatest is 1.125. To determine which value is the least and which is the greatest, compare all three values in decimal form, fraction form, or percents. When comparing the three decimals, 0.125, 1.125, and 0.004, one can note that 0.004 is the smallest value, so $\dfrac{2}{5}\%$ is the least of the values and 1.125 is the greatest.

Problem Set Sample Solutions

1. Create a model to represent the following percents.
   a. 90%
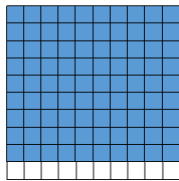
   b. 0.9%

   c. 900%

d. $\dfrac{9}{10}\%$

2. Benjamin believes that $\dfrac{1}{2}\%$ is equivalent to 50%. Is he correct? Why or why not?
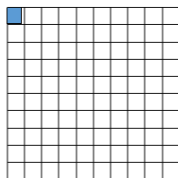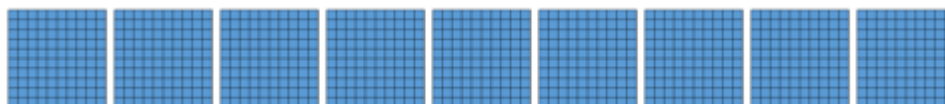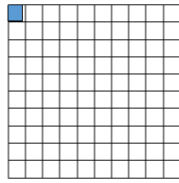
Benjamin is not correct, because $\dfrac{1}{2}\%$ is equivalent to 0.50%, which is equal to $\dfrac{\frac{1}{2}}{100}$. The second percent is equivalent to $\dfrac{50}{100}$. These percents are not equivalent.

3. Order the following from least to greatest.

100%, $\dfrac{1}{100}$, 0.001%, $\dfrac{1}{10}$, 0.001, 1.1, 10, and $\dfrac{10,000}{100}$

0.001%, 0.001, $\dfrac{1}{100}$, $\dfrac{1}{10}$, 100%, 1.1, 10, and $\dfrac{10,000}{100}$

4. Fill in the chart by converting between fractions, decimals, and percents. Show work in the space below.

Fraction	Decimal	Percent
$\dfrac{1}{1}$	1	100%
$\dfrac{33}{400}$	0.0825	8.25%
$6\dfrac{1}{4}$	6.25	625%
$\dfrac{\frac{1}{8}}{100}$	0.00125	$\dfrac{1}{8}\%$
$\dfrac{2}{300}$	$0.00\overline{6}$	$\dfrac{2}{3}\%$
$\dfrac{333}{1,000}$	0.333	33.3%
$\dfrac{\frac{3}{4}}{100}$	0.0075	$\dfrac{3}{4}\%$
$2\dfrac{1}{2}$	2.50	250%
$\dfrac{1}{200}$	0.005	$\dfrac{1}{2}\%$
$\dfrac{150}{100}$	1.5	150%
$\dfrac{5\frac{1}{2}}{100}$	0.055	$5\dfrac{1}{2}\%$

Exercise 1 Cards

I have the equivalent value, 0.11. Who has the card equivalent to 350%?	I have the equivalent value, 3.5. Who has the card equivalent to $\dfrac{3}{8}$?	I have the equivalent value, 37.5%. Who has the card equivalent to $\dfrac{\frac{1}{4}}{100}$?	I have the equivalent value, 0.0025%. Who has the card equivalent to 5?	I have the equivalent value, 500%. Who has the card equivalent to $1\dfrac{2}{5}$?
I have the equivalent value, 140%. Who has the card equivalent to $\dfrac{1}{5}\%$?	I have the equivalent value, 0.002. Who has the card equivalent to 100%?	I have the equivalent value, 1. Who has the card equivalent to $\dfrac{210}{100}$?	I have the equivalent value, 210%. Who has the card equivalent to $\dfrac{\frac{3}{4}}{100}$?	I have the equivalent value, 0.75%. Who has the card equivalent to $35\dfrac{1}{2}\%$?
I have the equivalent value, 0.355. Who has the card equivalent to 2%?	I have the equivalent value, $\dfrac{1}{50}$. Who has the card equivalent to 0.5%?	I have the equivalent value, $\dfrac{1}{200}$. Who has the card equivalent to 0.37?	I have the equivalent value, 37%. Who has the card equivalent to 90%?	I have the equivalent value, $\dfrac{9}{10}$. Who has the card equivalent to $\dfrac{\frac{1}{10}}{100}$?
I have the equivalent value, 0.10%. Who has the card equivalent to $\dfrac{1}{2}$?	I have the equivalent value, 50%. Who has the card equivalent to 300?	I have the equivalent value, $30,000\%$. Who has the card equivalent to $\dfrac{3}{5}\%$?	I have the equivalent value, $\dfrac{3}{500}$. Who has the card equivalent to 75%?	I have the equivalent value, $\dfrac{3}{4}$. Who has the card equivalent to $\dfrac{180}{100}$?
I have the equivalent value, 180%. Who has the card equivalent to 5%?	I have the equivalent value, 0.05. Who has the card equivalent to $\dfrac{1}{100}\%$?	I have the equivalent value, $\dfrac{1}{10,000}$. Who has the card equivalent to 1.1?	I have the equivalent value, 110%. Who has the card equivalent to 250%?	I have the equivalent value, 2.5. Who has the card equivalent to 18%?
I have the equivalent value, $\dfrac{9}{50}$. Who has the card equivalent to $\dfrac{15}{4}$?	I have the equivalent value, 375%. Who has the card equivalent to 0.06?	I have the equivalent value, 6%. Who has the card equivalent to 0.4?	I have the equivalent value, 40%. Who has the card equivalent to 1.5%?	I have the equivalent value, $\dfrac{3}{200}$. Who has the card equivalent to 11%?

Fractions, Decimals, and Percents—Round 1

Number Correct: _____

Directions: Write each number in the alternate form indicated.

1.	$\frac{20}{100}$ as a percent		23.	$\frac{9}{10}$ as a percent	
2.	$\frac{40}{100}$ as a percent		24.	$\frac{9}{20}$ as a percent	
3.	$\frac{80}{100}$ as a percent		25.	$\frac{9}{25}$ as a percent	
4.	$\frac{85}{100}$ as a percent		26.	$\frac{9}{50}$ as a percent	
5.	$\frac{95}{100}$ as a percent		27.	$\frac{9}{75}$ as a percent	
6.	$\frac{100}{100}$ as a percent		28.	$\frac{18}{75}$ as a percent	
7.	$\frac{10}{10}$ as a percent		29.	$\frac{36}{75}$ as a percent	
8.	$\frac{1}{1}$ as a percent		30.	96% as a fraction	
9.	$\frac{1}{10}$ as a percent		31.	92% as a fraction	
10.	$\frac{2}{10}$ as a percent		32.	88% as a fraction	
11.	$\frac{4}{10}$ as a percent		33.	44% as a fraction	
12.	75% as a decimal		34.	22% as a fraction	
13.	25% as a decimal		35.	3% as a decimal	
14.	15% as a decimal		36.	30% as a decimal	
15.	10% as a decimal		37.	33% as a decimal	
16.	5% as a decimal		38.	33.3% as a decimal	
17.	30% as a fraction		39.	3.3% as a decimal	
18.	60% as a fraction		40.	0.3% as a decimal	
19.	90% as a fraction		41.	$\frac{1}{3}$ as a percent	
20.	50% as a fraction		42.	$\frac{1}{9}$ as a percent	
21.	25% as a fraction		43.	$\frac{2}{9}$ as a percent	
22.	20% as a fraction		44.	$\frac{8}{9}$ as a percent	

Fractions, Decimals, and Percents—Round 1 [KEY]

Directions: Write each number in the alternate form indicated.

1.	$\frac{20}{100}$ as a percent	**20**%	23.	$\frac{9}{10}$ as a percent	**90**%
2.	$\frac{40}{100}$ as a percent	**40**%	24.	$\frac{9}{20}$ as a percent	**45**%
3.	$\frac{80}{100}$ as a percent	**80**%	25.	$\frac{9}{25}$ as a percent	**36**%
4.	$\frac{85}{100}$ as a percent	**85**%	26.	$\frac{9}{50}$ as a percent	**18**%
5.	$\frac{95}{100}$ as a percent	**95**%	27.	$\frac{9}{75}$ as a percent	**12**%
6.	$\frac{100}{100}$ as a percent	**100**%	28.	$\frac{18}{75}$ as a percent	**24**%
7.	$\frac{10}{10}$ as a percent	**100**%	29.	$\frac{36}{75}$ as a percent	**48**%
8.	$\frac{1}{1}$ as a percent	**100**%	30.	96% as a fraction	$\frac{\mathbf{72}}{\mathbf{75}}$ *or* $\frac{\mathbf{24}}{\mathbf{25}}$
9.	$\frac{1}{10}$ as a percent	**10**%	31.	92% as a fraction	$\frac{\mathbf{23}}{\mathbf{25}}$
10.	$\frac{2}{10}$ as a percent	**20**%	32.	88% as a fraction	$\frac{\mathbf{22}}{\mathbf{25}}$
11.	$\frac{4}{10}$ as a percent	**40**%	33.	44% as a fraction	$\frac{\mathbf{11}}{\mathbf{25}}$
12.	75% as a decimal	**0.75**	34.	22% as a fraction	$\frac{\mathbf{11}}{\mathbf{50}}$
13.	25% as a decimal	**0.25**	35.	3% as a decimal	**0.03**
14.	15% as a decimal	**0.15**	36.	30% as a decimal	**0.3**
15.	10% as a decimal	**0.1**	37.	33% as a decimal	**0.33**
16.	5% as a decimal	**0.05**	38.	33.3% as a decimal	**0.333**
17.	30% as a fraction	$\frac{\mathbf{3}}{\mathbf{10}}$	39.	3.3% as a decimal	**0.033**
18.	60% as a fraction	$\frac{\mathbf{3}}{\mathbf{5}}$	40.	0.3% as a decimal	**0.003**
19.	90% as a fraction	$\frac{\mathbf{9}}{\mathbf{10}}$	41.	$\frac{1}{3}$ as a percent	$\mathbf{33\frac{1}{3}}$%
20.	50% as a fraction	$\frac{\mathbf{1}}{\mathbf{2}}$	42.	$\frac{1}{9}$ as a percent	$\mathbf{11\frac{1}{9}}$%
21.	25% as a fraction	$\frac{\mathbf{1}}{\mathbf{4}}$	43.	$\frac{2}{9}$ as a percent	$\mathbf{22\frac{2}{9}}$%
22.	20% as a fraction	$\frac{\mathbf{1}}{\mathbf{5}}$	44.	$\frac{8}{9}$ as a percent	$\mathbf{88\frac{8}{9}}$%

Fractions, Decimals, and Percents—Round 2

Number Correct: _____

Improvement: _____

Directions: Write each number in the alternate form indicated.

1.	$\frac{30}{100}$ as a percent		23.	$\frac{6}{10}$ as a percent	
2.	$\frac{60}{100}$ as a percent		24.	$\frac{6}{20}$ as a percent	
3.	$\frac{70}{100}$ as a percent		25.	$\frac{6}{25}$ as a percent	
4.	$\frac{75}{100}$ as a percent		26.	$\frac{6}{50}$ as a percent	
5.	$\frac{90}{100}$ as a percent		27.	$\frac{6}{75}$ as a percent	
6.	$\frac{50}{100}$ as a percent		28.	$\frac{12}{75}$ as a percent	
7.	$\frac{5}{10}$ as a percent		29.	$\frac{24}{75}$ as a percent	
8.	$\frac{1}{2}$ as a percent		30.	64% as a fraction	
9.	$\frac{1}{4}$ as a percent		31.	60% as a fraction	
10.	$\frac{1}{8}$ as a percent		32.	56% as a fraction	
11.	$\frac{3}{8}$ as a percent		33.	28% as a fraction	
12.	60% as a decimal		34.	14% as a fraction	
13.	45% as a decimal		35.	9% as a decimal	
14.	30% as a decimal		36.	90% as a decimal	
15.	6% as a decimal		37.	99% as a decimal	
16.	3% as a decimal		38.	99.9% as a decimal	
17.	3% as a fraction		39.	9.9% as a decimal	
18.	6% as a fraction		40.	0.9% as a decimal	
19.	60% as a fraction		41.	$\frac{4}{9}$ as a percent	
20.	30% as a fraction		42.	$\frac{5}{9}$ as a percent	
21.	45% as a fraction		43.	$\frac{2}{3}$ as a percent	
22.	15% as a fraction		44.	$\frac{1}{6}$ as a percent	

COMMON CORE

Lesson 1:   Percent
Date: 11/19/14

engage^{ny}

Fractions, Decimals, and Percents—Round 2 [KEY]

Directions: Write each number in the alternate form indicated.

1.	$\frac{30}{100}$ as a percent	**30**%	23.	$\frac{6}{10}$ as a percent	**60**%
2.	$\frac{60}{100}$ as a percent	**60**%	24.	$\frac{6}{20}$ as a percent	**30**%
3.	$\frac{70}{100}$ as a percent	**70**%	25.	$\frac{6}{25}$ as a percent	**24**%
4.	$\frac{75}{100}$ as a percent	**75**%	26.	$\frac{6}{50}$ as a percent	**12**%
5.	$\frac{90}{100}$ as a percent	**90**%	27.	$\frac{6}{75}$ as a percent	**8**%
6.	$\frac{50}{100}$ as a percent	**50**%	28.	$\frac{12}{75}$ as a percent	**16**%
7.	$\frac{5}{10}$ as a percent	**50**%	29.	$\frac{24}{75}$ as a percent	**32**%
8.	$\frac{1}{2}$ as a percent	**50**%	30.	64% as a fraction	$\frac{48}{75}$ **or** $\frac{16}{25}$
9.	$\frac{1}{4}$ as a percent	**25**%	31.	60% as a fraction	$\frac{15}{25}$ **or** $\frac{3}{5}$
10.	$\frac{1}{8}$ as a percent	**12.5**%	32.	56% as a fraction	$\frac{14}{25}$
11.	$\frac{3}{8}$ as a percent	**37.5**%	33.	28% as a fraction	$\frac{7}{25}$
12.	60% as a decimal	**0.6**	34.	14% as a fraction	$\frac{7}{50}$
13.	45% as a decimal	**0.45**	35.	9% as a decimal	**0.09**
14.	30% as a decimal	**0.3**	36.	90% as a decimal	**0.9**
15.	6% as a decimal	**0.06**	37.	99% as a decimal	**0.99**
16.	3% as a decimal	**0.03**	38.	99.9% as a decimal	**0.999**
17.	3% as a fraction	$\frac{3}{100}$	39.	9.9% as a decimal	**0.099**
18.	6% as a fraction	$\frac{3}{50}$	40.	0.9% as a decimal	**0.009**
19.	60% as a fraction	$\frac{3}{5}$	41.	$\frac{4}{9}$ as a percent	$44\frac{4}{9}$%
20.	30% as a fraction	$\frac{3}{10}$	42.	$\frac{5}{9}$ as a percent	$55\frac{5}{9}$%
21.	45% as a fraction	$\frac{9}{20}$	43.	$\frac{2}{3}$ as a percent	$66\frac{2}{3}$%
22.	15% as a fraction	$\frac{3}{20}$	44.	$\frac{1}{6}$ as a percent	$16\frac{2}{3}$%