

# Percents Summary

## KEY TERM

- benchmark percents

LESSON  
**1**

## We Are Family!

Percent can be used to represent a part-to-whole relationship with a whole of 100. The symbol "%" means "out of 100." You can think of a percent as a fraction in which the denominator is 100.

Percents, fractions, and decimals can be used interchangeably.

For example, you can write 15 out of 100 as the fraction  $\frac{15}{100}$  or  $\frac{3}{20}$ . Written as a decimal, 15 out of 100 is 0.15. Because percent means "out of 100", 15 out of 100 can also be written as 15%.

When the denominator is a factor of 100, scale up the fraction to write it as a percent.

$$\begin{array}{rcl} & \times 20 & \\ \frac{4}{5} & = & \frac{80}{100} \\ & \times 20 & \\ \frac{80}{100} & = & 80\% \end{array}$$

When the denominator is not a factor of 100, you can divide the numerator by the denominator to write the fraction as a decimal, which you can then write as a percent.

$$\begin{array}{r} 0.625 \\ 8 \overline{)5.000} \\ -48 \\ \hline 20 \\ -16 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$
$$\frac{5}{8} = 5 \div 8$$

$$0.625 = 62.5\%$$

Common Equivalent Fractions, Decimals, and Percents									
Fraction	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{4}{5}$
Decimal	0.2	0.25	$0.\bar{3}$	0.4	0.5	0.6	$0.\bar{6}$	0.75	0.8
Percent	20%	25%	$33\frac{1}{3}\%$	40%	50%	60%	$66\frac{2}{3}\%$	75%	80%

LESSON  
**2**

## Warming the Bench

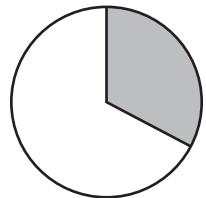
When ordering numbers expressed as fractions, decimals, and percents, you can first write the numbers in the same form before comparing.

For example, to order the numbers  $0.88$ ,  $90\%$ , and  $\frac{17}{20}$  from least to greatest, you can write each number as a percent.

$$0.88 = \frac{88}{100} = 88\% \qquad \frac{17}{20} = \frac{85}{100} = 85\%$$

The numbers in order from least to greatest are  $\frac{17}{20}$ ,  $0.88$ , and  $90\%$ .

You can estimate percents when using a visual model.



For example, the shaded part appears to be about  $\frac{1}{3}$  of the whole circle, and  $\frac{1}{3} \approx 33\%$ .

A **benchmark percent** is a percent that is commonly used, such as  $1\%$ ,  $5\%$ ,  $10\%$ ,  $25\%$ ,  $50\%$ , and  $100\%$ . With fractions and decimals, benchmarks can be used to make estimations. With percents, however, you can use benchmarks to calculate any whole percent of a number.

For example, determine each value if 400 is 100%. There is more than one way to use benchmark percents to determine the values.

You can determine any whole percent of a number by using 10%, 5%, and 1%.

For example, what is 28% of 500?

$$28\% = 10\% + 10\% + 5\% + 1\% + 1\% + 1\%$$

$$10\% \text{ of } 500 \text{ is } 500 \times \frac{1}{10}, \text{ or } 50.$$

$$5\% \text{ of } 500 \text{ is } 50 \times \frac{1}{2}, \text{ or } 25.$$

$$1\% \text{ of } 500 \text{ is } 25 \times \frac{1}{5}, \text{ or } 5.$$

$$50 + 50 + 25 + 5 + 5 + 5 = 140$$

28% of 500 is 140.

a. 50%	50% is half of 100%. $400 \times \frac{1}{2} = 200$
b. 25%	25% is half of 50%. $200 \times \frac{1}{2} = 100$
c. 10%	10% is one-fifth of 50%. $200 \times \frac{1}{5} = 40$
d. 5%	5% is half of 10%. $40 \times \frac{1}{2} = 20$
e. 1%	1% is one-fifth of 5%. $20 \times \frac{1}{5} = 4$

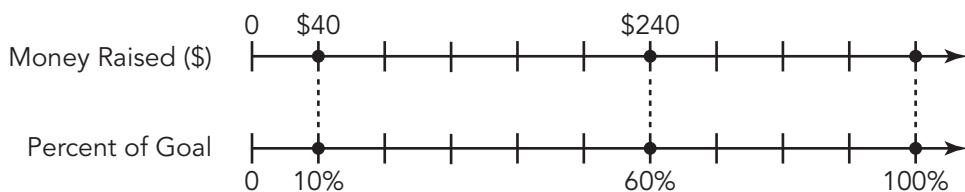
LESSON  
**3**

## The Forest for the Trees

Percent problems often have a part, a percent, and a whole. When you know the part and the percent, you can use a variety of strategies to determine the whole.

One strategy is a double number line.

For example, Karla's homeroom raised \$240 for charity, which is 60% of their goal. Karla uses a double number line to record the amount of money raised and the percent of the goal raised.



Karla's homeroom has raised \$240, which is 60% of the goal.

To determine the value that corresponds to 10%, Karla divided the amount raised so far by 6:  
 $\$240 \div 6 = \$40$ .

Since  $10\% \times 10 = 100\%$ , she can multiply \$40 by 10 to determine the homeroom's goal:  
 $\$40 \times 10 = \$400$ .

You can also use proportions to determine the whole in percent problems.

For example, Carlos is told that 65% of the students, or 78 students, prefer pizza for lunch according to a recent survey. He wants to know how many students were surveyed.

He wrote a proportion and determined that 120 students were surveyed.

$$\begin{array}{rcl} \text{part} & & \frac{78}{?} = \frac{65}{100} \\ \text{whole} & & \div 5 \quad \times 6 \\ \hline \frac{65}{100} & = & \frac{13}{20} = \frac{78}{?} \\ \div 5 & & \times 6 \end{array}$$

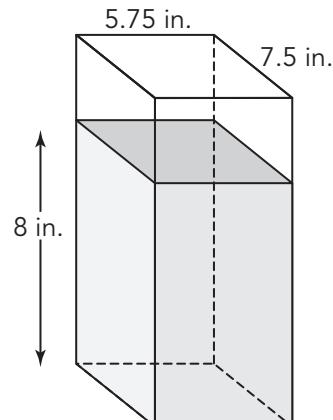
$$\frac{78}{120} = \frac{65}{100}$$

These strategies can be used to solve geometry problems as well.

For example, the tank shown is 75% full of water. What is the height of the tank?

The volume of the water can be calculated using the formula  $V = Bh$ , where the  $B$  is equal to the area of the base, and  $h$  is equal to the height of the water in the tank.

$$\text{Volume of water} = 5.75 \times 7.5 \times 8 = 345 \text{ cubic inches}$$



The volume of 345 cubic inches is 75% the volume of the whole tank.

Set up a proportion and scale up to determine the volume of the tank.

The volume of the tank is 460 cubic inches.

Divide the volume of the tank by the area of its base to determine the tank's height.

$$460 \div 43.125 = 10.67 \text{ inches}$$

$$\begin{array}{rcl} \times 4.6 & & \\ \hline \frac{75}{100} & = & \frac{345}{?} \\ \times 4.6 & & \end{array}$$