<u>6.2 Solve General Applications of Percent</u> from *Prealgebra* by OpenStax is available under a <u>Creative</u> <u>Commons Attribution 4.0 International</u> license. © Jul 20, 2016, OpenStax. UMGC has modified this work and it is available under the original license.



Solve General Applications of Percent

Learning Objectives

By the end of this section, you will be able to:

- > Translate and solve basic percent equations
- Solve applications ofpercent
- Find percent increase and percent decrease

Translate and Solve Basic Percent Equations

We will solve percent equations by using the methods we used to solve equations with fractions or decimals. In the past, you may have solved percent problems by setting them up as proportions. That was the best method available when you did not have the tools of algebra. Now as a prealgebra student, you can translate word sentences into algebraic equations, and then solve the equations.

We'll look at a common application of percent—tips to a server at a restaurant—to see how to set up a basic percent application.

When Aolani and her friends ate dinner at a restaurant, the bill came to \$80. They wanted to leave a 20% tip. What amount would the tip be?

To solve this, we want to find what *amount* is 20% of \$80. The \$80 is called the *base*. The amount of the tip would be 0.20(80), or \$16 See Figure 6.6. To find the amount of the tip, we multiplied the percent by the base.



Figure 6.6 A 20% tip for an \$80 restaurant bill comes out to \$16.

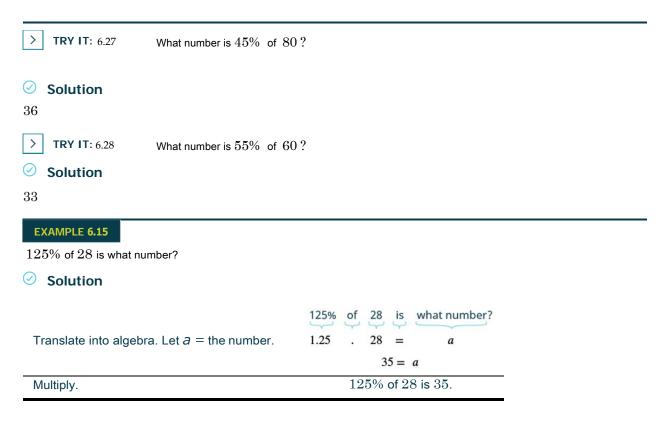
In the next examples, we will find the amount. We must be sure to change the given percent to a decimal when we translate the words into an equation.

EXAMPLE 6.14

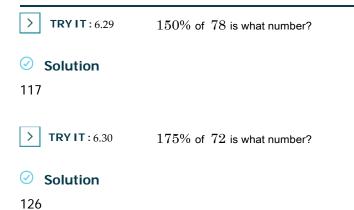
What number is 35% of 90?



Translate into algebra. Let $n = $ the number.	n	=	0.35	•	90
Multiply.	31.5 is	n = 3 35	100-100-100	00	



Remember that a percent over 100 is a number greater than 1. We found that 125% of 28 is 35, which is greaterthan 28.



In the next examples, we are asked to find the base.

EXAMPLE 6.16

Translate and solve: 36 is 75% of what number?

Solution

Translate. Let <i>b</i> = the number.	36 is 75% of what number? 36 = 0.75 . b
Divide both sides by 0.75.	$\frac{36}{0.75} = \frac{0.75b}{0.75}$
Simplify.	48 = <i>b</i>
	36 is 75% of 48

 \rightarrow TRY IT: 6.31 17 is 25% of what number?

Solution

68

TRY IT: 6.32 40 is 62.5% of what number?

64

EXAMPLE 6.17

6.5% of what number is \$1.17?

⊘ Solution

Translate. Let <i>b</i> = the number.	6.5% of what number is \$1.17?
	0.065 . $b = 1.17$
Divide both sides by 0.065.	$\frac{0.065n}{0.065} = \frac{1.17}{0.065}$
Simplify	n = 18
	6.5% of \$18 is \$1.17.

 \rightarrow TRYIT: 6.33 7.5% of what number is \$1.95?

Solution

\$26

 \rightarrow TRY IT: 6.34 8.5% of what number is \$3.06?

Solution

\$36

In the next examples, we will solve for the percent.

EXAMPLE 6.18

What percent of $36\,$ is $\,9?$

Solution

Translate into algebra. Let p = the percent.	What percent of 36 is 9? $p 36 = 9$
Divide by 36.	$\frac{36p}{36} = \frac{9}{36}$
Simplify.	$p = \frac{1}{4}$
Convert to decimal form.	p = 0.25
Convert to percent.	ρ = 25% 25% of 36 is 9.

 \rightarrow TRY IT: 6.35 What percent of 76 is 57?

⊘ Solution

75%

TRY IT: 6.36 What percent of 120 is 96?

⊘ Solution

80%

EXAMPLE 6.19

144 is what percent of 96?

⊘ Solution

Translate into algebra. Let p = the percent.	$ \begin{array}{rcl} 144 & \text{is} & \text{what percent} & \text{of} & 96? \\ 144 & = & p & . & 96 \end{array} $
Divide by 96.	$\frac{144}{96} = \frac{96p}{96}$
Simplify.	1.5 = p
Convert to percent.	150% = p
	144 is 150% of 96.

 \rightarrow TRY IT: 6.37 110 is what percent of 88?

Solution

125%

 \rightarrow TRY IT: 6.38 126 is what percent of 72?

Solution

175%

Solve Applications of Percent

Many applications of percent occur in our daily lives, such as tips, sales tax, discount, and interest. To solve these applications, we'll translate to a basic percent equation, just like those we solved in the previous examples in this section. Once you translate the sentence into a percent equation, you know how to solve it.

We will update the strategy we used in our earlier applications to include equations now. Notice that we will translate a sentence into an equation.

? HOW TO: SOLVE AN APPLICATION

- Step 1. Identify what you are asked to find and choose a variable to represent it.
- Step 2. Write a sentence that gives the information to find it.
- Step 3. Translate the sentence into an equation.
- Step 4. Solve the equation using good algebra techniques.
- Step 5. Write a complete sentence that answers the question.
- Step 6. Check the answer in the problem and make sure it makes sense.

Now that we have the strategy to refer to, and have practiced solving basic percent equations, we are ready to solve percent applications. Be sure to ask yourself if your final answer makes sense—since many of the applications we'll solve involve everyday situations, you can rely on your own experience.

EXAMPLE 6.20

Dezohn and his girlfriend enjoyed a dinner at a restaurant, and the bill was \$68.50. They want to leave an 18% tip. If the tip will be 18% of the total bill, how much should the tip be?

Solution

What are you asked to find?	the amount of the tip
Choose a variable to represent it.	Let t= amount oftip.
Write a sentence that gives the information to find it.	The tip is 18% of the total bill.
Translate the sentence into an equation.	The tip is 18% of \$68.50. $t = 0.18$. \$68.50
Multiply.	t = 12.33
Write a complete sentence that answers the question.	The couple should leave a tip of \$12.33.

	If we approximate the bill to \$70 and the percent to
Check that the answer is reasonable.	20%, we would have a tip of \$14. So a tip of \$12.33
	seems reasonable.

> TRY IT: 6.39

Cierra and her sister enjoyed a special dinner in a restaurant, and the bill was \$81.50. If she wants to leave 18% of the total bill as her tip, how much should she leave?

Solution

\$14.67

> TRY IT : 6.40

Kim had lunch at her favorite restaurant. She wants to leave 15% of the total bill as her tip. If her bill was \$14.40, how much will she leave for the tip?

⊘ Solution

\$2.16

EXAMPLE 6.21

The label on Masao's breakfast cereal said that one serving of cereal provides $85\,$ milligrams (mg) of potassium, which is $2\%\,$ of the recommended daily amount. What is the total recommended daily amount of potassium?

Nutrition Serving Size: 1 cup (47g)	ı Fac	cts
Servings Per Container: A	bout 7	
79		
Amount Per Serving	Cereal W	ith Milk
Calories	180	230
Calories from Fat	10	20
	% Daily	Value*
Total Fat 1g	2%	2%
Saturated Fat 0g	0%	0%
Trans Fat 0g		
Polyunsaturated Fat 0.5g	3	
Monounsaturated Fat 0.5	5g	
Cholesterol 0mg	0%	0%
Sodium 190mg	8%	11%
Potassium 85mg	2%	8%
Total Carbohydrate 40g	13%	15%
Dietary Fiber 1g	4%	4%
Sugars 8g		
Protein 3g		

⊘ Solution

What are you asked to find?	the total amount of potassium recommended
Choose a variable to represent it.	Let $a = \text{total amount of potassium.}$
Write a sentence that gives the information to find it.	85% mg if 2% of the total amount.
Translate the sentence into an equation.	85 mg is 2% of a ? 85 = 0.02 . a
Divide both sides by 0.02.	$\frac{85}{0.02} = \frac{0.02a}{0.02}$
Simplify.	4,250 = a
Write a complete sentence that answers the question.	The amount of potassium that is recommended is 4250 mg.

> TRY IT : 6.41

One serving of wheat square cereal has $\,7\,$ grams of fiber, which is $\,29\%\,$ of the recommended daily amount. What is the total recommended daily amount of fiber?

Solution

24.1 grams

> TRY IT: 6.42

One serving of rice cereal has $190~\rm mg$ of sodium, which is 8% of the recommended daily amount. What is the total recommended daily amount of sodium?

Solution

2,375 mg

EXAMPLE 6.22

Mitzi received some gourmet brownies as a gift. The wrapper said each brownie was 480 calories, and had 240 calories of fat. What percent of the total calories in each brownie comes from fat?

Solution

What are you asked to find?	the percent of the total calories from fat	
Choose a variable to represent it.	Let $p = percent from fat.$	
Write a sentence that gives the information to find it.	What percent of 480 is 240?	
Translate the sentence into an equation.	What percent of 480 is 240? p . 480 = 240	
Divide both sides by 480.	$\frac{p \cdot 480}{480} = \frac{240}{480}$	
Simplify.	p = 0.5	
Convert to percent form.	p = 50%	
Write a complete sentence that answers the question.	Of the total calories in each brownie, 50% is fat.	
Check if the answer is reasonable.	Yes. 240 is half of 480, so 50% makes sense.	

> TRY IT: 6.43

Veronica is planning to make muffins from a mix. The package says each muffin will be 230 calories and 60 calories will be from fat. What percent of the total calories is from fat? (Round to the nearest whole percent.)

Solution

26%

> TRY IT: 6.44

The brownie mix Ricardo plans to use says that each brownie will be 190 calories, and 70 calories are from fat. What percent of the total calories are from fat?

Solution

37%

Find Percent Increase and Percent Decrease

People in the media often talk about how much an amount has increased or decreased over a certain period of time. They usually express this increase or decrease as a percent.

To find the **percent increase**, first we find the amount of increase, which is the difference between the new amount and the original amount. Then we find what percent the amount of increase is of the original amount.

? HOW TO: FIND PERCENT INCREASE.

Step 1. Find the amount of increase.

• increase = new amount - original amount

Step 2. Find the percent increase as a percent of the original amount.

EXAMPLE 6.23

In 2011, the California governor proposed raising community college fees from \$26 per unit to \$36 per unit. Find the percent increase. (Round to the nearest tenth of a percent.)

Solution

What are you asked to find?	the percent increase
Choose a variable to represent it.	Let $p = percent$.
Find the amount of increase.	36 - 26 = 10 new original increase amount amount
Findthepercentincrease.	The increase is what percent of the original amount?
Translate to an equation.	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
Divide both sides by 26.	$\frac{10}{26} = \frac{26p}{26}$
Round to the nearest thousandth.	0.384 = p
Convert to percent form.	38.4% = P
Write a complete sentence.	The new fees represent a 38.4% increase over the old fees.

> TRY IT : 6.45

In 2011, the IRS increased the deductible mileage cost to 55.5 cents from 51 cents. Find the percent increase. (Round to the nearest tenth of a percent.)

Solution

8.8%

> TRY IT : : 6.46

In 1995, the standard bus fare in Chicago was \$1.50. In 2008, the standard bus fare was \$2.25. Find the percent increase. (Round to the nearest tenth of a percent.)

⊘ Solution

50%

Finding the **percent decrease** is very similar to finding the percent increase, but now the amount of decrease is the difference between the original amount and the final amount. Then we find what percent the amount of decrease is of the original amount.

?

HOW TO: FIND PERCENT DECREASE.

Step 1. Find the amount of decrease.

decrease = original amount - new amount

Step 2. Find the percent decrease as a percent of the original amount.

EXAMPLE 6.24

The average price of a gallon of gas in one city in June 2014 was \$3.71. The average price in that city in July was \$3.64. Find the percent decrease.

Solution

What are you asked to find?	the percent decrease
Choose a variable to represent it.	Let $p = percent$.
Find the amount of decrease.	3.71 - 3.64 = 0.07 original new increase amount amount
Find the percent of decrease.	The decrease is what percent of the original amount?
Translate to an equation.	0.07 is what percent of 3.71: 0.07 = p . 3.71
Divide both sides by 3.71.	$\frac{0.07}{3.71} = \frac{3.71p}{3.71}$
Round to the nearest thousandth	0.019 = p
Convert to percent form.	1.9% = P
Write a complete sentence.	The price of gas decreased 1.9%.



TRY IT: 6.47

The population of one city was about 672,000 in 2010. The population of the city is projected to be about 630,000 in 2020. Find the percent decrease. (Round to the nearest tenth of a percent.)

Solution

6.3%



TRY IT: 6.48

Last year Sheila's salary was \$42,000. Because of furlough days, this year her salary was \$37,800. Find the percent decrease. (Round to the nearest tenth of a percent.)



10%

Key Concepts

- To translate a percent problem, first write an equation and then solve it.
- Percents can be used to solve many types of problems. The strategy is to write a sentence that gives the information, translate it to an equation, and solve using algebra.
- Some percent problems involve finding percent increase or decrease, which is the difference between a new amount and an original amount.