Percents

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Memorize the definition of percent.
2. Add and remove the percent symbol.
3. Solve simple percent problems.

1. The Definition of Percent

The symbol % means **percents**. It is sometimes written instead of the fraction $\frac{1}{100}$.

That is, $1\% = 1 \cdot \frac{1}{100} = \frac{1}{100}$.

2. Add and Remove the Percent Symbol

Sometimes we want to use the percent symbol % and sometimes we don't. Depending on what you need, following are the procedures for adding and removing a percent symbol.

Add a percent symbol:

Multiply a given number by 100 and add the percent symbol.

If possible,

- write as a mixed number using fractions or decimals
- reduce fractions to lowest terms

Remove a percent symbol:

Divide the numeric portion of a given percent by 100 and drop the percent symbol.

If possible,

- write as a mixed number using fractions or decimals
- reduce fractions to lowest terms

Example 1: Add a Percent Symbol

Express $\frac{3}{8}$ as a percent in fraction and in decimal form.

Multiply the number by 100 and add the percent symbol.

$$\frac{3}{8}(100)\% = \frac{300}{8}\%$$

We must now write the result as a mixed number with any fractions reduced to lowest terms. Use the calculator liberally!

In fraction form: $37\frac{1}{2}\%$

In decimal form: 37.5%

Example 2: Add a Percent Symbol

Express $\frac{1}{6}$ as a percent in fraction and in decimal form.

Multiply the number by 100 and add the percent symbol.

$$\frac{1}{6}(100) = \frac{100}{6}\%$$

We must now write the result as a mixed number with any fractions reduced to lowest terms. Use the calculator liberally!

In fraction form: $16\frac{4}{6}\% = 16\frac{2}{3}\%$

In decimal form: $16.\overline{6}\%$ (remember, 0.666666… is written as $0.\overline{6}$)

Example 3: Add a Percent Symbol

a. Express 0.4 as a percent.

Multiply the number by 100 and add the percent symbol.

$0.4(100)\% = 40\%$

Nothing else needs to be done.

b. Express 3.4 as a percent.

Multiply the number by 100 and add the percent symbol.

$3.4(100)\% = 340\%$

Nothing else needs to be done.

Example 4: Remove a Percent Symbol

Express 75% without a percent and write this number in fraction and in decimal form.

Divide the number portion by 100 and drop the percent symbol.

$$\frac{75}{100}$$

We must now write the result with the fraction reduced to lowest terms. Use the calculator liberally!

In fraction form: $\frac{75}{100} = \frac{3}{4}$

In decimal form: *0.75* (divide 75 by 100)

Example 5: Remove a Percent Symbol

Express 23.4% without a percent and write this number in fraction and in decimal form.

Divide the numeric portion by 100 and drop the percent symbol.

$$\frac{23.4}{100}$$

We must now write the result with the fraction reduced to lowest terms. Use the calculator liberally!

In fraction form: $\frac{23.4}{100} \cdot \frac{10}{10} = \frac{234}{1000} = \frac{117}{500}$

In decimal form: 0.234 (divide 23.4 by 100)

Example 6: Remove a Percent Symbol

Express 115% without a percent and write this number in fraction and in decimal form.

Divide the numeric portion by 100 and drop the percent symbol.

$$\frac{115}{100}$$

We must now write the result as a mixed number with any fractions reduced to lowest terms. Use the calculator liberally!

In fraction form: $1\frac{15}{100} = 1\frac{3}{20}$

In decimal form: *1.15* (divide 115 by 100)

Example 7: Remove a Percent Symbol

Express 300% without a percent.

Divide the numeric portion by 100 and drop the percent symbol.

$$\frac{300}{100} = 3$$

Nothing else needs to be done.

3. Simple Percent Problems

Many applications involving percents are based on the following formula:

$A = P \cdot B$, where

A - is the number resulting of a percent applied to some (base) amount
P - is a percent expressed as a decimal
B - is the number to which a percent is applied.

Example 8: Application using Percent

What number is 10% of 388?

Let's insert the given information into the formula $\boldsymbol{A = P \cdot B}$.

Given are $\boldsymbol{P = 10\% = 0.1}$ and $\boldsymbol{B = 388}$. The number we are asked to find is $\boldsymbol{A}$.

Then $\boldsymbol{A = 0.1(388) = 38.8}$.

Please note that the word "of" in the question is replaced by the multiplication symbol $\cdot$ in the formula. Remember that the multiplication symbol can then be replaced by a set of parentheses.

We find that the number we are looking for is ***38.8*** which is 10% of 388.

Example 9: Application using Percent (1 of 2)

What percent is 150 of 30?

Let's insert the given information into the formula $\boldsymbol{A = P \cdot B}$.

Given are $\boldsymbol{A = 30}$ and $\boldsymbol{B = 150}$. The number we are asked to find is $\boldsymbol{P}$.

Then $\boldsymbol{30 = P(150)}$.

Please again note that the word "of" in the question is replaced by the multiplication symbol $\cdot$ in the formula.

Example 9: Application using Percent (2 of 2)

We must now isolate ***P***, and we do so by dividing both sides of the equality by its coefficient. Let's give the answer in decimal form.

$$\frac{30}{150} = 0.2$$

Since we are asked to find a percent, we need to change the decimal to percent form by multiplying by 100 and adding a % symbol. If necessary, use a calculator.

We find that the percent we are looking for is ***20***. That is, 20% of 150 equals 30.

Example 10: Application using Percent (1 of 2)

60 is 30% of what number?

Let's insert the given information into the formula $\boldsymbol{A = P \cdot B}$.

Given are $\boldsymbol{P = 30\% = 0.3}$ and $\boldsymbol{A = 60}$. The number we are asked to find is $\boldsymbol{B}$.

Then $\boldsymbol{60 = 0.3B}$.

Please again note that the word "of" in the question is replaced by the multiplication symbol $\cdot$ in the formula.

Example 10: Application using Percent (2 of 2)

We must now isolate ***B***, and we do so by dividing both sides of the equality by its coefficient. Let's give the answer in decimal form.

$$\frac{60}{0.3} = 200$$

We find that the number we are looking for is 200. That is, if we take 30% of 200, we end up with 60.

Example 11: Application using Percent

A certain automobile cooling system has a capacity of 6 gallons of fluid. To give protection to -10^{o} Fahrenheit, 40% of the cooling system capacity must be antifreeze. How many gallons of antifreeze should be used?

Let's insert the given information into the formula $\boldsymbol{A = P \cdot B}$.

We are told that $\boldsymbol{P = 40\% = 0.4}$ and $\boldsymbol{B = 6}$. The number we are asked to find is $\boldsymbol{A}$.

$\boldsymbol{A = 0.4(6) = 2.4}$

2.4 gallons of antifreeze must be used for the automobile to be protected to -10^{o} F.

Example 12: Application using Percent

A patient's medication was increased by 32.5 mg or 10% per day. How many mg did the patient get on the day before the increase?

Let's insert the given information into the formula $\boldsymbol{A = P \times B}$.

We are told that $\boldsymbol{P = 10\%}$ and $\boldsymbol{A = 32.5}$. The number we are asked to find is $\boldsymbol{B}$.

$$\boldsymbol{32.5 = 0.1B}$$

We must now isolate $\boldsymbol{B}$, and we do so by dividing both sides of the equality by its coefficient. Let's give the answer in decimal form.

$$\frac{\boldsymbol{32.5}}{\boldsymbol{0.1}} = \boldsymbol{325}$$

The patient received 325 mg the day before the increase of the medication.