6.1 Understand Percent

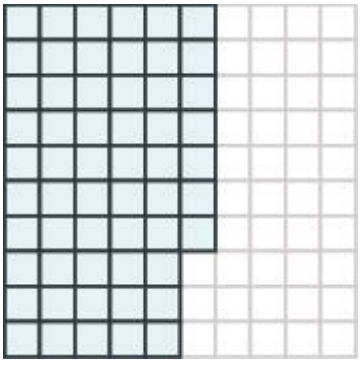
Use the Definition of Percent

How many cents are in one dollar? There are 100 cents in a dollar. How many years are in a century? There are 100 years in a century. Does this give you a clue about what the word “percent” means? It is really two words, “per cent,” and means per one hundred. A **percent** is a ratio whose denominator is 100. We use the percent symbol %, to show percent.

NOTE: PERCENT

A percent is a ratio whose denominator is 100.

According to data from the American Association of Community Colleges (2015), about 57% of community college students are female. This means 57 out of every 100 community college students are female, as the figure below shows. Out of the 100 squares on the grid, 57 are shaded, which we write as the ratio $\frac{57}{100}$.



Among every 100 community college students, 57 are female.

Similarly, 25% means a ratio of $\frac{25}{100}$, 3% means a ratio of $\frac{3}{100}$ and 100% means a ratio of $\frac{100}{100}$. In words, "one hundred percent" means the total -- 100% -- is $\frac{100}{100}$, and since $\frac{100}{100}$ = 1, we see that 100% means 1 whole.

Example

Exercise

According to the Public Policy Institute of California (2010), 44% of parents of public school children would like their youngest child to earn a graduate degree. Write this percent as a ratio.

Write the percent as a ratio.

Solution

The amount we want to convert is 44%.	44%
Write the percent as a ratio. Remember that *percent* means per 100.	$\frac{44}{100}$

Write the percent as a ratio.

According to a survey, 89% of college students have a smartphone.

$\frac{89}{100}$

Write the percent as a ratio.

A study found that 72% of U.S. teens send text messages regularly.

$\frac{72}{100}$

Example

Exercise

In 2007, according to a U.S. Department of Education report, 21 out of every 100 first-time freshmen college students at 4-year public institutions took at least one remedial course. Write this as a ratio and then as a percent.

Solution

The amount we want to convert is 21 out of every 100.

Write as a ratio.	$\frac{21}{100}$
Convert the 21 per 100 to percent.	21%

Write as a ratio and then as a percent: The American Association of Community Colleges reported that 62 out of 100 full-time community college students balance their studies with full-time or part time employment.

$\frac{62}{100}, 62\%$

Write as a ratio and then as a percent: In response to a student survey, 41 out of 100 Santa Ana College students expressed a goal of earning an Associate's degree or transferring to a four-year college.

$\frac{41}{100}, 41\%$

Convert Percents to Fractions and Decimals

Since percents are ratios, they can easily be expressed as fractions. Remember that **percent** means per 100, so the denominator of the fraction is 100.

CONVERT A PERCENT TO A FRACTION.

1. Write the percent as a ratio with the denominator 100.
2. Simplify the fraction if possible.

Example

Exercise

Convert each percent to a fraction:

ⓐ 36%
ⓑ 125%

Solution

ⓐ

	36%
Write as a ratio with denominator 100.	$\frac{36}{100}$
Simplify.	$\frac{9}{25}$

ⓑ

	125%
Write as a ratio with denominator 100.	$\frac{125}{100}$
Simplify.	$\frac{5}{4}$

NOTE

Exercise

Convert each percent to a fraction:

ⓐ 48%
ⓑ 110%

1. ⓐ $\frac{12}{25}$
2. ⓑ $\frac{11}{10}$

NOTE

Exercise

Convert each percent to a fraction:

ⓐ 64%
ⓑ 150%

1. ⓐ $\frac{16}{25}$
2. ⓑ $\frac{3}{2}$

The previous example shows that a **percent** can be greater than 1. We saw that 125% means $\frac{125}{100}$, or $\frac{5}{4}$. These are improper fractions, and their values are greater than one.

Example

Exercise

Convert each percent to a fraction:

ⓐ 24.5%
ⓑ $33\frac{1}{3}$%

ⓐ

	24.5%
Write as a ratio with denominator 100.	$\frac{24.5}{100}$
Clear the decimal by multiplying numerator and denominator by 10.	$\frac{24.5(10)}{100(10)}$
Multiply.	$\frac{245}{1000}$
Rewrite showing common factors.	$\frac{5 \cdot 49}{5 \cdot 200}$
Simplify.	$\frac{49}{200}$

ⓑ

	$33\frac{1}{3}\%$
Write as a ratio with denominator 100.	$\frac{33\frac{1}{3}}{100}$
Write the numerator as an improper fraction.	$\frac{\frac{100}{3}}{100}$
Rewrite as fraction division, replacing 100 with $\frac{100}{1}$.	$\frac{100}{3} \div \frac{100}{1}$
Multiply by the reciprocal.	$\frac{100}{3} \cdot \frac{1}{100}$
Simplify.	$\frac{1}{3}$

NOTE

Exercise

Convert each percent to a fraction:

ⓐ 64.4%
ⓑ $66\frac{2}{3}\%$

1. ⓐ $\frac{161}{250}$
2. ⓑ $\frac{2}{3}$

NOTE

Exercise

Convert each percent to a fraction:

ⓐ 42.5%
ⓑ $8\frac{3}{4}\%$

1. ⓐ $\frac{113}{250}$
2. ⓐ $\frac{7}{80}$

Earlier we learned how to convert fractions to decimals. To convert a percent to a decimal, we first convert it to a fraction and then change the fraction to a decimal.

NOTE: CONVERT A PERCENT TO A DECIMAL.

1. Write the percent as a ratio with the denominator 100.
2. Convert the fraction to a decimal by dividing the numerator by the denominator.

Example

Exercise

Convert each percent to a decimal:

ⓐ 6%
ⓑ 78%

Solution

Because we want to change to a decimal, we will leave the fractions with denominator 100 instead of removing common factors.

ⓐ

	6%
Write as a ratio with denominator 100.	$\frac{6}{100}$
Change the fraction to a decimal by dividing the numerator by the denominator.	0.06

ⓑ

	78%
Write as a ratio with denominator 100.	$\frac{78}{100}$
Change the fraction to a decimal by dividing the numerator by the denominator.	0.78

NOTE

Exercise

Convert each percent to a decimal:

ⓐ 9%
ⓑ 87%

1. ⓐ 0.09
2. ⓑ 0.87

NOTE

Exercise

Convert each percent to a decimal:

ⓐ 3%
ⓑ 91%

1. ⓐ 0.03
2. ⓑ 0.91

Example

Exercise

Convert each percent to a decimal:

ⓐ 135%
ⓑ 12.5%

Solution

ⓐ

	135%
Write as a ratio with denominator 100.	$\frac{135}{100}$
Change the fraction to a decimal by dividing the numerator by the denominator.	1.35

ⓑ

	12.5%
Write as a ratio with denominator 100.	$\frac{12.5}{100}$
Change the fraction to a decimal by dividing the numerator by the denominator.	0.125

NOTE

Exercise

Convert each percent to a decimal:

ⓐ 115%
ⓑ 23.5%

1. ⓐ 1.15
2. ⓑ 0.235

NOTE

Exercise

Convert each percent to a decimal:

ⓐ 123%
ⓑ 16.8%

1. ⓐ 1.23
2. ⓑ 0.168

Let's summarize the results from the previous examples and look for a pattern we could use to quickly convert a percent number to a decimal number.

Percent	**Decimal**
6%	0.06
78%	0.78
135%	1.35
12.5%	0.125

Do you see the pattern?

To convert a **percent** number to a decimal number, we move the decimal point two places to the left and remove the % sign. (Sometimes the decimal point does not appear in the percent number, but just like we can think of the integer 6 as 6.0, we can think of 6% as 6.0%.) Notice that we may need to add zeros in front of the number when moving the decimal to the left.

The figure below shows visually how to convert percents to decimals by moving the decimal point two places to the left.

Percent	Decimal
006.%	0.06
078.%	0.78
135.%	1.35
012.5%	0.125

Example

Exercise

Among a group of business leaders, 77% believe that poor math and science education in the U.S. will lead to higher unemployment rates.

NOTE

Exercise

Convert the percent to:

ⓐ a fraction
ⓑ a decimal

Solution

ⓐ

77%

Write as a ratio with denominator 100. $\frac{77}{100}$

ⓑ

$\frac{77}{100}$

Change the fraction to a decimal by dividing the numerator by the denominator. 0.77

NOTE

Exercise

Convert the percent to:

ⓐ a fraction and
ⓑ a decimal

Twitter's share of web traffic jumped 24% when one celebrity tweeted live on air.

1. ⓐ $\frac{6}{25}$
2. ⓑ 0.24

NOTE

Exercise

Convert the percent to:

ⓐ a fraction and
ⓑ a decimal

The U.S. Census estimated that in 2013, 44% of the population of Boston age 25 or older have a bachelor's or higher degrees.

1. ⓐ $\frac{22}{50}$
2. ⓑ 0.44

Example

Exercise

There are four suits of cards in a deck of cards—hearts, diamonds, clubs, and spades. The probability of randomly choosing a heart from a shuffled deck of cards is 25%. Convert the percent to:

ⓐ a fraction
ⓑ a decimal

(credit: Riles 32807, Wikimedia Commons)

Solution

ⓐ

	25%
Write as a ratio with denominator 100.	$\frac{25}{100}$
Simplify.	$\frac{1}{4}$

ⓑ $\frac{1}{4}$

Change the fraction to a decimal by dividing the numerator by the denominator.	0.25

NOTE

Exercise

Convert the percent to:

ⓐ a fraction, and
ⓑ a decimal

The probability that it will rain Monday is 30%.

1. ⓐ $\frac{3}{10}$
2. ⓑ 0.3

NOTE

Exercise

Convert the percent to:

ⓐ a fraction, and
ⓑ a decimal

The probability of getting heads three times when tossing a coin three times is 12.5%.

1. ⓐ $\frac{12.5}{100}$
2. ⓑ 0.125

Convert Decimals and Fractions to Percents

To convert a decimal to a **percent**, remember that percent means per hundred. If we change the decimal to a fraction whose denominator is 100, it is easy to change that fraction to a percent.

NOTE: CONVERT A DECIMAL TO A PERCENT.

1. Write the decimal as a fraction.
2. If the denominator of the fraction is not 100, rewrite it as an equivalent fraction with denominator 100.
3. Write this ratio as a percent.

Example

Exercise

Convert each decimal to a percent:

ⓐ 0.05
ⓑ 0.83

Solution

ⓐ

	0.05
Write as a fraction. The denominator is 100.	$\frac{5}{100}$
Write this ratio as a percent.	5%

ⓑ

	0.83
The denominator is 100.	$\frac{83}{100}$
Write this ratio as a percent.	83%

NOTE

Exercise

Convert each decimal to a percent:

ⓐ 0.01
ⓑ 0.17

1. ⓐ 1%
2. ⓐ 17%

NOTE

Exercise

Convert each decimal to a percent:

ⓐ 0.04
ⓑ 0.41

1. ⓐ 4%
2. ⓐ 41%

To convert a mixed number to a percent, we first write it as an improper fraction.

Example

Exercise

Convert each decimal to a percent:

ⓐ 1.05
ⓑ 0.075

ⓐ

	1.05
Write as a fraction.	$1\frac{5}{100}$
Write as an improper fraction. The denominator is 100.	$\frac{105}{100}$
Write this ratio as a percent.	105%

Notice that since $1.05 > 1$, the result is more than 100%.

ⓑ

	0.075
Write as a fraction. The denominator is 1,000.	$\frac{75}{1,000}$
Divide the numerator and denominator by 10, so that the denominator is 100.	$\frac{7.5}{100}$
Write this ratio as a percent.	7.5%

NOTE

Exercise

Convert each decimal to a percent:

ⓐ 1.75
ⓐ 0.0825

1. ⓐ 175%
2. ⓐ 8.25%

NOTE

Exercise

Convert each decimal to a percent:

ⓐ 2.25
ⓑ 0.0925

1. ⓐ 225%
2. ⓐ 9.25%

Let's summarize the results from the previous examples so we can look for a pattern.

Decimal	Percent
0.05	5%
0.83	83%
1.05	105%
0.075	7.5%

Do you see the pattern? To convert a decimal to a percent, we move the decimal point two places to the right and then add the percent sign.

The figure below uses decimal numbers and shows visually to convert them to percents by moving the decimal point two places to the right and then writing the % sign.

Percent	Decimal
006.%	0.06
078.%	0.78
135.%	1.35
012.5%	0.125

In the section on Decimals we learned how to convert fractions to decimals. Now we also know how to change decimals to percents. So to convert a fraction to a percent, we first change it to a decimal and then convert that decimal to a percent.

NOTE: CONVERT A FRACTION TO A PERCENT.

1. Convert the fraction to a decimal.
2. Convert the decimal to a percent.

Example

Exercise

Convert each fraction or mixed number to a percent:

ⓐ $\frac{3}{4}$

ⓑ $\frac{11}{8}$

ⓒ $2\frac{1}{5}$

Solution

To convert a fraction to a decimal, divide the numerator by the denominator.

ⓐ	
Change to a decimal.	$\frac{3}{4}$
Write as a percent by moving the decimal two places.	0.75
	75%
ⓑ	
Change to a decimal.	$\frac{11}{8}$
Write as a percent by moving the decimal two places.	1.375
	137.5%
ⓒ	
Write as an improper fraction.	$2\frac{1}{5}$
Change to a decimal.	$\frac{11}{5}$
Write as a percent.	2.20
	220%

Notice that we needed to add zeros at the end of the number when moving the decimal two places to the right.

NOTE

Exercise

Convert each fraction or mixed number to a percent:

ⓐ $\frac{5}{8}$
ⓑ $\frac{11}{4}$
ⓒ $3\frac{2}{5}$

1. ⓐ 62.5%
2. ⓑ 275%
3. ⓒ 340%

NOTE

Exercise

Convert each fraction or mixed number to a percent:

ⓐ $\frac{7}{8}$
ⓑ $\frac{9}{4}$
ⓒ $1\frac{3}{5}$

1. ⓐ 87.5%
2. ⓑ 225%
3. ⓐ 160%

Sometimes when changing a fraction to a decimal, the division continues for many decimal places and we will **round** off the quotient. The number of decimal places we round to will depend on the situation. If the decimal involves money, we round to the hundredths place. For most other cases in this book we will round the number to the nearest thousandth, so the percent will be rounded to the nearest tenth.

Example

Exercise

Convert $\frac{5}{7}$ to a percent.

Solution

To change a fraction to a decimal, we divide the numerator by the denominator.

	$\frac{5}{7}$
Change to a decimal—rounding to the nearest thousandth.	0.714
Write as a percent.	71.4%

NOTE

Exercise

Convert the fraction to a percent: $\frac{3}{7}$

42.9%

NOTE

Exercise

Convert the fraction to a percent: $\frac{4}{7}$

57.1%

When we first looked at fractions and decimals, some of the fractions converted to a **repeating decimal**. When we converted the fraction $\frac{4}{3}$ to a decimal, we wrote the answer as 1.3. We will use this same notation, as well as fraction notation, when we convert fractions to percents in the next example.

Example

Exercise

An article in a medical journal claimed that approximately $\frac{1}{3}$ of American adults are obese. Convert the fraction $\frac{1}{3}$ to a percent.

Solution

	$\frac{1}{3}$
Change to a decimal.	$3\overline{)1.00}$ $0.33\ldots$ 9 10 9 1
Write as a repeating decimal.	$0.333\ldots$
Write as a percent.	$33\frac{1}{3}\%$

Convert the fraction to a percent:

According to the U.S. Census Bureau, about $\frac{1}{9}$ of United States housing units have just $1$1bedroom.

11.1% or $11\frac{1}{9}\%$

NOTE

Exercise

Convert the fraction to a percent:

According to the U.S. Census Bureau, about $\frac{1}{6}$ of Colorado residents speak a language other than

English at home.

16.6% or $16\frac{2}{3}\%$

Key Concepts

- A percent is a ratio whose denominator is 100.

- Percents can be converted to fractions and decimals. To convert a percent to a fraction, write it as a ratio with the denominator 100. To convert to a decimal, then divide the numerator by the denominator.
- A decimal can be converted to a percent by moving the decimal point two places to the right and adding a percent sign. A fraction can be converted to a percent by first converting it to a decimal.