

## Part 1: Decimal to Percent

Turning a decimal to a percent is easy if we know what percents mean. A percent is a standardized fraction, with denominator 100. For example, 14% is exactly the same thing as  $\frac{14}{100}$ .

**Example 1** *Convert 0.6 to a percent.*

We first obtain a fraction by "growing a 1". We can check mentally: any number divided by 1 results in the original number.

$$0.6 = \frac{0.6}{1}$$

Now we want to turn this fraction into one with denominator 100. The only thing we can do to a fraction without changing its value is to multiply upstairs and downstairs by the same number. Since our goal is to turn the denominator into 100, we will use 100.

$$0.6 = \frac{0.6}{1} = \frac{0.6 \cdot 100}{1 \cdot 100} = \frac{60}{100} = 60\%$$

Thus  $0.6 = 60\%$ .

**Example 2** *Convert 1.209 to a percent.*

We first obtain a fraction by "growing a 1". Then we turn this fraction into one with denominator 100. The only thing we can do to a fraction without changing its value is to multiply upstairs and downstairs by the same number. Since our goal is to turn the denominator into 100, we will use 100.

$$1.209 = \frac{1.209}{1} = \frac{1.209 \cdot 100}{1 \cdot 100} = \frac{120.9}{100} = 120.9\%$$

Thus  $1.209 = 120.9\%$ . The percent we obtained is larger than 100%, indicating that we have started with a decimal that is larger than 1.

## Part 2: Fraction to Percent

Again, the process is simple if we know what percents mean. A percent is a standardized fraction, with denominator 100. For example, 14% is exactly the same thing as  $\frac{14}{100}$ .

**Case 1.** If we are lucky, we have a fraction whose denominator is a factor of 100.

**Example 3** *Convert  $\frac{7}{20}$  to a percent.*

The only thing we can do to a fraction without changing its value is to multiply upstairs and downstairs by the same number. Since our goal is to turn the denominator into 100, we will use 5.

$$\frac{7}{20} = \frac{7 \cdot 5}{20 \cdot 5} = \frac{35}{100} = 35\%$$

Thus  $\frac{7}{20} = 35\%$ .

**Example 4** Convert  $\frac{3}{4}$  to a percent.

The only thing we can do to a fraction without changing its value is to multiply upstairs and downstairs by the same number. Since our goal is to turn the denominator into 100, we will use 25.

$$\frac{3}{4} = \frac{3 \cdot 25}{4 \cdot 25} = \frac{75}{100} = 75\%$$

Thus  $\frac{3}{4} = 75\%$ .

**Example 5** Convert  $\frac{17}{10}$  to a percent.

The only thing we can do to a fraction without changing its value is to multiply upstairs and downstairs by the same number. Since our goal is to turn the denominator into 100, we will use 10.

$$\frac{17}{10} = \frac{17 \cdot 10}{10 \cdot 10} = \frac{170}{100} = 170\%$$

Thus  $\frac{17}{10} = 170\%$ . The percent we obtained is larger than 100%, indicating that we have started with a fraction that is larger than 1.

**Case 2.** If we are given a fraction whose denominator is not a factor of 100, we can not apply the method used above. The process is still simple: we convert the fraction to a decimal, and then convert the decimal to a percent.

Fraction  $\longleftrightarrow$  Decimal  $\longleftrightarrow$  Percent

**Example 6** Convert  $\frac{29}{80}$  to a percent.

Step 1. We convert  $\frac{29}{80}$  to a decimal by division.

$$29 \div 80 = 0.3625$$

The result is a terminating decimal. To preserve accuracy, we will carry all digits after the decimal point.

Step 2. We convert the decimal to a percent as described in Part 1.

$$0.3625 = \frac{0.3625}{1} = \frac{0.3625 \cdot 100}{1 \cdot 100} = \frac{36.25}{100} = 36.25\%$$

Thus  $\frac{29}{80} = 36.25\%$ .

**Example 7** Convert  $\frac{4}{7}$  to a percent.

Step 1. We convert  $\frac{4}{7}$  to a decimal by division.

$$4 \div 7 = 0.571428571428\dots$$

The result is a non-terminating repeating decimal. To preserve accuracy, we will carry five (or more) digits after the decimal point.

Step 2. We convert the decimal to a percent as described in Part 1.

$$0.57142857 = \frac{0.57142857}{1} = \frac{0.57142857 \cdot 100}{1 \cdot 100} = \frac{57.142857}{100} = 57.142857\%$$

We round the result according to the accuracy requested in the particular problem. For now, we will round to three decimals after the decimal point. The result is  $\frac{4}{7} \approx 57.143\%$ . The sign  $\approx$  means "approximately equal".

**Example 8** Convert  $\frac{43}{15}$  to a percent.

Step 1. We convert  $\frac{43}{15}$  to a decimal by division.

$$43 \div 15 = 2.866666\dots$$

The result is a non-terminating repeating decimal. To preserve accuracy, we will carry five (or more) digits after the decimal point.

Step 2. We convert the decimal to a percent as described in Part 1.

$$2.866666 = \frac{2.866666}{1} = \frac{2.866666 \cdot 100}{1 \cdot 100} = \frac{286.6666}{100} = 286.6666\%$$

We round the result according to the accuracy requested in the particular problem. For now, we will round to three decimals after the decimal point. The result is  $\frac{43}{15} \approx 286.667\%$ . The sign  $\approx$  means "approximately equal". The result is a percent larger than 100%, indicating that we have started with a fraction larger than 1.

### Part 3: Percent to Decimal

**Example 9** Convert 64% to a decimal.

First we re-write the percent as a fraction. Then we perform the division indicated by the fraction

$$64\% = \frac{64}{100} = 0.64$$

Thus  $64\% = 0.64$ .

**Example 10** Convert 150% to a decimal.

First we re-write the percent as a fraction. Then we perform the division indicated by the fraction

$$150\% = \frac{150}{100} = 1.5$$

Thus  $150\% = 1.5$ .

**Example 11** Convert 8.5% to a decimal.

First we re-write the percent as a fraction. Then we perform the division indicated by the fraction

$$8.5\% = \frac{8.5}{100} = 0.085$$

Thus  $8.5\% = 0.085$

## Part 4: Percent to Fraction

We have left the easiest one for last. Percents already are fractions, with denominator 100.

**Example 12** Convert 55% to a reduced fraction.

We rewrite the percent as a fraction and simplify.

$$55\% = \frac{55}{100} = \frac{\cancel{5} \cdot 11}{\cancel{5} \cdot 20} = \frac{11}{20}$$

**Example 13** Convert 240% to a reduced fraction.

We rewrite the percent as a fraction and simplify.

$$240\% = \frac{240}{100} = \frac{20 \cdot 12}{20 \cdot 5} = \frac{12}{5} = 2\frac{2}{5}$$

Thus  $240\% = 2\frac{2}{5}$ . The result is a mixed number, indicating that we started with a percent larger than 100%.

**Example 14** Convert 37.5% to a reduced fraction.

When we rewrite the percent as a fraction, the numerator is not an integer. We fix this by multiplying both numerator and denominator by 10. The rest is as before.

$$37.5\% = \frac{37.5}{100} = \frac{37.5 \cdot 10}{100 \cdot 10} = \frac{375}{1000} = \frac{125 \cdot 3}{125 \cdot 8} = \frac{3}{8}$$

Thus  $37.5\% = \frac{3}{8}$ .

## Exercises

Compute the missing values in the table shown below.

Fraction	Percent	Decimal
$\frac{3}{5}$		
	0.15	
		70%
$\frac{4}{5}$		
	0.52	
		50%
$\frac{2}{9}$		
	1.2	
		100%
$\frac{3}{4}$		
	0.1	
		8%

## Answers for Exercises

Fraction	Percent	Decimal
$\frac{3}{5}$	60%	0.6
$\frac{3}{20}$	0.15	15%
$\frac{7}{10}$	0.7	70%
$\frac{4}{5}$	0.8	80%
$\frac{13}{25}$	0.52	52%
$\frac{1}{2}$	0.5	50%
$\frac{2}{9}$	0.2222	22.222%
$\frac{5}{4}$ or $1\frac{1}{4}$	1.2	120%
1	1	100%
$\frac{3}{4}$	0.75	75%
$\frac{1}{10}$	0.1	10%
$\frac{2}{25}$	0.08	8%

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