

# **BASICS OF PERCENT**

Percent is a special way to represent decimals and fractions in hundredths. This unit is about connecting ratios, proportions, and percents. Comparisons and conversions will be made between numbers expressed as fractions, decimals, and/or percents. Estimation will be used to determine an approximate of a percent of a number. The problem-solving technique of applying trial and error will be examined through various types of problem scenarios.

Fractions to Percent and Vice Versa

Percents and Decimals

Comparing Decimals, Fractions, and Percents

Estimating with Percent

Problem Solving Using Trial and Error

## Fractions to Percents and Vice Versa



### Fractions to Percents

Fractions have percent equivalences and vice versa. Let's look at some examples of expressing a fraction as a percent.

*Example 1:* Express  $\frac{5}{8}$  as a percent.

$$5 \div 8 = 0.625$$

Express the fraction as a decimal by dividing the numerator by the denominator.

$$0.625 = 62.5\%$$

Multiply the decimal by 100 using the shortcut of moving the decimal point two places to the right.

$$\frac{5}{8} = 62.5\%$$

*Example 2:* Express  $2\frac{2}{3}$  as a percent.

$$2\frac{2}{3} = \frac{8}{3}$$

Express the mixed fraction as an improper fraction.

$$8 \div 3 = 2.666\dots$$

Express the fraction as a decimal by dividing the numerator by the denominator.

$$2.666\dots = 266.67\%$$

Multiply the decimal by 100 using the shortcut of moving the decimal point two places to the right, and then round the repeating decimal to the nearest hundredth of a percent.

$$2\frac{2}{3} = 266.67\%$$

*Example 3:* Express  $\frac{3}{400}$  as a percent.

$$3 \div 400 = 0.0075$$

Express the fraction as a decimal by dividing the numerator by the denominator.

$$0.0075 = 0.75\%$$

Multiply the decimal by 100 using the shortcut of moving the decimal point two places to the right.

$$\frac{3}{400} = 0.75\%$$

## Percents to Fractions

Fractions have percent equivalences and vice versa. Let's look at some examples of expressing a percent as a fraction.

*Example 1:* Express 35% as a fraction.

$$35\% = \frac{35}{100}$$

Meaning of percent.

$$\frac{35}{100} = \frac{7}{20}$$

Simplify the fraction reducing by 5.

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

*Example 2:* Express  $8\frac{1}{2}\%$  as a fraction.

$$8\frac{1}{2}\% = \frac{8\frac{1}{2}}{100}$$

Meaning of percent.

$$8\frac{1}{2} \div 100$$

Use division of fractions.

$$\frac{17}{2} \div \frac{100}{1}$$

Write the division problem in fraction form.

$$\frac{17}{2} \cdot \frac{1}{100} = \frac{17}{200}$$

Invert the second fraction, and then multiply.

$$8\frac{1}{2}\% = \frac{17}{200}$$

## Percents and Decimals

### Express Percents as Decimals Using a Shortcut

When expressing a percent as a decimal, the percent number is divided by 100.

When dividing a number by 100, the decimal point is moved two places to the left.

#### Percent to Decimal (Shortcut)

Move the decimal point **two places** to the **left**.

*Example 1:* Express 89% as a decimal.

If a decimal point is not visible, then we assume that it is located at the end of the number. We then divide the percent by 100 or just move the decimal point **two places** to the **left**.

$$\left( \begin{array}{r} .89 \\ 100 \overline{)89.00} \end{array} \right)$$

89% can be written as 89.%

$\leftarrow$  89.% = 0.89      *Shortcut:* Move the decimal two places to the left.

$$89\% = 0.89$$

*Example 2:* Express 6.25% as a decimal.

$$\left( \begin{array}{r} .0625 \\ 100 \overline{)6.2500} \end{array} \right)$$

Divide the percent by 100 or just move the decimal point **two places** to the **left**.

$\leftarrow$  6.25% = 0.0625      *Shortcut:* Move the decimal point two places to the left. Use a zero as a place holder.

$$6.25\% = 0.0625$$

*Example 3:* Express 275% as a decimal.

If a decimal point is not visible, then we assume that it is located at the end of the number. We then divide the percent by 100 or just move the decimal point **two places** to the **left**.

$$\left( \begin{array}{r} 2.75 \\ 100 \overline{)275.00} \end{array} \right)$$

275% can be written as 275.%

$275.\% = 2.75$       *Shortcut:* Move the decimal two places to the left.

$275\% = 2.75$

### Express Decimals as Percents Using a Shortcut

When expressing a decimal as a percent, the decimal number is multiplied by 100. When multiplying a number by 100, the decimal point is moved two places to the right.

#### Decimal to Percent (Shortcut)

Move the decimal point **two places** to the **right**.

*Example 4:* Express 0.34 as a percent.

Multiply the percent by 100 or just move the decimal point **two places** to the **right**.

$$\left( \begin{array}{r} 0.34 \\ \times 100 \\ \hline 34.00 = 34 \end{array} \right)$$

$0.34 = 34.\%$  or just 34%

$0.34 = 34\%$

*Example 5:* Express 8.5 as a percent.

Multiply the percent by 100 or just move the decimal point **two places** to the **right**.

$$\left( \begin{array}{r} 8.5 \\ \times 100 \\ \hline 850.0 = 850 \end{array} \right)$$

8.5 = 850.% or just 850%      Use a zero as a place holder.

$$8.5 = 850\%$$

*Example 6:* Express 0.0025 as a percent.

Multiply the percent by 100 or just move the decimal point **two places** to the **right**.

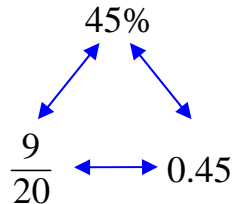
$$\left( \begin{array}{r} 0.0025 \\ \times \quad 100 \\ \hline 0.2500 = 0.25 \end{array} \right)$$

$$0.0025 = 0.25\%$$

$$0.0025 = 0.25\%$$

## Compare Percents, Fractions, and Decimals

Percents, fractions, and decimals may all be used to represent the same quantity. Let's take a look at how to apply this connection.



$$45\% = 0.45 = \frac{45}{100} = \frac{9}{20}$$

*Example:* Rearrange the given numbers in order from least to greatest.

$$\frac{3}{4}, 15 \text{ out of } 16, 0.075, 79\%$$

To solve, express each number as a decimal, and then compare.

$$\frac{3}{4} = 0.75$$

$$15 \text{ out of } 16 = 15 \div 16 = 0.9375$$

$$0.075 \quad \text{No change}$$

$$79\% = 0.79$$

List the decimals and add enough zeros to compare.

0.7500

0.9375

0.0750

0.7900

Compare the numbers without the decimals and put them in order from smallest to largest:

$$750 \rightarrow 7500 \rightarrow 7900 \rightarrow 9375$$

Least to greatest written as decimals:

$$0.0750, 0.7500, 0.7900, 0.9375$$

Least to greatest written as original numbers:

$$0.075, \frac{3}{4}, 79\%, 15 \text{ out of } 16$$



## Estimating with Percent

On many occasions we only need to estimate when working with percent. An estimate is a value that is close to the actual value but easier to compute mathematically.



Let's examine a variety of ways to estimate, and then choose which method or combination of methods works best for the given problem.

### Finding 1% First

*Example 1:* Estimate 40% of 876.

$$1\% \text{ of } 876 \text{ is } 8.76$$

$$876 \times .01 = 8.76$$

$$8.76 \approx 9$$

Round 8.76 to nearest whole number 9.

$$40 \times 9 = 360$$

If 1% is approximately 9, then multiply 9 by 40 to get an estimate of 40% of 876.

$$40\% \text{ of } 876 \approx 360$$

### Finding a Nearby Simple Fraction

*Example 2:* Estimate 73% of 589.

$$73\% \text{ is about } 75\% \text{ or } \frac{3}{4}.$$

Round the percent to the nearest percent equal to a simple fraction.

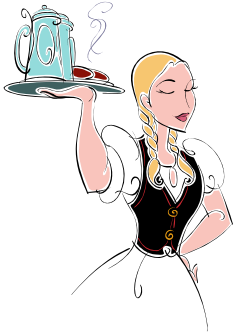
$$589 \approx 600$$

Round 589 to 600 to multiply by  $\frac{3}{4}$ .

$$\left( \frac{3}{4} \times 600 = \frac{3}{4} \times \frac{600}{1} = \frac{3}{\cancel{4}_1} \times \frac{600^{150}}{1} = \frac{450}{1} = 450 \right)$$

$$73\% \text{ of } 589 \approx 450$$

## Figuring a Standard 15% Restaurant Tip Mentally



*Example 3:* When eating out at a restaurant, it is standard to give a tip of 15% for good service. If the family meal costs \$43.28, how much should be left as a tip?

Estimate 15% of \$43.28

\$43.28 is about \$44      Round up to get an even number (easier to use)

*Think:* 10% + 5% = 15%

10% of \$44 is \$4.40      A quick way to find 10% of a number is to move the decimal point one place to the left.

\$44	)
×.10	
4.40 = \$4.40	

\$44. = \$4.40  
     $\leftarrow$

5% of \$44 is \$2.20      (5% is  $\frac{1}{2}$  of 10%, therefore  $\frac{1}{2}$  of \$4.40 is \$2.20)

2.20	)
2)4.40	

$$4.40 + 2.20 = \$6.60$$

So, a tip that might be left for this meal would be \$6.60.

Some people round up or down to the nearest quarter, fifty-cents, or dollar. In this case, the tip might be \$6.50, \$6.75, or even \$7.00.

## Problem Solving Using Trial and Error

Many math problems can be solved using the “*Guess and Check*” strategy. The summary below details how the strategy is used.

- First, make an educated guess for a solution.
- Check the guess.
- If incorrect, determine how to improve the next guess.
- Guess again and check the new guess.
- Repeat the steps until the correct solution is determined.

# Guess and Check

*Example 1:* The product of three consecutive whole numbers is 504. What are the three numbers?

Follow these steps when using the “Guess and Check” strategy.

- What is given?

The product of *three consecutive whole numbers* is **504**.

(*Product* is the answer to a multiply problem.)

(*Consecutive whole numbers* are numbers that follow each other by one, for example: 5, 6, and 7.)

- What is asked?

What are the three numbers?

- *Plan:* Since the solution is a **product** and the numbers need to be **consecutive**, first try multiplying three single digit numbers to find a range of what the numbers may be.

- Solve

Guess:  $4 \times 5 \times 6 = 120$

Too low so increase the numbers.

Guess:  $9 \times 10 \times 11 = 990$

Too high so decrease the numbers.

Guess:  $6 \times 7 \times 8 = 336$

Too low, but closer.

Guess:  $7 \times 8 \times 9 = 504$

Yes!!!



The product of 7 times 8 times 9 equals 504.

*Example 2:* A certain number, multiplied by itself, is 2,116. What is the number?

Follow these steps when using the “Guess and Check” strategy.

- What is given?

One number, multiplied by itself, is 2,116.

- What is asked?

What is the number?

- *Plan:* Use multiples of 10 to find a range.

- Solve

Test multiples of 10.

Guess:  $40 \times 40 = 1600$

Too low so increase the numbers.

Guess:  $60 \times 60 = 3600$

Too high so decrease the numbers.

Guess:  $50 \times 50 = 2500$

Too high, but closer.

Now try halfway between 40 and 50 since 2115 is between 1600 and 2500.

Guess:  $45 \times 45 = 2025$

Too low, but closer.

Now try counting by ones between 45 and 50.

Guess:  $46 \times 46 = 2116$

Yes!!!



The number, 46, times itself equals 2116.