

# **BASIC PERCENT APPLICATIONS**

There are three basic types of percent problems: finding part, finding base, and finding percent. There are several ways to solve these types of problems; but, in this unit, we will focus on the “is/of” method to set up proportions based on percents. There are many uses of percent and in this unit we will extend our knowledge of percent problems to learn how to calculate “percent change”. In addition, we will examine how insurance premiums are calculated using tables to save time in figuring premium costs.

## **The Three Basic Types of Percent Problems**

### **Percent Change**

### **Calculating Insurance Premiums**

## The Three Basic Types of Percent Problems

Percent means per hundred; thus, when we say 27% we mean 27 out of 100. Percents can be written as equivalent decimals and fractions.

$27\% = 0.27$  Move the decimal point two (2) places to the left.

$27\% = \frac{27}{100}$  Put 27 over 100 since percent means per hundred.

Percents greater than 100% represent whole numbers or mixed numbers.

$200\% = 2$        $350\% = 3.5 = 3\frac{5}{10} = 3\frac{1}{2}$

The three basic types of percent problems are:

- (1) finding the part (finding a percent of a number)
- (2) finding percent
- (3) finding the base

There are several ways to solve these three types of problems; however, we will focus on the “ratio-proportion” method.

When finding the part or the base, use the ratio  $\frac{\text{is}}{\text{of}}$  to set up a proportion. The **part** is near the word “**is**” and the **base** will follow the word “**of**”. The **percent** is identified by the word percent or the percent symbol (%).

## Finding Part

To find **what part a percent is of the base**, use the following proportion.

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{\%}{100} = \frac{\text{part}}{\text{base}}$$

*Example 1:* What is 32% of 350?

**What** is 32% of 350?

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{32}{100} = \frac{n}{350}$$

The percent (32%) is placed over 100.

The base follows “of” and is 350.

The part is near “is” and is unknown ( $n$ ).

Now solve:

$$\frac{32}{100} = \frac{n}{350}$$

$$100n = 32(350)$$

$$100n = 11200$$

$$n = 112$$

Cross Multiply

Simplify

Divide

$$32\% \text{ of } 350 = 112$$

*Other ways* this problem may be stated are:

Thirty-two percent of 350 is what number?

Find 32% of 350.

*A Second Method:* Since this type of percent problem is used often, we will discuss another method which is quicker. To find part, the **percent of a number**, first write the percent as a decimal by moving the decimal point two places to the left, and then multiply the given numbers.

To find 32% of 350, simply change 32% to a decimal, interpret the “of” as multiplication, and then multiply.

$$\begin{aligned} 32\% \text{ of } 350 &= \\ &= 0.32 \times 350 \\ &= 112.00 \\ &= 112 \end{aligned}$$

32% of 350 is **112**

## Finding Percent

To find **what percent a number is of another number**, let's go back to the percent proportion.

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{\%}{100} = \frac{\text{part}}{\text{base}}$$

*Example 2:* Twenty-six is what percent of 50?

Twenty-six is **what percent** of 50?

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{n}{100} = \frac{26}{50}$$

The unknown percent ( $n$ ) is placed over 100.

The base follows “of” and is 50.

The part is near “is” and is 26.

Now solve:

$$\frac{n}{100} = \frac{26}{50}$$

$$50n = 26(100)$$

$$50n = 2600$$

$$n = 52$$

Cross Multiply

Simplify

Divide

$$\frac{52}{100} = 52\%$$

Fifty-two percent of 50 is 26.

*Other ways* this problem may be stated are:

What percent of 50 is 26? Twenty-six out of 50 is what percent?

*A Second Method:* To find **percent**, make a fraction, divide to find the decimal, and then move the decimal point two places to the right for percent.

To solve “26 is what percent of 50, make a fraction:

$$\frac{26}{50} \quad \text{The number that follows “of” is the base of the fraction.}$$

Change the fraction to a decimal:

$$\begin{array}{r} .52 \\ 50 \overline{)26.00} \\ \underline{250} \\ 100 \\ \underline{100} \\ 0 \end{array}$$

Change the decimal to a percent by moving the decimal point two places to the right.

$$.52 = 52\%$$

→  
26 is **52%** of 50

## Finding Base

The third type of basic percent problems is **finding the base** when given the percent and part.

To find the base, we’ll revisit the percent proportion one more time.

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{\%}{100} = \frac{\text{part}}{\text{base}}$$

*Example 3:* Seventy-five is 15% of what number?

Seventy-five is 15% of what number?

$$\frac{\%}{100} = \frac{\text{is}}{\text{of}} \rightarrow \frac{15}{100} = \frac{75}{n}$$

The percent (15%) is placed over 100.  
The base follows “of” and is unknown ( $n$ ).  
The part is near “is” and is 75.

Now solve:

$$\frac{15}{100} = \frac{75}{n}$$

$$15n = 75(100)$$

$$15n = 7500$$

$$n = 500$$

Cross Multiply

Simplify

Divide

Seventy-five is 15% of 500.

*Other ways* this problem may be stated are:

Fifteen percent of what number is 75?

*A Second Method:* To find **base**, write an equation and divide using the decimal for the percent.

To solve “Seventy-five is 15% of what number”, write an equation:

Seventy-five is 15% of what number

$$75 = 0.15 \times n \quad \text{is(=)} \quad \text{of}(\times) \quad 75\%(0.75)$$

Divide to solve.

$$\frac{75}{0.15} = \frac{0.15 \times n}{0.15}$$

$$\begin{array}{r} 500. \\ .15 \overline{)75.00} \\ \underline{75} \\ 000 \\ \underline{000} \end{array}$$

75 is 15% of **500**



## Percent Change



In our daily living, we see many changes transpire through the years. In the financial world, changes can be charted through percent. We will now look at how to represent changes of increase and changes of decrease in percent.

**Percent of change** is the ratio of the **amount of change** to the **original amount**.

$$\text{Percent Change} = \frac{\text{Amount of Change}}{\text{Original Amount}}$$

## Percent of Increase

*Example 1:* Union High School's enrollment increased from 525 students last year to 562 students this year. What is the percent of increase in the number of students this year?

*Step 1:* Subtract to find the amount of change.

$$562 - 525 = 37$$

*Step 2:* Write a proportion to solve, "37 (change) is what percent of 525 (original enrollment)".

$$\frac{\text{Amount of Change}}{\text{Original Amount}} = \frac{37}{525} = \frac{n}{100}$$

$$\frac{37}{525} = \frac{n}{100}$$

Cross Multiply

$$\frac{525n}{525} = \frac{3700}{525}$$

Divide

$$n = \frac{3700}{525}$$

$$n \approx 7\%$$

\*Round to the nearest whole percent.

$$\begin{array}{r} 7.04 \\ 525 \overline{)3700.00} \\ \underline{3675} \phantom{00} \\ 2500 \phantom{00} \\ \underline{2100} \phantom{00} \\ 400 \phantom{00} \end{array} \quad 7.04 \approx 7\%$$

There is a 7% increase in students at Union High School this year.

## Percent of Decrease

*Example 2:* The town population decreased from 4000 to 3350 in the last census year. Find the percent of decrease.

*Step 1:* Subtract to find the amount of change.

$$4000 - 3350 = 650$$

*Step 2:* Write a proportion to solve, “650 (change) is what percent of 4000 (original population)”.

$$\frac{\text{Amount of Change}}{\text{Original Amount}} = \frac{650}{4000} = \frac{n}{100}$$

$$\frac{650}{4000} = \frac{n}{100}$$

$$4000n = 65000$$

$$\frac{4000n}{4000} = \frac{65000}{4000}$$

$$n = \frac{65000}{4000}$$

$$n = 16.25\%$$

$$\begin{array}{r} 16.25 \\ 4 \overline{)65.00} \quad 16.25\% \\ \underline{4} \phantom{00} \\ 25 \phantom{0} \\ \underline{24} \phantom{0} \\ 10 \phantom{0} \\ \underline{8} \phantom{0} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

There is a 16.25% decrease in the town population.

## Calculating Insurance Premiums

Life insurance protects against financial loss due to death. There are four types of life insurance listed in the table below.

Insurance rates vary by age. The younger an insured person is at the beginning of coverage, the lower the premium.

*Example:* Joe is 35 years old. Use the table to find his annual premium for a \$10,000, 10-year term policy.

Annual Premiums Per \$1,000 of Insurance							
Age	Term		Straight Life	Limited Payment		Endowment	
	5-Year	10-Year		20-Year	30-Year	20-Year	30-Year
20	7.80	8.15	17.65	30.00	24.00	51.40	33.80
25	8.55	9.15	20.05	33.05	26.45	52.25	34.85
30	9.80	10.70	22.90	36.20	28.60	50.80	34.10
35	11.75	13.05	26.65	40.35	32.35	52.50	36.40
40	14.50	16.50	31.20	44.70	36.45	54.35	39.20

Let's look at the table again and focus on the *column* for a 10-year "term" policy and the *row* for a 35-year old person.

Annual Premiums Per \$1,000 of Insurance							
Age	Term		Straight Life	Limited Payment		Endowment	
	5-Year	10-Year		20-Year	30-Year	20-Year	30-Year
20	7.80	8.15	17.65	30.00	24.00	51.40	33.80
25	8.55	9.15	20.05	33.05	26.45	52.25	34.85
30	9.80	10.70	22.90	36.20	28.60	50.80	34.10
35	11.75	13.05	26.65	40.35	32.35	52.50	36.40
40	14.50	16.50	31.20	44.70	36.45	54.35	39.20

Also, consider that the chart shows **cost per \$1000** of insurance coverage; so, divide 10,000 by 1000 to find what number to multiply times the cost per 1000.

$$10,000 \div 1000 = \frac{10,000}{1,000} = 10$$

Cost per 1,000 = 13.05 (from the chart)

Therefore, the cost for \$10,000 is:

$$13.05 \times 10 = 130.50$$

$$\left( \begin{array}{r} 13.05 \\ \phantom{13.}10 \\ \hline 130.50 \end{array} \right)$$

The annual premium to insure Joe, age 35, with a 10-year term policy and coverage of \$10,000 life insurance is \$130.50.