

**Section A.1: Three Ways of Using Percentages****Using percentages**

We can use percentages in three different ways:

- *To express a fraction of something.* For example, "A total of 10,000 newspaper employees, 2.6% of the newspaper work force, lost their jobs" uses percentage to express a fraction of total newspaper work force.
- *To describe a change in something.* For example, "Cisco stock rose 5.7% last week, to \$18" uses percentage to describe a change in stock price.
- *To compare two objects.* For example, "High definition television sets have 125% more resolution than conventional TV sets, but cost 400% more" uses percentage to compare the resolutions and the costs of televisions.

**Using Percentages as Fractions****Ex.1**

If 10% of eighth-graders smoke and there are 50,000 eighth-graders, how many eighth-graders smoke?

**Using Percentages to Describe Change****Absolute change and relative change**

We can express the change of something in two ways:

- The *absolute change* describes the actual increase or decrease from a reference value to a new value:

$$\text{absolute change} = \text{new value} - \text{reference value}.$$

- The *relative change* is a fraction that describes the size of the absolute change in comparison to the reference value:

$$\text{relative change} = \frac{\text{absolute change}}{\text{reference value}} = \frac{\text{new value} - \text{reference value}}{\text{reference value}}.$$

The relative change can be converted from a fraction to a percentage by multiplying by 100%. The relative change formula leads to the following important rules:

- When a quantity doubles in value, its relative change is  $1 = \frac{100}{100} = 100\%$ .
- When a quantity triples in value, its relative change is  $2 = 200\%$ .
- When a quantity quadruples in value, its relative change is  $3 = 300\%$ . And so on.

Note that the absolute and relative change are positive if the new value is greater than the reference value and the absolute and relative change are negative if the new value is less than the reference value.

**Ex.2**

Suppose the population of a town was 2,000 in 1980 and 7,000 in 2000. Find the absolute change and the relative change.

**Ex.3 Depreciating a Computer.**

You bought a computer three years ago for \$1000. Today, it is worth only \$300. Describe the absolute and relative change in the computer's value.

**Using Percentages for Comparisons**Absolute change and relative difference

Percentages are commonly used to compare two numbers. There are two different ways to compare two objects:

- The *absolute change* is the actual difference between the compared value and the reference value:

$$\text{absolute difference} = \text{compared value} - \text{reference value}.$$

- The *relative difference* describes the size of the absolute difference as a fraction of the reference value:

$$\text{relative difference} = \frac{\text{absolute difference}}{\text{reference value}} = \frac{\text{compared value} - \text{reference value}}{\text{reference value}}.$$

The relative difference formula gives a fraction. We can convert the answer to a *percent difference* by multiplying it by 100%.

The absolute and relative difference are positive if the compared value is greater than the reference value and the absolute and relative change are negative if the compared value is less than the reference value.