

Most numbers have units. A **unit** is the word (or words) come after the number and describe what the number is measuring. For example: 5 apples, or 3.1 miles, etc. To add and subtract numbers, they must have the same units. Things get tricky when we need to multiply and divide numbers. Numbers being multiplied or divided are called **factors**. When we multiply numbers, we also multiply their units. When we divide, we divide units.

1. When we say that something has doubled, what factor are we talking about?
2. In 2000, the population of the United States was 282 million people. In 2020 it was 330 million. By what factor has the population increased?

One special kind of factor is a **conversion factor** that is used to convert numbers measured with one unit into the equivalent number in a different unit. For example, 1 yard is 3 feet so the conversion factor to convert yards into feet is $\left(\frac{3 \text{ feet}}{1 \text{ yard}}\right)$. In words: 3 feet per yard. To convert 9 yards into feet, just multiply by the conversion factor.

$$9 \text{ yards} \times \left(\frac{3 \text{ feet}}{1 \text{ yard}}\right) = 27 \text{ feet}$$

Notice that the units for yards cancel out, leaving only the units for feet.

4. What is the conversion factor to convert feet back to yards?
5. What is the conversion factor to convert kilometers to meters?
6. What is the conversion factor to convert decimal numbers like 0.6 into percentages?

Conversion factors can be strung together to convert several units at once. This technique is called **factor-label method**. For example, to compute how many seconds there are in one year, just multiply the following conversion factors together:

$$1 \text{ year} \times \left(\frac{365 \text{ days}}{1 \text{ year}}\right) \times \left(\frac{24 \text{ hours}}{1 \text{ day}}\right) \times \left(\frac{60 \text{ minutes}}{1 \text{ hour}}\right) \times \left(\frac{60 \text{ seconds}}{1 \text{ minute}}\right).$$

That is definitely a job for a calculator! The answer is 31,536,000 seconds.

Example: Feeding the Population

7. How many acres of farmland would it take to grow enough corn to sustain one person for a whole year?
 - A person needs about 2,000 calories per day.
 - An ear of corn has about 100 calories.
 - An acre of land can produce about 200 bushels of corn depending on weather, soil, and other factors.
 - A bushel of corn is about 50 ears.

8. How many acres of farmland would it take to grow enough corn to feed the population of the United States? As of 2020, there were 330 million people in the USA.

9. A square mile is the same as 640 acres. There are about 3,120,000 square miles of land in the lower 48 states. What percent of land in the lower 48 would need to be devoted to farming to raise enough corn to feed the country?

10. As of 2019, there are about 900 million acres of farmland in the United States. This is much more than the minimum needed to feed the population. How many times more farmland is there than the minimum needed to feed the population?

11. Is your answer to the last problem a factor or a unit?