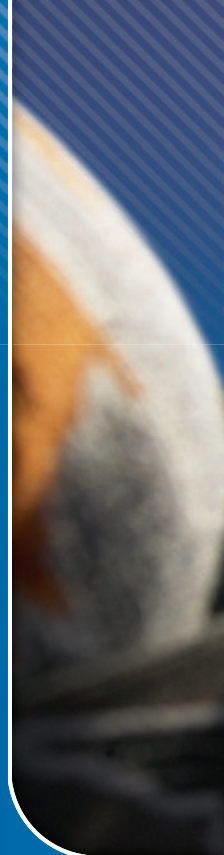


# Using Algebra to Describe



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### A picture is worth a thousand words.

In mathematics, pictures and symbols are used to summarize mathematical concepts that normally require many words to describe, as shown below.

For many years you have multiplied fractions. You know that  $\frac{5}{8} \cdot \frac{3}{4} = \frac{15}{32}$ . Here is the general rule for multiplying fractions.

**To multiply two fractions, multiply their numerators to get the numerator of the product, and then multiply their denominators to get the denominator of the product.**

Wow! This rule is quite a mouthful. It is 26 words long. Here is the same rule in the language of algebra.

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}, b \neq 0, d \neq 0$$



The description in algebra is much shorter than the description in words, just like showing the photograph above is “shorter” than trying to describe it in words. The algebraic description also shows the arithmetic of fractions. *Algebraic descriptions can make it easier to understand relationships among numbers and quantities.*

In the algebraic description,  $a$ ,  $b$ ,  $c$ , and  $d$  are *variables*. Except for the fact that  $b$  and  $d$  cannot equal zero (you cannot divide by 0), these variables can stand for any numbers. They could be whole numbers, fractions, decimals, or percents. They could be positive or negative.

The algebraic description works for any situation in which you need to multiply fractions. Algebra is a powerful language that is used throughout the world. This is why almost all students are required to learn some algebra.

In this book you will see how algebra can be used to describe patterns, to explain why numbers act as they do, to solve problems, and to discover and prove relationships between quantities. This first chapter describes patterns with algebra and illustrates them with graphs.