Key Concepts

Lesson 1

Variables and Expressions

Objective Teach students the notion of *variable* and *algebraic expression.* Provide practice writing algebraic expressions from verbal expressions and writing verbal expressions from algebraic ones.

Note to the Teacher *The most important concept in algebra is that of a variable. This is a concept that your students may have seen before, but it is important to begin by reviewing and discussing this concept.*

Start by reminding your students that a variable is simply a letter or sometimes a symbol used to represent a quantity. For example, suppose b represents the number of boys in the class and g represents the number of girls. A *verbal expression* like "There are 14 girls in the class." can be written as an *algebraic expression* or *equation,* which involves a variable.

$$g = 14$$

We can also write a verbal expression from an algebraic one. Because we know that the variable b represents the number of boys in the class, the algebraic equation $b = 15$ can be translated to the verbal sentence "There are 15 boys in the class."

It is a good idea to give a definition of *algebraic expression* to your class. It need not be a formal definition that your students need to memorize, but it is a good idea to write it on the board and discuss it so that your students understand it.

What is an algebraic expression?

You may want to introduce these definitions.

- A **variable** is a letter or symbol used to represent a quantity.
- An **algebraic expression** consists of one or more numbers and variables along with one or more arithmetic operations.

Some examples of algebraic expressions are shown below.

$x + 6$ $\qquad$ $\frac{x}{4} - 3$ $\qquad$ $\frac{x^2}{3y^3} \cdot 12x$

Give your students several simple quantities and have them assign variables to describe them. For example, the number of students with brown hair might be x, and the number of students with blonde hair might be y. Then ask them for both verbal and algebraic expressions and equations to express these quantities. For example, $y = 4$ could be expressed verbally as "There are four students with blonde hair."

You might write a table like the following to show the relation between verbal and algebraic expressions.

Verbal Expressions	Algebraic Expressions
2 more than a number x	$x + 2$
The square of a number x divided by 3 times a number y	$\frac{x^2}{3y}$
The number of eyes in the classroom (Let s represent the number of students in the class.)	$2s + 2$ or $2(s + 1)$ (Each student has 2 eyes and the teacher has 2 eyes)

Remind your students of the terms that describe expressions like x^5. These expressions are called *powers*. The x is the *base* of the power and the number 5 is called the *exponent*. The expression x^5 is described verbally as *"x raised to the fifth power"* or simply *"x to the fifth."*

Now use the following examples of translating between algebraic and verbal expressions.

Example 1 **Write an algebraic expression for *the sum of 3 and the number x divided by 16.***

Solution $(3 + x) \div 16$ or $\frac{3 + x}{16}$

Example 2 **Write an algebraic expression for *six subtracted from the number y, all raised to the fourth power.***

Solution $(y - 6)^4$

Example 3 **Write a verbal expression for $5m - n^2$.**

Solution the product of 5 and the number m minus the number n raised to the second power (or n squared)

Example 4 **Write a verbal expression for $(x + 2)^y$.**

Solution the sum of the number x and 2, all raised to the exponent y (or the yth power)

There is one final term that you should describe to your students in this lesson. To **evaluate** an expression means to find its values. Use the following examples to illustrate this definition.

Example 5 **Evaluate 4^3.**

Solution $4^3 = 4 \cdot 4 \cdot 4$

$= 64$

Example 6 **Evaluate the expression $(x + 3)^2$ when $x = 3$.**

Solution Substitute 3 for x in the expression.

$(x + 3)^2 = (3 + 3)^2$

$= 6^2$

$= 36$

Note to the Teacher *The processes of assigning variables to quantities and of translating between verbal and algebraic expressions are fundamental in algebra. Your students will be performing these tasks throughout the entire course as well as in higher mathematics and science. Make sure your students get plenty of practice with these skills by assigning lots of problems for both in class work and homework.*