PBS Lesson Series

Math: Grade 8, Lesson 1, Equations and Expressions

Objective: Students will write equations using symbols.
Lesson Focus: Writing Equations Using Symbols
Practice Focus: Writing Equations Using Symbols
TN Standard: 8.EE.C.7.b with supporting standards 7.EE.B.4; 6.EE.B.7
Key Vocabulary:

- Expressions
- Equations
- Equivalent symbolic statements
- "Most Common Mistake" phrases:
  - Added to
  - Taken from
  - More than
  - Less than
- Consecutive
  - Consecutive numbers
  - Consecutive odd or even numbers

Teacher Video Materials:

- Whiteboard & Markers

Student Materials: Materials

- Paper and writing utensil or other notetaking device
- Student packet for math, grade 8 lesson 1, which can be found at www.tn.gov/education
- No calculator required

Teacher Do	Student Do
<u>Opening</u> **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 8th graders out there, though all children are welcome to tune in. This lesson is the first in our series.** **My name is ____ and I'm an ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!** **Today we will be learning about Equations and Expressions and reviewing Writing Equations Using Symbols! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and a writing utensil or another notetaking device** • **Student packet for math, grade 8 lesson 1, which can be found at www.tn.gov/education** • **No calculator needed today!**	Students get materials ready for the lesson

Ok, let's begin!	
<u>Intro</u> **Today we are reviewing writing equations using symbols. Let's start by thinking back to some things we've already learned about equations and expressions. Take a look at this mathematical statement and the equivalent expression.** [Teacher show or write on the board ahead of time.] **Think about how they are related and which representation you prefer and why.** [Pause]	Students look for how the two are related and to think about which representation they prefer and why as they write their own ideas on their own paper or notetaking device.

The number 1,157 is the sum of the squares of two consecutive odd integers divided by the difference between the two consecutive odd integers.	$1157 = \frac{x^2 + (x+2)^2}{(x+2) - x}$

Using letters to represent numbers in mathematical statements was introduced by René Descartes in the 1600s. In that era, people used only words to describe mathematical statements. The use of letters, or symbols, to represent numbers not only brought clarity to mathematical statements, it also expanded the horizons of mathematics.

The reason we want to learn how to write a mathematical statement using symbols is to save time and labor. Imagine having to write the sentence: "The number is the sum of the squares of two consecutive odd integers divided by the difference between the two consecutive odd integers." Then, imagine having to write the subsequent sentences necessary to solve it; compare that to the following:

[Write this on the board]

Let x represent the first odd integer. Then,

$$1157 = \frac{x^2 + (x+2)^2}{(x+2) - x}.$$

Notice that *x* is just a number. That means the square of *x* is also a number, along with the square of the next odd integer and the difference between the numbers. This is a symbolic statement about numbers.

Writing in symbols is simpler than writing in words, as long as everyone involved is clear about what the symbols mean. This lesson focuses on accurately transcribing written statements into mathematical symbols. When we write mathematical statements using letters, we say we are using symbolic language.

All of the mathematical statements in this lesson are equations. Recall that an equation is a statement of equality between two

expressions. Developing equations from written statements forms an important basis for problem solving and is one of the most vital parts of algebra. Throughout this module, there will be work with written statements and symbolic language. We will work first with simple expressions, then with equations that gradually increase in complexity, and finally with systems of equations (more than one equation at a time).	
<u>Teacher Model</u> **Let's look at three examples. While you are watching, follow along on your own paper or other notetaking device.** [Use the Scaffolding options, and minimize to examples 1, 4 and 5 if necessary] [Example 1] **Here's a statement we want to express using symbolic language**: **A whole number has the property that when half the number is added to 15, we get the number itself.** [Write on the board] **First, we define the variable. Let *x* be the whole number.** **Using *x* to represent the whole number, write "half of the number." Remember you can often write expressions in more than one way.** **Response: *x*/2 or ½ *x* or (½)*x*.** **Now, let's write the entire statement:** **Did you get something like this?** [Teacher writes or shows.] ***x*/2 + 15 = x or ½ x + 15 = x** [Example 2] **Let's try this with another example:** **Here's a statement**: **When a number is taken away from 57, what remains is four more than 5 times the number.** [Teacher shows or writes on the board.] **Don't forget to define the variable! Let *x* be the whole number.** **Start your equation with one part of the statement. How about "four more than 5 times the number? What would that look like?** [Pause.] **Did you get something like this? 5*x* + 4** [Teacher writes or shows.] **Are there other ways to write that expression?** [Pause.] **Great! Now, let's try this part of the statement: "A number taken away from 57"** [Pause.]	Students follow along writing their ideas on their own paper or notetaking device during the examples. Students may copy or just watch. Students review their work and compare with teacher. Students may copy or just watch. Students review their work and compare with teacher. Students review their work and compare with teacher.

Did you get something like this? 57 – x [Teacher writes or shows.] **Remember, in this case, (*x* – 57) is NOT the same as (57 – *x*).** **Let's write the whole statement.** [Pause]	Students review their work and compare with teacher. Students write equation.
Did you get something like this? **57 – *x* = 5*x* + 4** [Teacher writes or shows.] **Great!**	Students review their work and compare with teacher.
[Example 3] **Let's do a third example.** **Here's a statement**: **The sum of three consecutive integers is 372.** [Teacher writes or shows.] **Don't forget that the first step to define the variable!**	
Remember that "consecutive" means one after the next. For example, 18, 19, and 20 are consecutive integers.	Students write an expression.
If we let *x* represent the first integer, what do we need to do to get the next consecutive integer? **If *x* is the first integer, we add 1 to *x* to get the next integer.** **In symbols, the next integer would be *x* + 1. What do we need to do now to get the next consecutive integer?** Pause.	Students review their work and compare with teacher. Students answer.
We need to add 1 to that integer, or (*x* + 1 + 1); this is the same as (*x* + 2).	Students review their work and compare with teacher.
Now, express the statement: The sum of three consecutive integers is 372. [Pause] **Did you get something like this? *x* + *x* + 1 + *x* + 2 = 372** [Teacher writes or shows.]	Students answer. Students review their work and compare with teacher.
You may also choose to rewrite the above equation as 3*x* + 3 = 372. Transforming equations such as this is a focus of the next few lessons when you begin to solve linear equations.	
<u>Guided Practice</u> **Okay, students. I'm going to show you a problem to try on your own. Write your response on your paper or notetaking device. Then check it against my results.**	
[Exercise 1] **Here's Practice 1:** [Teacher writes or shows.]	Students pause video to work selected problems on their

The sum of four consecutive even integers is equal to 28. [Pause.] **Did you get something like this?** (Teacher writes and shows.) **Let *x* be the first even number.** ***(x* + 2) is the next even number.** ***(x* + 2 + 2) or *(x* + 4) is the THIRD even number.** ***(x* +2 + 2 + 2) or (*x* + 6) is the fourth even number.** **So, *x* + *x* + 2 + *x* + 4 + *x* + 6 = 28** [Exercise 2] **Here's Practice 2:** [Teacher writes or shows.] **Steven has some money. If he spends $9.00, then he will have 3/5 of the amount he started with.** [Pause.] **Did you get something like this?** [Teacher writes and shows.] **Let *x* be the amount of money Steven has.** **So, *x* - $9 = (3/5) x** **Great!**	student page. The problem should also be written on the board in case students don't have the practice page available. Students review their work and compare with teacher. Students answer. Students review their work and compare with teacher.
<u>Independent Practice</u> **Now we will review some key points from our lesson today:** • **We know how to write mathematical statements using symbolic language.** • **Written mathematical statements can be represented as more than one correct symbolic statement.** • **We must always begin writing a symbolic statement by defining our symbols (variables).** • **Complicated statements should be broken into smaller parts, or worked with simpler numbers.** **Now let's try some extra practice. We'll call this your Exit Ticket.** **Try these two on your own:** [Teacher writes or shows both.] **Write each of the following statement using symbolic language:** 1. **When you square five times a number, you get three more than the number.** 2. **Monica had some cookies. She gave seven to her sister. Then, she divided the remainder into two halves, and she still had five cookies left.** [Pause.] **Here are the answers!** [teacher write or show both] 1. **Let *x* equal the number. So, $(5x)^2 = x + 3$** 2. **Let *x* equal the number of cookies that Monica has. So, $(x - 7)/2 = 5$**	Students write or listen to the closing points. Students complete Exit Ticket

You can now complete the student practice worksheet for grade 8, lesson 1 if you want some additional practice.	Students complete student practice worksheet Grade 8 Lesson 1.
<u>Closing:</u> • **I enjoyed doing some mathematics with you today! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series!** • **Bye!**	