LESSON 1

Objective

Write and evaluate an expression with a variable.

Common Core State Standards

- **6.EE.2a** Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.*
- **6.EE.2c** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6 s^2$ to find the volume and surface area of a cube with sides of length s = 1/2.*
- **6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Expressions with a Variable

As students become more fluent in computation, they begin to understand that mathematical relationships are not always static. For example, most students recognize that the total cost of movie tickets depends upon the number of tickets purchased. Using a variable as a placeholder for an unknown value allows them to communicate this relationship between cost and quantity. Students should recognize that variables are any letter or symbol used to represent a number.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *How can the expressions* n × 5 *and* c × 5 *describe the same situation?*
- **Say:** *I have some green tiles and six red tiles in my hand.* **Ask:** *What expression describes how many tiles I have?* Have students suggest other situations that can be described using variable expressions. Elicit examples for addition, subtraction, multiplication, and division.
- Have students explain how to evaluate *x – 3* for *x = 10, 28,* and *52.*

Solve It

Reread the problem with students. Have them write a paragraph explaining the meaning of the expression *n "times" 5* and how they can use models and symbols to evaluate the expression for the sixth car.

More Ideas

For other ways to teach about expressions with variables —

- Write *a – 2, b + 2, 2c,* and *d ÷ 2* on the board. Have students give different ways to read each expression, such as *a minus 2* and *2 less than a* for *a – 2.* Have students use Two-Color Counters to model the four expressions when the variable in each equals 4 and when it equals 10. Discuss how to substitute numbers to evaluate expressions symbolically.
- Use polyhedral dice to provide students with more practice. Have students write an expression, state different ways to read the expression, and then roll the dice. They use the rolled number to evaluate the expression.

Formative Assessment

Have students try the following problem.

Evaluate 33 + z *for* z = 11.

A. 3 **B.** 11 **C.** 22 **D.** 44

Try It! 30 minutes | Groups of 4

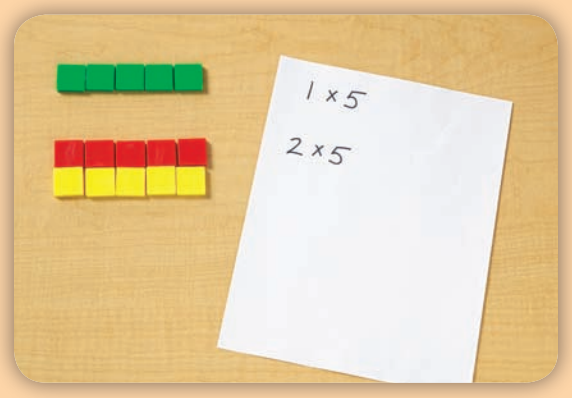
Here is a problem about expressions with a variable.

It takes 5 minutes to wash each car at Details Car Wash. The total time needed to get a car washed depends upon the car's position in line. Write an expression to show the number of minutes it will take Sally to get her car washed. Then evaluate the expression to determine how long it takes Sally to get her car washed if her car is the sixth car in line.

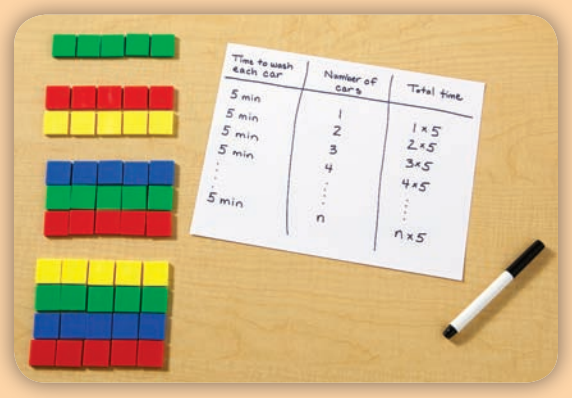
Introduce the problem. Then have students do the activity to solve the problem. Distribute Color Tiles, paper, and pencils to students. Write *1* × *2* and *n* × *2* on the board. Point out that each statement is an expression because it contains only numbers and/or symbols and operations (no equal sign).

Materials

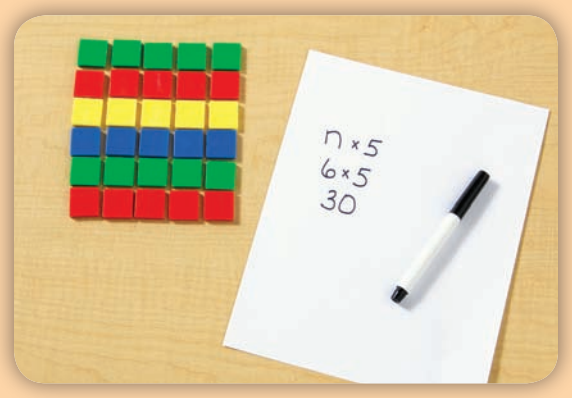
- Color Tiles (100 per group)
- paper (3 sheets per group)
- pencils (1 per group)



1. Say: *Let each tile represent one minute. Make an array to show how many minutes it will take Sally to get her car washed if she is the first car in line.* Have students write the expression shown by the array. Repeat for 2, 3, and 4 cars.



2. Have students create a table to organize the information shown by each array. **Ask:** *What changes in each expression?* Write *n* × *5* on the board. Introduce the term *variable*.



3. Say: *Find the length of the wait when n = 6.* Explain that finding the value of an expression is called *evaluating* the expression. Have students model the situation.

⚠ Look Out!

Students who have difficulty writing variable expressions may find it helpful to first think of the situation as static and use numbers to help them identify the relationship. Once they understand the relationship, they can replace the "made-up" number in the expression with a letter. Remind students that when they evaluate an expression, the operations and numbers (constants) in the expression do not change. Suggest that they think of the variable as the only amount that can vary, or change.

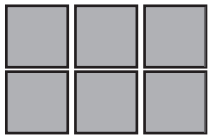
Answer Key

Use Color Tiles to model each term. Then use the rule to write an expression for any term, *n*.

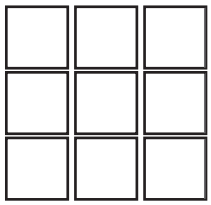
(Check students' work.)

1.

1 × 3



2 × 3

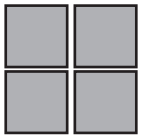


3 × 3

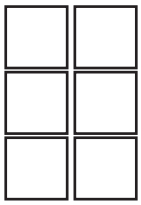
n × 3

2.

1 × 2



2 × 2



3 × 2

n × 2

Using Color Tiles, model the expression. Then evaluate the expression for the given values of *n*. Sketch the models.

3. 5 × *n*, when *n* = 1, 3, and 5

5; 15; 25

4. *n* + 2, when *n* = 2, 6, and 10

4; 8; 12

Evaluate each expression when *n* = 1, 4, 9, and 0.

5. 4 × *n*

4; 16; 36; 0

6. *n* + 10

11; 14; 19; 10

7. *n* × 6

6; 24; 54; 0

8. 1 × *n*

1; 4; 9; 0

9. *n* + 3

4; 7; 12; 3

10. 2*n*

2; 8; 18; 0

Answer Key

Challenge! How many times can you evaluate the expression $n \times 9$? How do you decide the value to use for n?

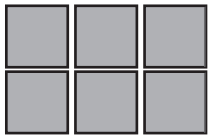
Challenge: (Sample) unlimited; There is an infinite number of numbers to use for the variable.

Name _____

Use Color Tiles to model each term. Then use the rule to write an expression for any term, *n*.

1.

_____



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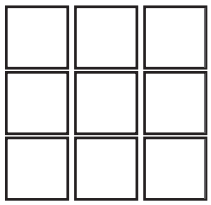

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2.

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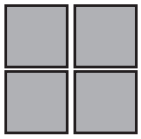

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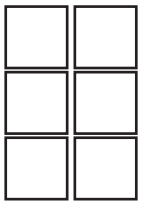

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_____

Using Color Tiles, model the expression. Then evaluate the expression for the given values of *n*. Sketch the models.

3. $5 \times n$, when $n = 1$, 3, and 5

_____

4. $n + 2$, when $n = 2$, 6, and 10

_____

Evaluate each expression when *n* = 1, 4, 9, and 0.

5. $4 \times n$

_____

6. $n + 10$

_____

7. $n \times 6$

_____

8. $1 \times n$

_____

9. $n + 3$

_____

10. $2n$

_____

Name _____

Challenge! How many times can you evaluate the expression $n \times 9$?
How do you decide the value to use for n?