

# LESSON 1

## Objective

Use the order of operations to simplify expressions.

## Common Core State Standards

- **5.OA.1** Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

## Operations and Algebraic Thinking

# Order of Operations

The order of operations makes the language of mathematics more universal. Knowing these rules helps students to communicate more accurately as they gain fluency in manipulating symbolic relationships. The sequence for the order of operations is—

1. Calculate inside parentheses.
2. Multiply and divide in order, from left to right.
3. Add and subtract in order, from left to right.

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

## Talk About It

Discuss the Try It! activity.

- **Ask:** *Why do the models have different solutions?*
- **Ask:** *Why is it necessary to follow the order of operations when simplifying an expression?*
- Write  $5 + 2 \times 6 - 8$  on the board. **Ask:** *How does the value of this expression differ when using the order of operations versus solving from left to right? Explain.*

## Solve It

Reread the problem with students. Have students draw a picture of the solution to the problem. Then have them write a short paragraph explaining how to use the order of operations to solve the problem.

## More Ideas

For other ways to teach the order of operations—

- Write  $20 - 12 \div 4$  on the board. Have students use Snap Cubes® to model the expression and compute using the order of operations. Repeat with other expressions.
- Use Two-Color Counters to model the problem  $5 - 3 + 6 \div 2 = 4$ . Have students use the counters to help them decide where parentheses should be inserted into the equation.

## Formative Assessment

Have students try the following problem.

*Simplify:*  $20 - 8 \div 4 \times 2$ .

- A. 1.5      B. 6      C. 9      D. 16

**Try It!**

20 minutes | Groups of 4

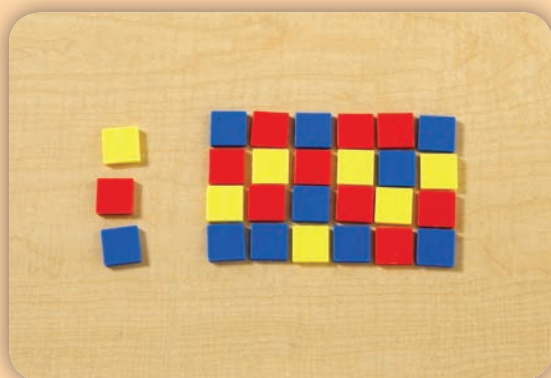
Here is a problem about the order of operations.

Jay brought some juice boxes to soccer practice to share with his teammates. He had 3 single boxes and 4 multi-packs. There are 6 single boxes in each multi-pack. To determine how many boxes of juice Jay brought to practice, evaluate  $3 + 4 \times 6$ .

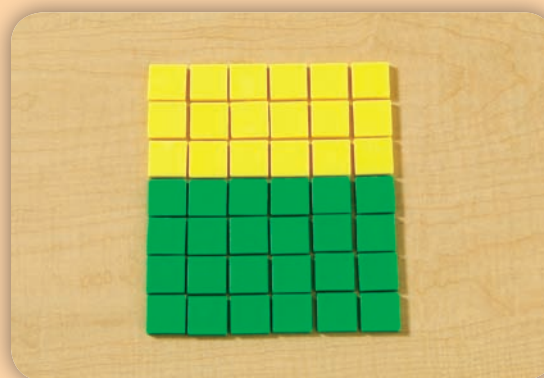
Introduce the problem. Then have students do the activity to solve the problem. Distribute Color Tiles, paper, and pencils to students. Explain that the order of operations provides rules for simplifying expressions. Discuss the rules.

**Materials**

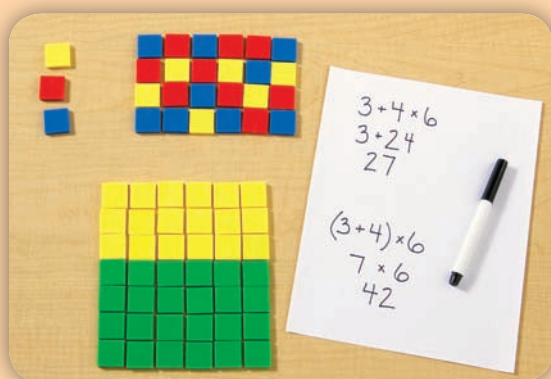
- Color Tiles (100 per group)
- paper (1 sheet per group)
- pencils (1 per group)



**1.** Write  $3 + 4 \times 6$  on the board. Have students start by laying down 3 tiles. Then have students add a 4-by-6 array. **Ask:** How many tiles are shown in the model?



**2.** Have students show  $3 + 4$  using a different color of tile for each addend. Then have them build an array to show this quantity times six. **Ask:** How many tiles are shown in the model?



**3. Say:** You built two models. **Ask:** How are they different? Have students write the expressions to represent the models. **Ask:** Which model is correct?

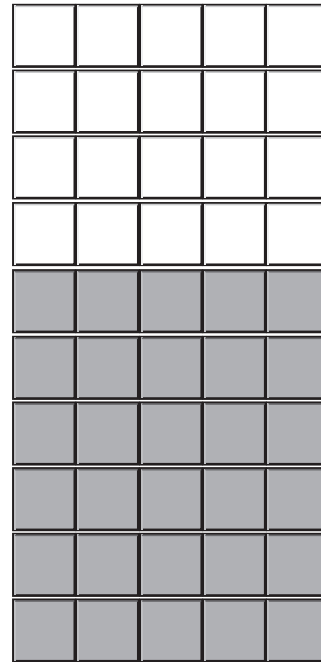
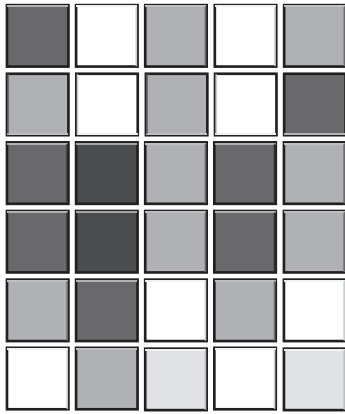
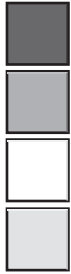
**Look Out!**

Because we read English from left to right, some students may continue to simplify expressions by performing operations in that order. Suggest that students write the order of operations at the top of their papers and then refer to the steps as they simplify expressions. Some students find a mnemonic, such as *Please My Dear Aunt Sally* (Parentheses Multiplication Division Addition Subtraction), helpful in remembering the order.

Use Color Tiles to model each expression. Write expressions for the models.  
Circle the model that shows  $4 + (6 \times 5) = 34$ .

(Check students' work.)

1.



$4 + 6 \times 5 = 34$ ;  $(4 + 6) \times 5 = 50$ ; The model on the left should be circled.

Using Color Tiles, model the expression using the Order of Operations.  
Sketch the model and write the answer.

2.  $8 + 5 \times 3$

(Check students' models.)

23

Use the Order of Operations to find each answer.

3.  $6 + 4 \times 3$

18

4.  $4 \times 2 + 10$

18

5.  $9 \times 2 \div 6$

3

6.  $7 \times 5 - 10$

25

7.  $6 \div 2 + 4$

7

8.  $3 \times 4 + 9$

21

## Answer Key

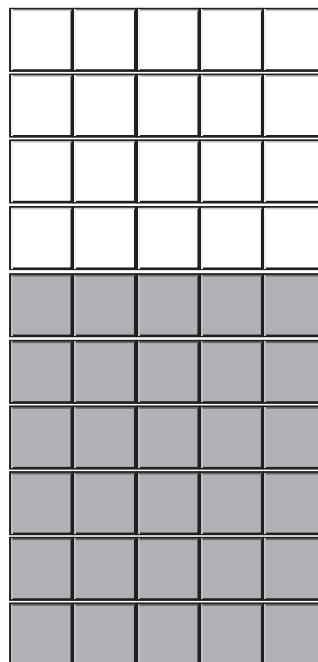
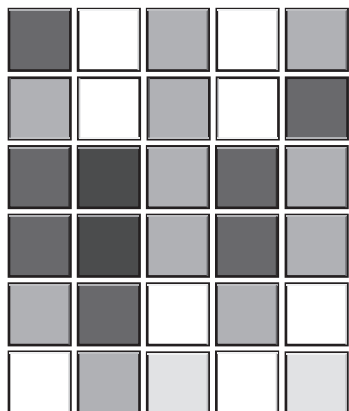
**Challenge!** Write the sequence of the Order of Operations. Show an expression where the answer is different when you use the Order of Operations compared to working from left to right. Show an expression where the answer is the same when you use the Order of Operations and when you work left to right. Explain how the second expression works both ways.

Challenge: (Sample) 1. Calculate inside parentheses, 2. Multiply and divide, 3. Add and subtract; The expression  $6 + 4 \times 2$  equals 14 when you use the Order of Operations. When you work left to right, it equals 20, which is not the correct answer. The expression  $3 \times 5 + 6$  equals 21 using the Order of Operations and when you work left to right. The operations are listed in the correct order for the Order of Operations when you read from left to right.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

Use Color Tiles to model each expression. Write expressions for the models.  
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1.



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\_\_\_\_\_

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Sketch the model and write the answer.

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Use the Order of Operations to find each answer.

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4.  $4 \times 2 + 10$

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5.  $9 \times 2 \div 6$

\_\_\_\_\_

6.  $7 \times 5 - 10$

\_\_\_\_\_

7.  $6 \div 2 + 4$

\_\_\_\_\_

8.  $3 \times 4 + 9$

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