Name: _____   Date: _____

Student Exploration: Order of Operations

Vocabulary: expression, order of operations

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. On a typical two-way street, which side of the road do drivers drive on? _____

2. What do you think would happen if drivers could pick either side of the road to drive on?

   _____

   _____

Like driving, math has a set of rules. For example, when doing a multi-step calculation, such as $4 + 5 \cdot 6$, it's important that everyone does it the same way, so everyone gets the same answer.

Gizmo Warm-up

In the *Order of Operations* Gizmo, you'll evaluate **expressions** like $80 - 40 + 4 \cdot 3^2$.

In order to evaluate these expressions correctly, you'll need to use the **order of operations**. The acronym **PEMDAS** (**P**arentheses, **E**xponents, **M**ultiply/**D**ivide, **A**dd/**S**ubtract) will help you remember the correct order.

Simplify the expression shown below.

Press the blue parts of the expression to perform the associated operation.

$$80 - 40 + 4 \cdot 3^2$$

1. In the Gizmo, mouseover the blue subtraction sign.

   A. What happens? _____

   B. Should you do this step first? _____ Explain. _____

      _____

2. Click on the blue multiplication sign.

   A. What happens? _____

   B. Why does this happen? _____

Activity:	Get the Gizmo ready:	Evaluate sum
Evaluating expressions	• Click **Refresh** in your browser.	▼ $-40 + 4\cdot$

1. When you begin, you should see the expression shown at the right in the bottom window of the Gizmo.

   $$80 - 40 + 4 \cdot 3^2$$

   A. What should you do first to evaluate this expression? _____

      Click on the blue number or sign that corresponds to this step. (Click **Undo** anytime you want to go back a step.)

   B. The expression should now be 80 – 40 + 4 • 9. What operation should you perform

      next? _____ Click on the blue sign for this step.

   C. The expression should now be 80 – 40 + 36. The only operations left are addition

      and subtraction. How do you know which to do first? _____

      _____

   D. Complete the last two steps. What is the value of this expression? _____

2. Click **New**. You should see the expression shown at the right in the Gizmo.

   $$(2^2 \cdot 20 - 16) \div 16$$

   A. Since there are parentheses, start with the expression inside the parentheses. What

      should you do first to simplify $2^2 \cdot 20 - 16$? _____

   B. Finish simplifying $(2^2 \cdot 20 - 16) \div 16$. What is its value? _____

3. The original expression from above written without parentheses is $2^2 \cdot 20 - 16 \div 16$.

   A. Use the order of operations to simplify the expression. What is the result? _____

   B. How are the steps different without parentheses? _____

      _____

4. Click **New**. Work through more problems in the Gizmo. Be sure to read the feedback in the Gizmo along the way.

(Activity continued on next page)

Activity (continued from previous page)

5. Use the order of operations to simplify each expression below. Write all your steps in the space below each problem.

A. $2 \bullet 3 - 1 + 4$

D. $(4 \bullet 3 - 3^2) \bullet 7 + 8 \div 2$

B. $12 \div 4 \bullet 3 + 3^2$

E. $(9 \bullet 4 + 2 \bullet 6) \div (6 - 2^2)$

C. $5^2 \div 5 + (4^2 \bullet 2) - 36 \div 9$

F. $24 - (2^3 + 1) \div (3^3 - 12 \bullet 2)$