Name: _____   Date: _____

Student Exploration: Exponents and Power Rules

Vocabulary: base, exponent

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

1. Complete the following pattern:

   $4^3 = 4 \bullet 4 \bullet 4 = 64$ $4^2 = 4 \bullet 4 =$ _____ $4^1 =$ _____ $4^0 = 1$

   $4^{-3} = \dfrac{1}{4^3} = \dfrac{1}{\boxed{}}$ $4^{-2} = \dfrac{1}{\boxed{}} = \dfrac{1}{\boxed{}}$ $4^{-1} = \dfrac{1}{\boxed{}} = \dfrac{1}{\boxed{}}$

2. Simplify the following: $x^3 \bullet x^2 = (x \bullet x \bullet x) \bullet ($ _____ $\bullet$ _____ $) = x^{\boxed{}}$

3. In the problem above, what did you do with the two original exponents, 3 and 2, to get the

   exponent in the final product? _____

Gizmo Overview

In the *Exponents and Power Rules* Gizmo, you will simplify expressions with exponents, step-by-step. An **exponent** is a number, written to the right of and just above a number or expression (called the **base**), that indicates how many times the number or expression is multiplied by itself.

Here's how the Gizmo looks at first:

The expression for you to simplify is here.

The tiles give you four choices for the next step. Choose the one you think is correct and drag it into the white area above.

Click **Undo** to undo your last choice.

Click **New** to go to a different problem.

Read your feedback in the Gizmo. (No feedback is given for correct answers.)

Click **Proceed** to go to the next step.

Activity:	Get the Gizmo ready:	
Simplifying expressions with exponents	• You should see the expression $(3^4)^5$. If not, click **Refresh** in your browser.	

1. When you begin, you should see the expression shown to the right at the top of the Gizmo.

   <div style="border: 1px solid; padding: 5px;">**Rewrite with a single exponent** $\left(3^4\right)^5$</div>

   A. First, write x^5 as the product of repeated factors. $x^5 = $ _____

   B. Now, write $(3^4)^5$ as the product of repeated factors. $(3^4)^5 = $ _____

   C. How can you simplify the product above so it has a single exponent? _____

   _____

   D. In the Gizmo, choose the correct step. If your choice is incorrect, read the given

   feedback and try again. What is the simplified final answer? _____

   E. Use both words and variables to write a general rule for raising a power to a power.

   Words: _____

   Variables: $(x^a)^b = $ _____

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

   <div style="border: 1px solid; padding: 5px;">**Raise the product to the power** $\left(4b^{-3}\right)^{-2}$</div>

   A. Each factor in parentheses (4 and b^{-3}) is raised to the –2 power. How can you rewrite

   this expression to show that? _____ Select that tile in the Gizmo.

   B. You should now have $4^{-2}(b^{-3})^{-2}$. How does each factor of this product simplify?

          $4^{-2} = $ _____ $(b^{-3})^{-2} = $ _____

   C. Choose the last correct step. What is the simplified final answer? _____

   D. How is a negative exponent different from a positive exponent? _____

   _____

3. 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)

4. Simplify each expression below. Write all your steps in the space below each problem.

   A. $(5x^4)^2$

   D. $(3a^3b^5)^4$

   B. $(-3r^5)^3$

   E. $(6m^{-4}n^7)^2$

   C. $(2m^6)^{-4}$

   F. $(-2r^{-2}s^3)^{-6}$