Name: _____ Date: _____

SIMPLIFYING EXPRESSIONS INVOLVING EXPONENTS
COMMON CORE ALGEBRA I

There are many situations in science, engineering and other fields where a process is governed by **repeatedly multiplying (or dividing) by the same quantity**. Repeated multiplication (and division) is represented by **exponents**. We have worked with these already, but let's review some basics in the first exercise.

***Exercise* #1:** Each of the following problems involves basic exponent ideas. Answer each to review your previous knowledge.

(a) Represent 6^3 as an extended product. Do not evaluate the product.

(b) If $f(x) = 2x^3 + 7$, then $f(-1) = ?$

(c) If $x^3 \cdot x^5$ is written in the form of x^n what is the value of n? Write extended products if you don't remember the **Exponent Rule**.

(d) If the expression $\left(5x^3\right)^2$ is written in the form ax^b, what is the value of $a+b$?

(e) If the length of a rectangle is 3×10^5 meters and its width is 2×10^4 meters, what is its area written in **scientific notation**?

(f) Rewrite the product $\left(3x^2\right)^2\left(2x^5\right)^3$ as an equivalent expression in simplest exponential form.

We also would like to be able to write **simpler equivalent expressions** involving ratios (or division problems) involving exponents. This all comes down to your ability to **"unmultiply" fractions**. The next exercise will illustrate.

***Exercise* #2:** Consider the expression $\dfrac{2x^6}{4x^2}$.

(a) Write this expression as the product of two fractions, one of which is equal to **1**.

(b) Simplify the expression.

Let's see if we can develop a sense on how to simply these types of expressions more quickly.

***Exercise* #3:** Rewrite each expression as the product of two fractions, one of which is equal to **1.** Then, write it as an equivalent, but simpler, expression.

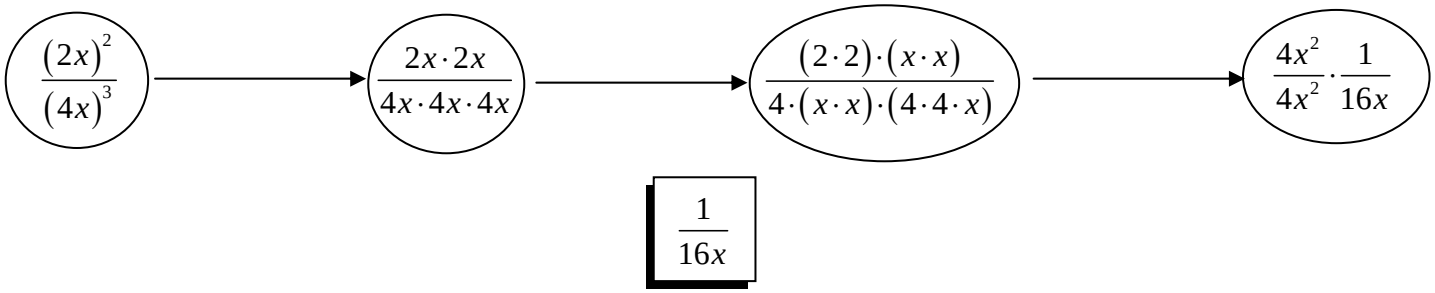
(a) $\frac{5^7}{5^3}$ (b) $\frac{x^4}{x^{10}}$ (c) $\frac{x^4y^8}{xy^{10}}$

Now, let's simplify some more complicated exponential expressions. Each time, go back to rewriting the expressions based on basic principles like **repeated multiplication** and **fractions equivalent to 1**.

***Exercise* #4:** Rewrite each of the following as equivalent exponential expressions in simplified exponential form.

(a) $\frac{\left(3x^2\right)^3}{9x^4}$ (b) $\frac{\left(5x^2y^3\right)^2}{\left(10xy\right)^2}$

***Exercise* #5:** The diagram below show how the expression $\frac{\left(2x\right)^2}{\left(4x\right)^3}$ gets simplified. For each transition, given the reason (rule, property, etcetera) that justifies the manipulation.



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SIMPLIFYING EXPRESSIONS INVOLVING EXPONENTS
COMMON CORE ALGEBRA I HOMEWORK

FLUENCY

1. Which of the following is equivalent to $\left(3x^2y\right)\left(10x^5y^3\right)$?

   (1) $30x^{10}y^3$ (3) $13x^7y^4$

   (2) $30x^7y^4$ (4) $13x^{10}y^3$

2. If the expression $\left(2x^4\right)^3$ was written in ax^b form, which of the following would be the sum of *a* and *b*?

   (1) 20 (3) 9

   (2) 14 (4) 18

3. A square field has a side length of 6×10^3 meters. Which of the following is its area in square meters?

   (1) 6×10^6 (3) 36×10^6

   (2) 36×10^9 (4) 6×10^9

4. Circle the reason for each of the following manipulations used to simplify the product $\left(8x^2\right)\left(3x^3\right)$.

$$\boxed{8x^2\cdot3x^7} \longrightarrow \boxed{8\cdot3\cdot x^2\cdot x^7} \longrightarrow \boxed{(8\cdot3)\cdot\left(x^2\cdot x^7\right)} \longrightarrow \boxed{24x^9}$$

commutative or associative commutative or associative commutative or exponent property

5. Rewrite each expression as the product of two fractions, one of which is equal to **1.** Then, write it as an equivalent, but simpler, expression.

   (a) $\dfrac{10^5}{10^2}$ (b) $\dfrac{x^2}{x^6}$ (c) $\dfrac{x^4y}{xy^8}$

6. Write each of the following expressions equivalently in simplest form.

(a) $\frac{4x^7}{8x^3}$ (b) $\frac{15x^{10}}{10x^2}$ (c) $\frac{16x}{20x^3}$

(d) $\frac{x^2y^5}{xy}$ (e) $\frac{18x^4y^2}{3x^8y^5}$ (f) $\frac{6x^5y^2}{8xy^3}$

7. For each of the following fractions, first simplify the numerator and denominator, then simplify the overall fraction. The first is done as an example.

(a) $\frac{\left(2x^2\right)^3}{\left(4x\right)^2}$ (b) $\frac{\left(10x^4\right)^2}{\left(5x^2\right)^3}$ (c) $\frac{\left(6x\right)^2}{\left(4x^2\right)^3}$

$= \frac{8x^6}{16x^2} = \frac{x^4}{2}$

(d) $\frac{\left(x^2y^5\right)^3}{\left(xy^2\right)^4}$ (e) $\frac{\left(2xy^2\right)^2}{4\left(x^2y^3\right)^2}$ (f) $\frac{\left(9xy\right)^2}{\left(3x\right)^3}$

REASONING

8. Kris has incorrectly simplified the expression $\frac{20x^6}{4x^2}$ as $5x^3$.

(a) Show using the value $x = 2$ that $\frac{20x^6}{4x^2}$ and $5x^3$ are not equivalent.

(b) What is the correct simplification?