Name: _____   Date: _____

EXPONENTS UNIT, LESSON 1: SIMPLIFYING EXPRESSIONS INVOLVING EXPONENTS

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.

Do Now: 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 $\dfrac{2x^6}{4x^2}$.

Simplify below.

$$\star \frac{1}{2}x^4 \qquad \star .5x^4 \qquad \frac{x^b}{x^a} = x^{b-a}$$

$$\star \frac{x^4}{2}$$

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

Exercise #3: Simplify each of the below fractions.

(a) $\dfrac{5^7}{5^3}$ $= 5^{7-3} = \boxed{5^4}$

(b) $\dfrac{x^4}{x^{10}}$ $= x^{-6}$

(c) $\dfrac{x^4 y^8}{x y^{10}}$

$\dfrac{x^7}{x^3} = x^4$

$x^{4-10} = \boxed{x^{-6}}$

$\dfrac{x^4}{x^1} \cdot \dfrac{y^8}{y^{10}}$

$x^3 \cdot y^{-2} = \boxed{x^3 y^{-2}}$

Now, let's simplify some more complicated exponential expressions.

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

(a) $\dfrac{\left(3x^2\right)^3}{9x^4}$

(b) $\dfrac{\left(5x^2 y^3\right)^2}{\left(10xy\right)^2}$

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SIMPLIFYING EXPRESSIONS INVOLVING EXPONENTS
HOMEWORK

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) $13x^{10}y^3$

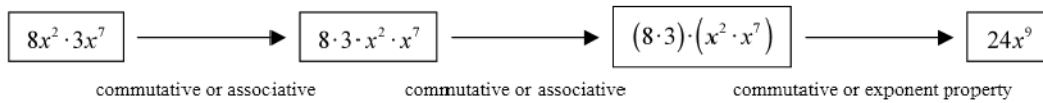2. If the expression $\left(2x^4\right)^3$ was written in ax^b form, which of the following would be the sum of a and b?

    (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 $\left(8x^2\right)\left(3x^3\right)$.

$8x^2 \cdot 3x^7$	→	$8\cdot3\cdot x^2\cdot x^7$	→	$\left(8\cdot3\right)\cdot\left(x^2\cdot x^7\right)$	→	$24x^9$
commutative or associative		commutative or associative		commutative or exponent property		

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

(a) $\dfrac{4x^7}{8x^3}$

(b) $\dfrac{15x^{10}}{10x^2}$

(c) $\dfrac{16x}{20x^3}$

(d) $\dfrac{x^2 y^5}{xy}$

(e) $\dfrac{18x^4 y^2}{3x^8 y^5}$

(f) $\dfrac{6x^5 y^2}{8xy^3}$

6. 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) $\dfrac{\left(2x^2\right)^3}{\left(4x\right)^2}$

(b) $\dfrac{\left(10x^4\right)^2}{\left(5x^2\right)^3}$

(c) $\dfrac{\left(6x\right)^2}{\left(4x^2\right)^3}$

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

(d) $\dfrac{\left(x^2 y^5\right)^3}{\left(xy^2\right)^4}$

(e) $\dfrac{\left(2xy^2\right)^2}{4\left(x^2 y^3\right)^2}$

(f) $\dfrac{\left(9xy\right)^2}{\left(3x\right)^3}$