Math 3 Name: Key

Unit 2 Day 1 – Equivalent Forms of Exponential Expressions Date:_____

Before we begin today's lesson, how much do you remember about exponents? Use expanded form to write the rules for the exponents.

Multiplying Exponential Expressions

$3^2 \cdot 3^4$	$y^4 \cdot y^{10}$	$12^3 \cdot 12^5$
$3^{2+4} = 3^6$	$y^{4+10} = y^{14}$	$12^{3+5} = 12^8$

SUMMARY: $a^m \cdot a^n =$ a^{m+n}

Dividing Exponential Expressions (Remember: $\frac{x}{x} = 1$)

$\frac{3^6}{3^2}$	$\frac{y^{10}}{y^4}$	$\frac{12^5}{12^3}$
$3^{6-2} = 3^4$	$y^{10-4} = y^6$	$12^{5-3} = 12^2$

SUMMARY: $\frac{a^m}{a^n} =$ a^{m-n}

Negative Exponential Expressions: Simplify 2 WAYS using expanded form AND the dividing rule

$\frac{3^2}{3^6}$	$\frac{y^4}{y^{10}}$	$\frac{12^3}{12^5}$
$3^{2-6} = 3^{-4} = \frac{1}{3^4} = \frac{1}{81}$	$y^{4-10} = y^{-6} = \frac{1}{y^6}$	$12^{3-5} = 12^{-2} = \frac{1}{12^2} = \frac{1}{144}$

SUMMARY: $\frac{1}{a^n} =$ a^{-n}

Exponential Expressions Raised to a Power

$(3^6)^2$	$(y^3)^4$	$(12m)^5$
$3^{6 \cdot 2} = 3^{12}$	$y^{3 \cdot 4} = y^{12}$	$12^5 m^5$

SUMMARY: $(a^m)^n =$ $a^{m \cdot n}$

SUMMARY: $(a \cdot b)^n =$ $a^n \cdot b^n$

We've learned how to simplify exponential expressions in the past and reviewed those just now. Next we need to use those properties to find some missing values.

Find the value of x in each of the following expressions.

$5^x \cdot 5^2 = 5^7$ $5^{x+2} = 5^7$ $x+2=7$ $-2 \quad -2$ $x=5$	$3^{-2} \cdot 3^x = 3^2$ $x+x=2$ $+2 \quad +2$ $x=4$	$4^{2/3} \cdot 4^x = 4^1$ $\frac{2}{3} + x = 1\frac{3}{3}$ $-\frac{2}{3} \quad -\frac{2}{3}$ $x=\frac{1}{3}$
$(5^3)^x = 5^6$ $5^{3x} = 5^6$ $\frac{3x}{3} = \frac{6}{3}$ $x=2$	$(3^{-2})^x = \frac{1}{3^2}$ $3^{-2x} = 3^{-2}$ $\frac{-2x}{-2} = \frac{-2}{-2}$ $x=1$	$(4^x)^{1/2} = 4$ $4^{\frac{1}{2}x} = 4^2$ $x \cdot \frac{1}{2} = 2$ $4 \div \frac{1}{2}$ $4 \cdot \frac{2}{1}$ $x=8$
$\frac{5^6}{5^x} = 5^4$ $5^{6-x} = 5^4$ $-x=4$ $-6 \quad -6$ $\frac{-x}{-1} = \frac{-2}{-1}$ $x=2$	$\frac{3^x}{3^{12}} = \frac{1}{3^2}$ $3^{x-12} = 3^{-2}$ $x-12=-2$ $+12 \quad +12$ $x=10$	$\frac{4^{3/2}}{4^x} = 4$ $4^{\frac{3}{2}-x} = 4^1$ $4^{1.5-x} = 4^1$ $x=.5$ or $\frac{1}{2}$
$\frac{5^2}{5^x} = 1 \rightarrow 5^0$ $5^{2-x} = 5^0$ $x=2$	$(3^x)^2 = 1 \rightarrow 3^0$ $\frac{2x}{2} = \frac{0}{2}$ $x=0$	$4^6 4^x = 1 \rightarrow 4^0$ $6+x=0$ $x=-6$

Find the values of x and y in each of the following expressions.

$\frac{5^x}{3^y} = \left(\frac{5}{3}\right)^2$ $\frac{5^x}{3^y} = \frac{5^2}{3^2}$ $x=2$ $y=2$	$\left(\frac{2^3}{3^x}\right)^{-2} = \frac{3^6}{2^y}$ $x=3$ $\frac{2x}{2} = \frac{6}{2}$ $y=6$ $\left(\frac{3^x}{2^3}\right)^2 = \frac{3^6}{2^y}$ $\frac{3^{2x}}{2^6} = \frac{3^6}{2^y}$	$\left(\frac{x^2}{5^1}\right)^3 = \frac{2^6}{5^y}$ $\frac{x^6}{5^3} = \frac{2^6}{5^y}$ $x=2$ $y=3$
$(5 \cdot 6)^2 = 5^x 6^y$ $5^2 \cdot 6^2 = 5^x \cdot 6^y$ $x=2$ $y=2$	$(2^x \cdot 6^3)^4 = 2^8 \cdot 6^y$ $2^{4x} \cdot 6^{12} = 2^8 \cdot 6^y$ $\frac{4x}{4} = \frac{8}{4}$ $x=2$ $y=12$	$(3^x 4^2)^3 = 4^y \cdot 1 \rightarrow 3^0$ $3^{3x} \cdot 4^6 = 4^y \cdot 3^0$ $\frac{3x}{3} = \frac{0}{3}$ $x=0$ $y=6$

These problems will have more than one correct solution pair for x and y. Find at least 3 solution pairs.

$(5^x)(5^y) = 5^{12}$

$5^{x+y} = 5^{12}$

Possible Solutions $x+y=12$

Option 1 $x=7$ $y=5$

Option 2 $x=6$ $y=6$

Option 3 $x=-4$ $y=16$

$(3^x)^y = 3^3$

$3^{xy} = 3^3$

Possible Solutions $xy=3$

Option 1 $x=1$ $y=3$

Option 2 $x=-1$ $y=-3$

Option 3 $x=2$ $y=1.5$

$\frac{4^x}{4^y} = 1$

$4^{x-y} = 4^0$

Possible Solutions $x-y=0$

Option 1 $x=3$ $y=3$

Option 2 $x=-19$ $y=-19$

Option 3 $x=11$ $y=11$

When there are so many rules to keep track of, it's very easy to make careless mistakes. To help you guard against that, it helps to become a critical thinker. Take a look at the expanded and simplified examples below. One of them has been simplified correctly and there's an error in the other two. Identify the correctly simplified example with a ☺ . For the incorrectly simplified examples, write the correct answer and provide suggestions so that the same mistake is not made again.

$\frac{x^2}{x^3} = x^{2-3} = x^{-1} = \frac{1}{x}$

$(4x)(x) = 4x^2$ ✓

$\frac{50c^2d^2}{5cd^5} = 45c^2d^3$

$= 10cd^{-3}$

$= \frac{10c}{d^3}$

You've seen some of the more common mistakes that can happen when simplifying exponential expressions, and you may have made similar mistakes in the past. For each of the next rows of problems, complete one of the problems correctly and two of the problems incorrectly. For the incorrect problems, try to use errors that you think might go unnoticed if someone wasn't paying close attention. When you finish, you'll switch papers with two different neighbors (one for each row) so that they can check your work, find, fix, and write suggestions for how those mistakes can be avoided.

$(2x^2y^3)^5$

$2^5 x^{10} y^{15}$

$32x^{10}y^{15}$

$(3x)^{-2}(x^2)$

$(3^{-2}x^{-2})x^2$

$\frac{x^2}{3^2x^2} = \frac{1}{9}$

$\frac{-3x^2}{y^6}$

$\frac{2xy^2}{8x^2y}$

$\frac{1x^{-1}y^1}{4} = \frac{y}{4x}$

$3^{-2}2^4x^3x$

$\frac{16x^4}{3^2} = \frac{16x^4}{9}$

$(-2xy)^4$

$(-2)^4x^4y^4$

$16x^4y^4$