# Lesson 1.2 – Division of Numbers in Exponential Form

**Recall that** when we combined bases that are being multiplied we __________ the exponents. Let's take a closer look at this rule.

In general, if *y* is any number and *m, n* are positive integers, then

$$y^m \cdot y^n = y^{m+n}$$

because

$$y^m \times y^n = \underbrace{(y \times \cdots \times y)}_{m \text{ times}} \times \underbrace{(y \times \cdots \times y)}_{n \text{ times}} = \underbrace{(y \times \cdots \times y)}_{m+n \text{ times}} = y^{m+n}$$

__________________________________________________________________

## Division of Numbers in Exponential Form

$$4^7 \div 4^2 \qquad \frac{9^{15}}{9^{11}}$$

Two examples of numbers in exponential form being divided.

We determined what occurs when we multiply numbers in exponential form, what occurs when we divide numbers in exponential form?

Let's use some logic. When multiplying like bases we add the exponents. Division is the opposite operation of multiplication, so what is the opposite operation of addition? _________________

We can hypothesize that we ______________ exponents when we divide numbers in exponential form. We will put that hypothesis to a test. Complete the notes on the next page.

**Class Notes –** Similar to the last lesson, we will expand the expression, then condense it.

| | |
|---|---|
| LP#1<br><br>$\frac{8^7}{8^3}$ | $\frac{12^6}{12^4}$ |
| LP#2<br><br>$\frac{x^5}{x^2}$ | $\frac{y^{10}}{y^5}$ |
| LP#3<br><br>$\frac{4^3 \cdot m^6}{4 \cdot m^4}$ | $\frac{7^5 \cdot p^4}{7^3 \cdot p}$ |

Use what you observe above to complete the following. Combine the like powers below into one power.

| | |
|---|---|
| $\frac{x^a}{x^b} =$ | $\frac{x^a \cdot y^c}{x^b \cdot y^d} =$ |

When we divide like bases the exponent for the new expression is the (sum/difference/product/quotient) ___________ of the original exponents.

**Class Notes** – Simplify the following expressions. Show your work by using one of the two methods below.

**Examples of how to show your work.**

Expanding and Condensing

$$3^5 \div 3^2 = \frac{3^5}{3^2} = \frac{3\cdot3\cdot3\cdot3\cdot3}{3\cdot3}$$

$$= \frac{3\cdot3\cdot3\cancel{\cdot3\cdot3}}{\cancel{3\cdot3}}$$

$$= 3\cdot3\cdot3$$

$$= 3^3$$

Using the algorithm

$$3^5 \div 3^2 = \frac{3^5}{3^2}$$

$$= 3^{5-2}$$

$$= 3^3$$

| | | | |
|---|---|---|---|
| LP#4 $\frac{13^{11}}{13^7}$ | $\frac{20^{19}}{20^{10}}$ | $\frac{190^{32}}{190^{14}}$ | $\frac{d^{15}}{d^8}$ |
| LP#5 $\frac{g^3h^{24}}{gh^{16}}$ | $\frac{j^4k^{55}}{j^2k^{22}}$ | $\frac{6^7\cdot x^{16}}{6^2\cdot x^{11}}$ | $\frac{14^{10}\cdot y^{16}}{14^4\cdot y^4}$ |

**Review** – Simplify the following expressions. Show work.

| | | | |
|---|---|---|---|
| R#1 $\dfrac{10^8}{10^4}$ | $\dfrac{m^5}{m^2}$ | $\dfrac{k^{14}}{k^{10}}$ | $\dfrac{a^7 \cdot b^{16}}{a^2 \cdot b^{11}}$ |
| R#2 $\dfrac{5^{12}}{5^6}$ | $\dfrac{g^9}{g^3}$ | $\dfrac{3^6 \cdot x^{11}}{3^2 \cdot x^7}$ | $\dfrac{d^3e^{10}}{d^2e^6}$ |
| R#3 $\dfrac{h^{11}}{h^3}$ | $\dfrac{x^7 \cdot y^{16}}{x^4 \cdot y^{13}}$ | $\dfrac{m^9 \cdot n^{12}}{m^2 \cdot n^{11}}$ | $\dfrac{p^2q^{16}}{p^2q^{13}}$ |