

Day 1: Properties of Exponents

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

OBJECTIVE 1 Multiplying Exponential Expressions

$$3 \cdot 3 = 3 \cdot 3 \cdot 3 \cdot 3$$

$$3^{2+4} = \boxed{3^6} = 729 \quad | \quad y^{4+10} = \boxed{y^{14}}$$

$$12^3 \cdot 12^5 = \boxed{12^8} = 429,981,696$$

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

OBJECTIVE 2 Dividing Exponential Expressions (Remember: $\frac{x}{x} = 1$)

$$\frac{3^6}{3^2} = \boxed{3^4} = 81 \quad | \quad \frac{y^{10}}{y^4} = \boxed{y^6}$$

$$\frac{12^5}{12^3} = \boxed{12^2} = 144$$

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

OBJECTIVE 3 Negative Exponential Expressions: Simplify 2 WAYS using expanded form AND the rule from OBJECTIVE 2

$$\frac{3^2}{3^6} = \frac{1}{3^4} = \boxed{\frac{1}{81}} \quad | \quad \frac{y^4}{y^{10}} = \frac{1}{y^6} = \boxed{\frac{1}{y^6}}$$

$$12^{3-5} = 12^{-2} = \frac{1}{12^2} = \boxed{\frac{1}{144}}$$

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

Another Rule
to Remember $a^0 = 1$

OBJECTIVE 4 Exponential Expressions Raised to a Power

$$(3^6)^2 = \boxed{3^{12}}$$

$$(y^3)^4 = \boxed{y^{12}}$$

$$(12m)^5 = \boxed{12^5 m^5}$$

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

The lesson...

$$y^{3+3+3+3} = y^{12} = \boxed{y^{12}}$$

① Simplify using Exponent Rules so 1 exponential per side
② Once bases are =, set exponents = & solve

$5^x \cdot 5^2 = 5^7$ $5^{x+2} = 5^7$ $x+2=7$ $x=5$	$3^{-2+x} = 3^2$ $-2+x=2$ $x=4$	$4^{2/3+x} = 4^4$ $\frac{2}{3}+x=4$ $x=\frac{10}{3}$
$(5^3)^x = 5^6$ $5^{3x} = 5^6$ $3x=6$ $x=2$	$3^{-2x} = 3^{-2}$ $-2x=-2$ $x=1$	$(4^x)^{1/2} = 4$ $4^{\frac{1}{2}x}=4$ $\frac{1}{2}x=1$ $x=2$
$\frac{5^6}{5^x} = 5^4$ $5^{6-x} = 5^4$ $6-x=4$ $x=2$	$\frac{3^x}{3^{12}} = \frac{1}{3^2}$ $\frac{1}{3^{12-x}} = \frac{1}{3^2}$ $12-x=2$ $x=10$	$4^{3/2} = 4^x$ $4^{\frac{3}{2}} = 4^x$ $\frac{3}{2} = x$ $x=\frac{3}{2}$
$\frac{5^2}{5^x} = 5^0$ $5^{2-x} = 5^0$ $2-x=0$ $x=2$	$(3^x)^2 = 1$ $3^{2x} = 3^0$ $2x=0$ $x=0$	$4^{6+x} = 4^0$ $6+x=0$ $x=-6$

Do
1st
column
together
and
2nd
column
...
you
try
the
others

Unit 3 NOTES

Honors Common Core Math 2

① Simplify the exponential using rules
 ② when bases are =, set exponents =
 and solve

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

$\frac{5^x}{3^y} = \frac{(5)^2}{(3)^2}$	$\frac{2^{-6}}{3^{-2x}} = \frac{3^6 \left(\frac{2^3}{3^x}\right)^{-2}}{2^3} = \frac{3^6}{2^y} \quad 3^{2x} = 3^6$	$\frac{x^6}{5^3} = \frac{2^6 \left(\frac{x^2}{5}\right)^3}{5^y} = \frac{2^6}{5^y} \quad 5^{3-y} = 2^6$
$\frac{5^x}{3^y} = \frac{5^2}{3^2}$	$5^x = 5^2 \quad x=2$	$x=3 \quad y=6$

Do 1st column together & top of 2nd column
... you try the others

$$(5 \cdot 6)^2 = 5^x 6^y$$

$$2^{4x} 6^{12} = 2^8 6^y$$

$$3^{3x} 4^6 = 3^0 4^y$$

III. These will have more than 1 correct solution pair for x & y. Find at least 3 solution pairs.

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

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

Possible Solutions

$$\text{Option 1: } x=6, y=6$$

$$\text{Option 2: } x=2, y=10$$

$$\text{Option 3: } x=3, y=9$$

many other options possible

$$(3^x)^y = 3^{18}$$

$$3^{xy} = 3^{18} \rightarrow xy=18$$

Possible Solutions

$$\text{Option 1: } x=2, y=9$$

$$\text{Option 2: } x=3, y=6$$

$$\text{Option 3: } x=1, y=18$$

several other options are possible

$$\frac{4^x}{4^y} = 1 \quad 4^{x-y} = 4^0$$

$$x-y=0$$

Possible Solutions

$$\text{Option 1: } x=3, y=3$$

$$\text{Option 2: } x=2, y=2$$

$$\text{Option 3: } x=597, y=597$$

Many other options are possible

IV. 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.

$$\frac{x^2}{x^3} = x \quad \begin{array}{l} \text{Subtract exponents} \\ \text{be careful with signs} \end{array}$$

$$x^{2-3} = x^{-1} = \boxed{\frac{1}{x}} \quad \begin{array}{l} \text{if } \ominus \text{ sign,} \\ \text{move it and use it!} \end{array}$$

$$(4x)(x) = 4x^2$$



Good job!

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

$$\frac{5 \cdot 10c^2d^2}{5cd^5} = 10c^{3-1}d^{3-5} = 10cd^{-3} = \boxed{\frac{10c}{d^3}}$$

V. 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.

$$2^5 x^{3-5} y^{3-5} = 2^5 x^{10} y^{15}$$

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

$$\frac{2xy^2}{2^2 x^2 y} = 2^{1-2} x^{1-2} y^{2-1} = \boxed{\frac{y}{4x}}$$

$$(3x)^{-2}(x^2)^{-2} = \frac{x^0}{3^2} = \boxed{\frac{1}{9}}$$

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

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

$$(-2xy)^4$$

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

$$16x^4 y^4$$