

Created by Mr. Lischwe

## Warm Up 10/(4 · 3 · 2 · 1)

**YOU ARE NOT ALLOWED TO USE A CALCULATOR FOR THIS WARM UP**

- 1) Guess: what do you think  $7^7$  is?
- 2) Guess: what do you think  $3^{20}$  is?
- 3) Guess: what do you think  $2^0$  is?
- 4) Guess: what do you think  $4^{-2}$  is?

## Quizzes...

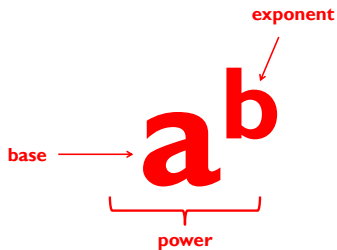
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## Objectives

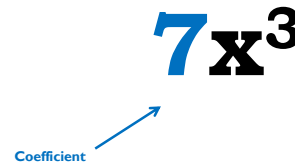
- ▶ Review exponent basics
- ▶ Understand powers with negative BASES
- ▶ Understand powers with negative EXPONENTS
- ▶ Multiply powers with the same base
- ▶ Divide powers with the same base

## Vocab



"squared" = to the 2<sup>nd</sup> power  
 "cubed" = to the 3<sup>rd</sup> power

What is the number "out in front" called?



Evaluate means “find the value of”...

Evaluate the following:

1.  $5^4$
2.  $2^7 + 2^2$
3.  $(-3)^4$
4.  $(-4)^4$

What is the difference here?

$$(-3)^2 \quad \text{vs.} \quad -3^2$$

## IMPORTANT

▶ When you plug a negative number in for  $x$  always put it in parentheses!!!

▶ Ex: Plug in  $-2$  into  $x^2$  and it would be  $(-2)^2$  NOT  $-2^2$

Evaluate the following

1.  $x^3$  for  $x = -2$
2.  $x^5$  for  $x = 3$
3.  $-5^2$
4.  $(-2)^7$

Finding a pattern

▶ Find a pattern and use it to complete the table:

Exponential Form	Standard Form
$2^5$	32
$2^4$	16
$2^3$	8
$2^2$	4
$2^1$	2
$2^0$	<input type="text"/>
$2^{-1}$	<input type="text"/>
$2^{-2}$	<input type="text"/>
$2^{-3}$	<input type="text"/>

Finding a pattern

▶ Find a pattern and use it to complete the table:

Exponential Form	Standard Form
$3^5$	243
$3^4$	81
$3^3$	27
$3^2$	9
$3^1$	3
$3^0$	<input type="text"/>
$3^{-1}$	<input type="text"/>
$3^{-2}$	<input type="text"/>
$3^{-3}$	<input type="text"/>

## IMPORTANT

- ▶ An expression that contains negative or zero exponents is not considered to be simplified. Expressions should be rewritten with only positive exponents.

The Rule:

### Zero Exponents:

- ▶ Anything to the zero power is 1!

Examples

$$1) 9^0 \quad 2) k^0 \quad 3) \left( \frac{8x^3y^2}{0.27abc} + 12.5q \right)^0$$

$$4) \frac{a^6}{a^6}$$

The Rule:

### Negative Exponents:

$$\text{Rule: } x^{-n} = \frac{1}{x^n}$$

- ▶ Negative exponent: 1 over the same power with a positive exponent

Basically...

▶ **NEGATIVE  
EXPONENTS =  
DIVIDING!!!**

$$4^{-2} = \frac{1}{16}$$

$$2^{-3} = \frac{1}{8}$$

$$10^{-3} = \frac{1}{1000}$$

$$2^{-4} = \frac{1}{16}$$

$$7^{-1} = \frac{1}{7}$$

Examples – Try these in your head!!!

- ▶ Write each using negative exponents:

$$\frac{1}{8^3} \quad \frac{1}{c^5} \quad \frac{1}{16} \quad \frac{1}{27}$$

Discuss with your group

- ▶ How would you simplify these four to have ONE base and ONE exponent?

1.  $2^3 \cdot 2^2$
2.  $h^8 \cdot h^{10}$
3.  $\frac{2^5}{2^3}$
4.  $\frac{x^6}{x^3}$

The Rules...

**Multiplying Powers with the same base**

- ▶ Keep the base, add the exponents

**Dividing Powers with the same base**

- ▶ Keep the base, subtract the exponents

Try it with numbers...

$$2^3 \cdot 2^2$$

$$\frac{2^6}{2^3}$$

**Examples: Multiplying**

1.  $a^{45} \cdot a^{22}$
2.  $6^5 \cdot 6^3$
3.  $x^3 \cdot y^5 \cdot y^2 \cdot x$
4.  $12j^5 \cdot 3j^2$

**Examples: Multiplying**

1.  $a^{45} \cdot a^{22}$        $a^{67}$
2.  $6^5 \cdot 6^3$        $6^8$
3.  $x^3 \cdot y^5 \cdot y^2 \cdot x$        $x^4 \cdot y^7$
4.  $12j^5 \cdot 3j^2$        $12 \cdot j \cdot j \cdot j \cdot j \cdot j \cdot 3 \cdot j \cdot j$   
 $= 36j^7$

**Examples: Dividing**

1.  $\frac{a^{45}}{a^{22}}$
2.  $\frac{6^5}{6^3}$
3.  $\frac{x^3 y^5}{x y^2}$
4.  $\frac{12j^5}{3j^2}$

**Examples: Dividing**

1.  $\frac{a^{45}}{a^{22}}$

$a^{23}$

2.  $\frac{6^5}{6^3}$

$6^2$

3.  $\frac{x^3y^5}{xy^2}$

$x^2 \cdot y^3$

4.  $\frac{12j^5}{3j^2}$

$$\frac{12 \cdot j \cdot j \cdot j \cdot j \cdot j}{3 \cdot j \cdot j}$$

$$= 4j^3$$

▶ **\*\*\*WHEN YOU HAVE COEFFICIENTS, MULTIPLY OR DIVIDE THEM JUST LIKE NORMAL NUMBERS!!!\*\*\***

Careful...

▶  $\frac{7x^5}{7x^3}$

▶  $\frac{7^5}{7^3}$

Helpful Hint

▶ If you are ever not sure about what to do, just **expand** it out!!!

Super-Crazy Example

**Simplify:**

$$\frac{-2a^6 \cdot 6b^3 \cdot a \cdot 4b^5}{18b^4 \cdot a^5 \cdot 3b^2}$$

Homework

Worksheet