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Warmup 1/(2<sup>4</sup> or 4<sup>2</sup>) + (2 + 2 + 2) · 2 - √36

- \*\*\*Turn in your WEEK TWO Warmups\*\*\*
- \*\*\*Start your WEEK THREE Warmup Page\*\*\*
- \*\*\*Make sure to keep it in a consistent spot where you won't lose it.\*\*\*
- Evaluate each power.
  1. 4<sup>4</sup>
  2. (-4)<sup>4</sup>
  3. -4<sup>4</sup>
  4. 4<sup>-4</sup>
  5. (-4)<sup>-4</sup>
  6. On a scale of 1-10, how hard was it to get up this morning?

## Warmup (continued)

Expand each and simplify.

7) (5x<sup>2</sup>)<sup>3</sup>

8) (5<sup>2</sup>)<sup>3</sup>

## ALEKS

- There were 30 minutes due on Tuesday, Jan 16 (pushed back 1 day because that was supposed to be the day we got back)
- There were 30 MORE minutes due today.
- If you did not get your minutes that were due today done, I will let you make them up this week without counting off for being late, and without docking your effort grade

## ■ POSITIVE EXPONENTS:

- Are 1 TIMES the base that many times
- 2<sup>4</sup> = 1 · 2 · 2 · 2 · 2

## ■ NEGATIVE EXPONENTS:

- Are 1 DIVIDED BY the base that many times
- 2<sup>-4</sup> = 1 ÷ 2 ÷ 2 ÷ 2 ÷ 2

$$= \frac{1}{2 \cdot 2 \cdot 2 \cdot 2}$$

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

## ■ ZERO EXPONENTS:

- Are the 1 not multiplied or divided by anything
- 2<sup>0</sup> = 1

One way to think about positive/negative exponents...

$$\begin{aligned} 3^4 &= 1 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \\ 3^3 &= 1 \cdot 3 \cdot 3 \cdot 3 \\ 3^2 &= 1 \cdot 3 \cdot 3 \\ 3^1 &= 1 \cdot 3 \\ 3^0 &= 1 \\ 3^{-1} &= \frac{1}{3} \\ 3^{-2} &= \frac{1}{3 \cdot 3} \\ 3^{-3} &= \frac{1}{3 \cdot 3 \cdot 3} \end{aligned}$$

(How do you expand a negative exponent? This is how.)

p.26 (1-4); p.34 (2, 4, 6); p.49 (31 - 35)

p.26: 1.  $4^5 \cdot 4^2 = 4^7$  or 65,536    2.  $-2a(3a^6) = -6a^7$     3.  $\frac{y^8}{y^3} = y^5$     4.  $\frac{24x^3}{6x^4} = 4x^{-1}$

p.34: 2.  $(h^6)^4 = h^{24}$     4.  $(7w^3)^3 = 343w^{21}$     6.  $(-6r^5s^2)^2 = 36r^{10}s^4$

p.49: 31.  $z^2 \cdot z^{-3} = \frac{1}{z}$     32.  $n^{-1} \cdot n^3 = n^2$     33.  $\frac{b^{-7}}{b^5} = \frac{1}{b^{12}}$     34.  $\frac{x^4}{x^{-2}} = x^6$

35.  $2^{-4} = \frac{1}{16}$

## QUIZ TOMORROW

- Multiplying Powers
- Dividing Powers
- Power to a Power
- Zero Exponents
- Negative Coefficients
- Make sure you can do them all **with** and **without** coefficients

## Negative Exponents

Negative Exponents:

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

■ Negative exponent:

- 1 over the same power with a positive exponent

Basically...

■ **NEGATIVE  
EXPONENTS =  
DIVIDING!!!**

## Negative Exponents

Examples

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

2)  $b^{-7} = \frac{1}{b^7}$

$= \frac{1}{9}$

3)  $x^3 \cdot x^{-5}$

$= x^{-2}$

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

4)  $\frac{g^4}{g^{10}} = g^{-6}$

$= \frac{1}{g^6}$

Mathematicians say:

**Never** leave a zero or negative exponent in your answer.

(It is not necessarily incorrect, it just isn't **simplified**. Just like  $\frac{12}{3}$  is not a simplified fraction.)

What about this?

■  $4x^0 \longrightarrow \text{X}$

■ The four is NOT connected to the exponent.

■  $4 \cdot x^0$

■  $4 \cdot 1$

■  $4$

What about this?

$\rightarrow 6x^{-4} \rightarrow \frac{1}{6x^4}$   
 The six is NOT connected to the exponent.  
 $\rightarrow 6 \cdot x^{-4}$   
 $\rightarrow 6 \cdot \frac{1}{x^4} \rightarrow \frac{6}{x^4}$   
 $\rightarrow \frac{6}{1} \cdot \frac{1}{x^4}$

What about this?

$\rightarrow \frac{x^2 y^{-3}}{z^4}$   
 $\rightarrow \frac{x^2}{z^4 y^3}$

Write each using negative exponents:

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

What about:

$$\frac{1}{x^{-5}}$$

If the negative exponent is already in the denominator, it moves back up to the numerator.

What about:

$$\frac{m^4}{m^{-2}}$$

**2 Methods:**

Shortcut

$$\begin{aligned}
 &\frac{m^4}{m^{-2}} \\
 &= m^{4-(-2)} \\
 &= m^6
 \end{aligned}$$

Moving Neg. Exponent First

$$\begin{aligned}
 &\frac{m^4}{\frac{1}{m^2}} \\
 &= \frac{m^4 \cdot m^2}{1} \\
 &= m^6
 \end{aligned}$$

Simplify using the zero & negative exponent properties.

$$\begin{aligned}
 1) \frac{q^3 q^2}{q^5} &= \frac{q^5}{q^5} \\
 &= q^0 \\
 &= 1
 \end{aligned}$$

$$\begin{aligned}
 2) \frac{n^{-3}}{n^5} &= \frac{n^{-3-5}}{n^5} \\
 &= \frac{1}{n^8}
 \end{aligned}$$

$$\begin{aligned}
 3) a^4 b^4 \cdot a^6 b^{-6} &= a^{10} b^{-2} \\
 &= a^{10} \cdot \frac{1}{b^2} \\
 &= \frac{a^{10}}{b^2}
 \end{aligned}$$

$$\begin{aligned}
 4) \frac{c^5 d^2}{c^2 d^5} &= \frac{c^3 d^1}{d^3} \\
 &= \frac{c^3}{d^2}
 \end{aligned}$$

**CHALLENGE!**



## Homework: Studying Reflection

- Choose two of the methods of studying and write a reflection of how they were helpful for you.