Warm Up

Simplify:

$$\left(\frac{5x^3y^4}{35x^{13}y^7}\right)^2$$

$$\left(\frac{1}{7x^{10}y^3}\right)^2$$

$$\frac{1}{49x^{20}y^6}$$

Name _K_

Division of Monomials Raised to a Power

Simplify each monomial. Show your work/thinking; all final answers must have positive exponents.

1. $\left(\dfrac{2x^4y^{12}}{y^{10}}\right)^3$

$(2x^4y^2)^3$

$\boxed{8x^{12}y^6}$

2. $\left(\dfrac{4x^7y^{20}}{xy^{18}}\right)^3$

$(4x^6y^2)^3$

$\boxed{64x^{18}y^6}$

3. $\left(\dfrac{\overset{2}{10}x^7y^{20}}{\underset{1}{5}x^{10}y^{18}}\right)^3$

$\left(\dfrac{2y^2}{x^3}\right)^3$

$\boxed{\dfrac{8y^6}{x^9}}$

4. $\left(\dfrac{\overset{3}{18}x^{13}y^{17}}{\underset{2}{12}x^{12}y^{12}}\right)^3$

$\left(\dfrac{3xy^5}{2}\right)^3$

$\boxed{\dfrac{27x^3y^{15}}{8}}$

5. $\left(\dfrac{\overset{1}{7}x^{11}y^5}{\underset{2}{14}x^{11}y^{25}}\right)^3$

$\left(\dfrac{1}{2y^{20}}\right)^3$

$\boxed{\dfrac{1}{8y^{60}}}$

6. $\left(\dfrac{\overset{1}{-2}x^{22}y}{\underset{3}{6}x^{30}y^5}\right)^3$

$\left(\dfrac{-1}{3x^8y^4}\right)^3$

$\boxed{\dfrac{-1}{27x^{24}y^{12}}}$

7.
$$\left(\frac{\overset{2}{4}4x^{23}y^{84}}{\underset{3}{6}6x^{20}y^{87}}\right)^3$$

$$\left(\frac{2x^3}{3y^3}\right)^3$$

$$\boxed{\frac{8x^9}{27y^9}}$$

8.
$$\left(\frac{\overset{1}{4}20x^{108}y^{15}z^3}{\underset{2}{8}40x^{112}y^4z^6}\right)^5$$

$$\left(\frac{y^{11}}{2x^4z^3}\right)^5$$

$$\boxed{\frac{y^{55}}{32x^{20}z^{15}}}$$

9.
$$\left(\frac{x^{47}y^{20}}{-2x^{45}y^{20}}\right)^4$$

$$\left(\frac{x^2}{-2}\right)^4$$

$$\boxed{\frac{x^8}{16}}$$

10.
$$\left(\frac{\overset{5}{-2}5x^{118}y^{112}}{\underset{1}{5}x^{114}y^{115}}\right)^2$$

$$\left(\frac{-5x^4}{y^3}\right)^2$$

$$\boxed{\frac{25x^8}{y^6}}$$

11.
$$\left[\left(\frac{24y^{18}z^5}{18x^2y^{20}}\right)\cdot\left(\frac{15x^{10}y^4}{20z^2}\right)\right]^3$$

$$\left(x^8y^2z^3\right)^3$$

$$\boxed{x^{24}y^6z^9}$$

12.
$$\left[\left(\frac{18x^{32}y^{58}}{5x^{37}y^{32}}\right)\cdot\left(\frac{-25x^4}{9y^{10}}\right)\right]^4$$

$$\left(\frac{-10y^{16}}{x}\right)^4$$

$$\boxed{\frac{10{,}000x^{64}}{x^4}}$$

What does an exponent mean?

An exponent tells us how many times a number is <u>multiplied</u>
(variable)

What does a negative exponent mean?

$y = 2^x$

x	y
-3	$\frac{1}{8}$
-2	$\frac{1}{4}$
-1	$\frac{1}{2}$
0	1
1	2
2	4
3	8
4	16

Anything to the power of zero = 1

÷2
÷2
÷2
÷2

×2
×2
×2

2^3 ← multiply 3 times

$2 \cdot 2 \cdot 2$

2^{-3} ← opposite   We are dividing by 2 - 3 times

$\dfrac{1}{2} \cdot \dfrac{1}{2} \cdot \dfrac{1}{2}$

$\dfrac{1}{2 \cdot 2 \cdot 2}$

The division bar:

$\dfrac{6}{3}$ ←— division bar

x^{-4} $\dfrac{1}{x \cdot x \cdot x \cdot x}$

When we divide by something it goes on the other side of the division bar

10   same as $\dfrac{10}{1}$

10 times 2 $10 \cdot 2$

10 divided by 2 → $\dfrac{10}{2}$

$$\frac{y^{-8}}{1} \qquad \frac{1}{y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y} = \frac{1}{y^8}$$

$$\frac{y^{-8}}{1} = \frac{1}{y^8}$$

division

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

dividing by 2- 3's

$$5m^{-3} = \frac{5}{m^3}$$

$$(a^{-2})(b^3) = \frac{1}{a^2} \cdot b^3 = \frac{b^3}{a^2}$$

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

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

$$x^5 \cdot x^2 = x^{5+2} = x^7$$

$$-6x^{-4}y^6 = \frac{-6y^6}{x^4}$$

$$\frac{3^4}{3^{-2}} = \frac{3^4 \cdot 3^2}{1} = 3^6$$

Dividing by
3^2, so 3^2 must
go on other side
of division bar

K^3 belongs in denominator

$$\frac{k^{-3}}{k^5} = \frac{1}{K^3 \cdot K^5} = \frac{1}{K^8}$$

$$\frac{12x^5}{4x^{-2}} = \frac{12X^5 \cdot X^2}{4} = 3X^7$$

x^2 needs to be
on otherside
of division bar

8-3 **Practice**

Negative Exponents

Write each expression using positive exponents. Then evaluate the expression.

1. 2^{-6} **2.** 5^{-1} **3.** 8^{-2} **4.** 10^{-3}

Simplify each expression.

5. g^{-6} **6.** s^{-1} **7.** q^0 **8.** $a^{-2}b^2$

9. m^5n^{-1} **10.** $p^{-1}q^{-6}r^3$ **11.** $x^{-3}y^2z^{-4}$ **12.** $a^{-2}b^0c^{-1}$

13. $12m^{-6}n^4$ **14.** $7xy^{-8}z$ **15.** $x^{-3}(x^2)$ **16.** $b^3(b^{-5})$

17. $\dfrac{b^3}{b^6}$ **18.** $\dfrac{y^3}{y^{-2}}$ **19.** $\dfrac{m^5n^3}{m^6n^2}$ **20.** $\dfrac{xy^2}{xy^3}$

21. $\dfrac{a^7b^4}{a^9b^2}$ **22.** $\dfrac{rs^{-3}}{r^2s^4}$ **23.** $\dfrac{16c^8}{4c^{10}}$ **24.** $\dfrac{9x^{-5}y^5}{36x^4y^3}$

25. $\dfrac{7p^2q^6}{21p^{-3}q^7}$ **26.** $\dfrac{-6m^5n^2q^{-1}}{36m^{-2}n^4q^{-1}}$ **27.** $\dfrac{4a^3b^2c^2}{6a^5b^3c}$ **28.** $\dfrac{28x^5y^{-3}z}{-4x^4yz^3}$

Homework

Finish classwork,
and complete EVEN numbers