

Essential Question: What are the multiplication properties of exponents?

Do Now: Simplify.

(a)  $x \cdot x \cdot x$

$x^3$

(b)  $(y^5)^2$

$(y^5)(y^5)$   
 $y^{10}$

(c)  $(xy)^2$

$(xy)(xy)$   
 $x^2 y^2$

be fair to every factor

Rules We Know

• Zero Power and Negative Exponents:  $a^0 = 1, a \neq 0$

$a^{-n} = \frac{1}{a^n}$  and  $\frac{1}{a^{-n}} = a^n, a \neq 0$



### Multiplication Properties of Exponents

Product of Powers Property	When multiplying powers with the same base, ADD the exponents.	$a^m \cdot a^n = a^{m+n}$
Power of Powers Property (raising a power to a power)	When raising a power to a power, MULTIPLY the exponents.	$(a^m)^n = a^{mn}$
Power of a Product Property (raising a product to a power)	When raising a product to a power, raise EACH factor to the power.	$(ab)^m = a^m b^m$

Let's practice:

1.  $z^9 \cdot y \cdot z^3$

$z^{12} y$

2.  $(-2)^1 (-2)^1 (-2)^3$

$(-2)^5$   
 $-32$

3.  $[(-3)^3]^2$

$(-3)^6$   
 $729$

\* 4.  $(4yz)^3$

$4^3 y^3 z^3$   
 $64 y^3 z^3$

5.  $(-2w)^2$

$(-2)^2 w^2$   
 $4w^2$

6.  $(-wy)^2$

$(-w)^2 y^2$   
 $w^2 y^2$

More Practice (Let's recall the rules for negative exponents!)

7.  $(4x^2y^3)^3$

$$4^3 x^6 y^9$$

$$64x^6y^9$$

$$\begin{array}{r} 16 \\ 27 \\ \hline 112 \\ 32 \\ \hline 432 \end{array}$$

\* 8.  $(4y)^2(-3y^2)^3$

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

$$16 y^2 (-27) y^6$$

$$-432 y^8$$

9.  $-(a^7b^2)(a^4b^9)^3$

$$-1 \cdot (a^7b^2)(a^{12}b^{27})^3$$

$$-1(a^7b^2)(a^{12}b^{27})^3$$

$$-a^{19}b^{29}$$

10.  $[(-2x^4)^3(-x^8)]^2$

$$[(-2)^3 x^{12} (-x^8)]^2$$

$$[-8 \cdot x^{12} \cdot (-x^8)]^2$$

$$[8x^{20}]^2$$

$$8^2 x^{40}$$

11.  $(2x^{-10}y^{-3})^6$

$$2^6 x^{-20} y^{-18}$$

$$\frac{2^6}{x^{20} y^{18}}$$

$$\frac{64}{x^{20} y^{18}}$$

12.  $\frac{1}{(8x^2)^3}$

$$(8x^2)^3$$

$$8^3 x^6$$

$$512x^6$$

Challenge:  $\left(\frac{7x^{-2}}{x^8y^{-5}}\right)^2$

$$\left(\frac{7x^{-10}}{y^{-5}}\right)^2$$

OR

$$\left(\frac{7x^{-2}}{x^8y^{-5}}\right)^2$$

$$\left(\frac{7y^5}{x^{10}}\right)^2$$

$$\left(\frac{7x^{-2}}{x^8y^{-5}}\right)\left(\frac{7x^{-2}}{x^8y^{-5}}\right)$$

$$\frac{7^2 y^{10}}{x^{20}}$$

$$\frac{49x^{-4}}{x^{16}y^{-10}}$$

$$\rightarrow \frac{49y^{10}}{x^{16}x^4}$$

$$\frac{49y^{10}}{x^{20}}$$

$$\frac{49y^{10}}{x^{20}}$$