

Simplify $(x^2y)^3$ using the definition of exponents

$$\begin{aligned} & x^2y \cdot x^2y \cdot x^2y \\ & \underbrace{x^2 \cdot x^2 \cdot x^2}_{x^6} \cdot y \cdot y \cdot y \\ & x^6y^3 \end{aligned}$$

a. $(xy)^2 = xy \cdot xy = xxyy = x^2y^2$

b. $(xy^2)^2 = xy^2 \cdot xy^2 = xxy^2y^2 = x^2y^4$

c. $(\pi r^2)^4 = \pi r^2 \cdot \pi r^2 \cdot \pi r^2 \cdot \pi r^2 = \pi^4 r^8$

Power-of-a-Product Property

$$(xy)^n = x^n y^n$$

$$[(x^m y^p)^n] = (x^m)^n (y^p)^n = x^{mn} y^{pn}$$

Ex: $(x^2 y^1 z^2)^3 = x^6 y^3 z^6$

Simplify:

a. $(ab)^5 = a^5 b^5$

b. $(pq)^3 = p^3 q^3$

c. $(x^3 y^2)^4 = (x^3)^4 (y^2)^4$ P. of P.
 $= x^{12} y^8$ P. of Pow.

d. $(a^2 b^4)^3 = a^6 b^{12}$

e. $(a^2 b^1 c^5)^2 = a^4 b^2 c^{10}$

f. $(ab^2 c^3)^4 = a^4 b^8 c^{12}$

g. $(2x^3y)^3$ * Never multiply "big" and "little" numbers.
 $= (2)^3 (x^3)^3 (y)^3$
 $= 2^3 x^9 y^3$
 $= 8x^9y^3$

h. $(3a^5y^2)^2 = (3)^2 (a^5)^2 (y^2)^2$
 $= 9a^{10}y^4$

$$i. (x^m y^2 z)^4 = (x^m)^4 (y^2)^4 (z)^4$$

$$x^{4m} y^8 z^4$$

$$j. (abcd)^n = a^n b^n c^n d^n$$

Powers of -1

$$(-1)^1 = -1$$

$$(-1)^2 = \underset{+}{(-1)(-1)} = +1$$

$$(-1)^3 = \underset{+}{(-1)(-1)} \underset{-}{(-1)} = -1$$

$$(-1)^4 = \underset{+}{(-1)(-1)} \underset{+}{(-1)(-1)} = 1$$

$$(-1)^5 = (-1)(-1)(-1)(-1)(-1) = -1$$

$$(-1)^{\text{odd}} = -1$$

$$(-1)^{\text{even}} = +1$$

Ex: Simplify

$$a. (-y)^5 = -y^5$$

$$b. (-y)^8 = y^8$$

$$*c. -y^2 = -y^2$$

$$d. (-y)^2 = y^2$$

$$\begin{aligned}
 e. (-3y)^4 &= +3^4 y^4 \\
 &\quad \underbrace{3 \cdot 3 \cdot 3 \cdot 3}_{9 \cdot 9} \\
 &= 81y^4
 \end{aligned}$$

$$f. (-v^4 w^3)^2 (-v^3)^4$$

$$(v^8 w^6) (v^{12})$$

$$v^{8+12} w^6$$

$$v^{20} w^6$$