

Power Rule for Exponents

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Assume that b is a real number and that m and n represent positive integers.

Then, $(b^m)^n = b^{mn}$

For exercises 1 – 3, simplify and write answers in exponent form.

1. $(3^4)^5$

Note $(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3) = (3^4)^2 = 3^8$

$(3^4)^5 = 3^{20}$

2. $(x^6)^8 = x^{48}$

3. $(d \cdot d^4)^3$
 $= (d^5)^3$
 $= d^{15}$

4. Evaluate the two expressions and compare the answers.

$(3^2)^4$ and $(3^4)^2$

$(3^2)^4 = 3^8$

same as $(3^4)^2 = 8$

$(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3) = 3^8$

Note: This is equal to $8! \cdot 8! = 6561$

The Properties $(ab)^m = a^m b^m$ and $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Power of a Product and Power of a Quotient

Assume that a and b are real numbers. Let m represent a positive integer. Then,

$(xy)^3 = (xy)(xy)(xy)$
 $= (x \cdot x \cdot x)(y \cdot y \cdot y)$
 $= x^3 y^3$

$(ab)^m = a^m b^m$

$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$

Ex.

simplify.

For exercises 5 – 7, use the appropriate property to clear the parentheses.

5. $(-2a)^4$
 $= (-2)^4 a^4$
 $= 16a^4$

6. $(3xy)^3$
 $= 3^3 x^3 y^3$
 $= 27x^3 y^3$

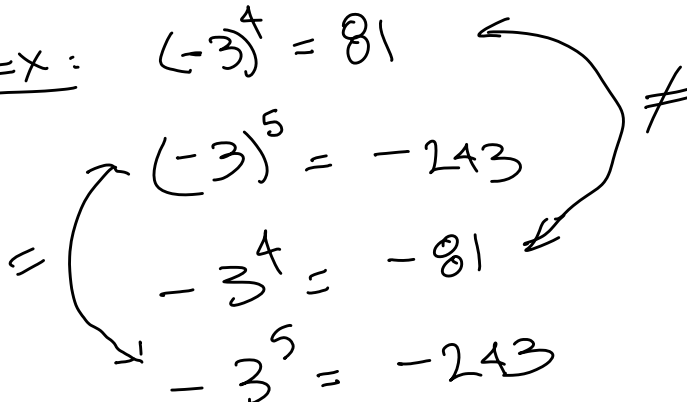
7. $\left(-\frac{c}{d}\right)^5$
 $= \frac{-c^5}{d^5}$
 $= -\frac{c^5}{d^5}$

see note on next page

Recall: * a negative number raised to an even power results in a positive number

* a negative number raised to an odd power results in a negative number.

Ex: $(-3)^4 = 81$
 $(-3)^5 = -243$
 $= \begin{cases} -3^4 = -81 \\ -3^5 = -243 \end{cases}$



$$\begin{array}{r} 81 \\ 3 \\ \hline 243 \end{array}$$

$$(ab)^m = a^m b^m$$

For exercises 8 – 14, simplify the expressions.

$$8. 6(c^3d)^4$$

$$= 6(c^3)^4 (d)^4$$

$$= \boxed{6c^{12}d^4}$$

Ex: $(-3x^4y^2)^2 (-2x^5yz^3)^3$

$$= (-3)^2 x^8 y^4 (-2)^3 x^{15} y^3 z^3$$

$$= 9x^8 y^4 (-8)x^{15} y^3 z^3$$

$$= \boxed{-72x^{23}y^7z^3}$$

$$10. \left(\frac{3}{s^3t}\right)^2 = \boxed{\frac{9}{s^6t^2}}$$

$$9. (-f)^6$$

$$= (-1f)^6$$

$$= (-1)^6 f^6$$

$$= 1 \cdot f^6$$

$$= \boxed{f^6}$$

$$11. \frac{m^3(m^4)^3}{m^5}$$

$$= \frac{m^3 m^{12}}{m^5}$$

$$= \frac{m^{15}}{m^5} = \boxed{m^{15-5}} = \boxed{m^{10}}$$

$$12. (r^3)^5 (r^2)^6$$

$$r^{15} r^{12}$$

$$= \boxed{r^{27}}$$

$$13. \frac{(3ab^3)^4 (a^5b)^5}{(3a^3b^3)^2}$$

$$= \frac{3^4 a^4 b^{12} a^{25} b^5}{3^2 a^6 b^6}$$

$$= \frac{81 a^{29} b^{17}}{9 a^6 b^6}$$

$$= \boxed{9a^{23}b^{11}}$$

$$14. \left(\frac{-5x^4}{y^5z^2}\right)^3$$

$$= \frac{(-5)^3 x^{12}}{y^{15} z^6}$$

$$= \boxed{\frac{-125x^{12}}{y^{15}z^6}} = \boxed{-\frac{125x^{12}}{y^{15}z^6}}$$

15. Simplify the expression using the properties of exponents. Assume that a , b , and m represent positive integers.

$$\left(\frac{a^2}{b^5}\right)^m$$

$$= \frac{a^{2m}}{b^{5m}}$$