Section 5.2: The Power Rules

Monday, October 28, 2013
9:30 AM

$$(x^2)^3 = x^2 \cdot x^2 \cdot x^2 = x^6$$

raising a power to a power:

$$(a^m)^n = a^{m \cdot n}$$

examples: simplify:

$$(x^{-2})^7 = x^{-14} \quad \text{or} \quad \frac{1}{x^{14}}$$

$$(x^{-2})^3 (x^{-3})^{-2} = x^{-6} \, x^6 = x^0 = 1$$

$$\frac{(a^2)^{-3}}{(a^{-2})^4} = \frac{a^{-6}}{a^{-8}} = a^2$$

power of a product:

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

NOTE:

$$(a+b)^n \neq a^n + b^n$$

$(a+b)^n \neq a^n + b^n$

examples: simplify:

$(2x)^3 = 8x^3$ $\quad [= (2x)(2x)(2x)]$

$(2xy^2)^3 = 8x^3y^6$

$(2x^{-1}y^2)^{-3}$

$\frac{1}{(2x^{-1}y^2)^3}$

$\frac{1}{2^3 x^{-3} y^6}$

$\frac{x^3}{8y^6}$

$2^{-3} x^3 y^{-6}$

$\frac{x^3}{2^3 y^6}$

$\frac{x^3}{8y^6}$

$\frac{(3xy)^{-3}}{3xy^3}$

$$\frac{1}{(3xy)^3\ 3xy^3}$$

$$\frac{3^{-3}\ x^{-3}\ y^{-3}}{3xy^3}$$

$$\frac{1}{3^3 x^3 y^3\ 3xy^3}$$

$$\frac{1}{3^3\ x^3 y^3\ 3xy^3}$$

$$\frac{1}{3^4\ x^4\ y^6}$$

$$\frac{1}{81\ x^4\ y^6}$$

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raising a quotient to a power:

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}$$

examples: simplify

$$\left(\frac{ab^{-3}}{a^2 b}\right)^{-2} = \left(\frac{a^2 b}{ab^{-3}}\right)^2$$

$$= \frac{a^4 b^2}{a^2 b^{-6}}$$

$$= a^2 b^2 b^6$$

$$= a^2 b^8$$

$$\left(\frac{2x^3y^2}{3xy^3}\right)^{-1} = \left(\frac{2x^2}{3y}\right)^{-1}$$

$$= \frac{3y}{2x^2}$$

$$\frac{(3x^{-1}y^3)^{-2}}{(3xy^{-1})^3} \cdot (9x^{-9}y^5) = \frac{3^{-2}x^2y^{-6}}{3^3x^3y^{-3}} \cdot 9x^{-9}y^5$$

$$= \frac{x^2y^3}{3^3 3^2 x^3 y^6} \cdot \frac{9y^5}{x^9}$$

$$= \frac{\cancel{3^2}x^2y^8}{3^3\cancel{3^2}x^{12}y^6}$$

$$= \frac{y^2}{27x^{10}}$$

Simplify:

$$\frac{4^{-3p}}{4^{-4p}}$$

$4^{-3p-(-4p)}$

4^p

$\frac{4^{4p}}{4^{3p}}$

4^p

note: you use the SAME RULES even with variables in exponent!

simplify

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

5^{12-9y} 5^{2y-4}

5^{8-7y}