

Sec. 7.3 Simplify a power raised to a power

Power of a Power Rule

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

Ex:

$$(a^3)^4 = (a^3)(a^3)(a^3)(a^3)$$

$$aaa \cdot aaa \cdot aaa \cdot aaa$$

Multiply the exponents = a^{12}

Ex:

$$a. (x^5)^7 = x^{5 \cdot 7} = x^{35}$$

$$b. (a^4)^{\frac{1}{2}} = a^{4 \cdot \frac{1}{2}} = a^2$$

$$c. (a^2)^{-5} = a^{-10} = \frac{1}{a^{10}}$$

$$d. (x^{-3})^7 = x^{-21} = \frac{1}{x^{21}}$$

$$e. (b^{\frac{3}{5}})^{-\frac{1}{2}} = b^{-\frac{3}{10}} = \frac{1}{b^{\frac{3}{10}}}$$

Power of a Product

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

$$\text{Ex: } (2x)^4 = (2x)(2x)(2x)(2x)$$

$$2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x$$

$$2^4 x^4$$

$$16x^4$$

Ex: $(3a)^3 = 3^3 a^3 = 27a^3$

$(2b)^5 = 2^5 b^5 = 32b^5$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$
 $4 \cdot 8 \cdot 16 \cdot 32$

$(9a^4)^{\frac{1}{2}} = 9^{\frac{1}{2}} (a^4)^{\frac{1}{2}}$
 $(3 \cdot 3)^{\frac{1}{2}} a^2$
 $3a^2$

$(5a^{\frac{1}{2}})^2 = 5^2 (a^{\frac{1}{2}})^2$
 $25a$ $5^2 = 5 \cdot 5$

$(3 \times 10^3)^2 = 3^2 \cdot (10^3)^2$
 9×10^6

$(9 \times 10^4)^2 = 9^2 \times (10^4)^2$
 81×10^8
 $8.1 \times 10^1 \times 10^8$
 8.1×10^9

$(8 \times 10^5)^2 = 8^2 \times (10^5)^2$
 64×10^{10}
 $6.4 \times 10^1 \times 10^{10}$
 6.4×10^{11}

$(v^3)^{-6} = v^{-18} = \frac{1}{v^{18}}$

$(z^{\frac{3}{5}})^{-\frac{1}{3}} = z^{-\frac{3}{15}} = z^{-\frac{1}{5}} = \frac{1}{z^{\frac{1}{5}}}$

$f(f^{-3})^{-8} = f(f^{24}) = f^{25}$

$(x^9)^{\frac{1}{2}} (a^9)^0 = x^{\frac{9}{2}}$
 $(2 \cdot 2 \cdot 2 \cdot 2) = 2 \cdot 2$
 $(4 \cdot 4) = 4$

$(16a^{10})^{-\frac{1}{2}} = 16^{-\frac{1}{2}} (a^{10})^{-\frac{1}{2}}$
 $\rightarrow 4^{-1} a^{-5}$
 $= \frac{1}{4a^5}$

$(5c^{\frac{1}{2}})^{-2} = 5^{-2} (c^{\frac{1}{2}})^{-2}$ $\frac{1}{2} \cdot 2 = 1$
 \downarrow
 $\frac{1}{(5c^{\frac{1}{2}})^2} = \frac{1}{25c}$

$(r^{\frac{2}{3}} s^4)^3 = (r^{\frac{2}{3}})^3 (s^4)^3$
 $r^2 s^{12}$

$(u^5 v^{-4})^{\frac{3}{10}} (u^6)^{\frac{1}{10}}$ $\frac{1}{10} \cdot \frac{3}{10} = \frac{3}{100}$

$(u^5)^{\frac{3}{10}} (v^{-4})^{\frac{3}{10}} (u^6)^{\frac{1}{10}}$ $\frac{1}{10} \cdot \frac{3}{10} = -\frac{3}{100}$

$u^{\frac{3}{2}} v^{-\frac{3}{5}} u^{24} = \frac{u^{\frac{3}{2}} u^{24}}{v^{\frac{3}{5}}}$ $\frac{3}{2} + 24 = 24 \frac{3}{2}$
 $\frac{3}{5} + \frac{3}{5} = \frac{6}{5}$

$= \frac{u^{\frac{105}{2}}}{v^{\frac{6}{5}}}$ $\frac{3}{2} + \frac{96}{2} = \frac{105}{2}$
 $\frac{3}{5} + \frac{3}{5} = \frac{6}{5}$

$(3 \times 10^2)^3 = 3^3 \times (10^2)^3$ $\frac{3 \cdot 3 \cdot 3}{27}$
 27×10^6
 $2.7 \times 10^1 \times 10^6$
 2.7×10^7

$$(5 \times 10^{-3})^4 = 5^4 \times (10^{-3})^4$$

$$625 \times 10^{-12}$$

$$6.25 \times 10^2 \times 10^{-12}$$

$$6.25 \times 10^{-10}$$

$$(2.5 \times 10^{-15})^{-2} = (2.5)^{-2} \times (10^{-15})^{-2}$$

$$\frac{2.5}{2.5} = 6.25^{-1}$$

$$6.25 \overline{) 1.0000} \quad \begin{array}{l} 16 \\ \underline{625} \\ 375 \\ \underline{375} \\ 0 \end{array}$$

$$\frac{1}{6.25} \times 10^{30}$$

$$0.16 \times 10^{30}$$

$$1.6 \times 10^{-1} \times 10^{30}$$

$$1.6 \times 10^{29}$$

$$(c^3)^4 = c^{12}$$

$$(2x^2y^2)^5 = 32y^{10}$$