

8.1: Properties of Exponents

$$X^a \cdot X^b = X^{a+b}$$

$$\frac{X^a}{X^b} = X^{a-b}$$

$$(X^a)^b = X^{a \cdot b}$$

$$X^{-a} = \frac{1}{X^a}$$

$$\frac{1}{X^{-a}} = X^a$$

$$X^0 = 1$$

$$(XY)^a = X^a Y^a$$

$$\left(\frac{X}{Y}\right)^a = \frac{X^a}{Y^a}$$

$$X^{\frac{a}{b}} = \sqrt[b]{X^a}$$

$$\text{Ex 1) } 2k^4 \cdot 4k = \boxed{8k^5}$$

$$\text{Ex 2) } \frac{18x^4 y^3}{3x^6} = 6x^{-2} y^3 = \boxed{\frac{6y^3}{x^2}}$$

$$\text{Ex 3) } (2x^2)^{-4} = 2^{-4} x^{2 \cdot -4} \\ = \frac{1}{16} \cdot x^{-8} = \boxed{\frac{1}{16x^8}}$$

$$\text{Ex 4) } x^4 y^3 \cdot (2y^2)^1 = \boxed{x^4 y^3}$$

$$\text{Ex 5) } a^4 b \cdot (2a^4 b^2)^{-3} = a^4 b \cdot 2^{-3} \cdot a^{4 \cdot -3} b^{2 \cdot -3} \\ = a^4 b \cdot \frac{1}{8} \cdot a^{-12} \cdot b^{-6} \\ = a^{-8} b^{-5} \cdot \frac{1}{8} \\ = \boxed{\frac{1}{8a^8 b^5}}$$

$$\begin{aligned} \text{Ex 6)} \quad \frac{2y^3 \cdot 3xy^6}{3x^2y^4} &= \frac{6xy^9}{3x^2y^4} \\ &= 2x^{-1}y^5 \\ &= \boxed{\frac{2y^5}{x}} \end{aligned}$$

$$\begin{aligned} \text{Ex 7)} \quad \frac{(3x^3z^2)^3}{x^3y^4z^2 \cdot x^{-4}z^3} &= \frac{27x^9z^6}{x^{-1}y^4z^5} \\ &= \boxed{\frac{27x^{10}z}{y^4}} \end{aligned}$$

$$\begin{aligned} \text{Ex 8)} \quad \frac{4m^4n^3p^3}{3m^2n^2p^4} &= \frac{4m^2np^{-1}}{3} \\ &= \boxed{\frac{4m^2n}{3p}} \end{aligned}$$

$$\begin{aligned} \text{Ex 9)} \quad \frac{(2pm^{-1}q^1)^{-4} \cdot 2m^{-1}p^3}{2pq^2} &= \frac{\frac{1}{16}p^{-4}m^4 \cdot 2m^{-1}p^3}{2pq^2} \\ &= \frac{\frac{1}{8}p^{-1}m^3}{2pq^2} \\ &= \frac{p^{-2}m^3}{16q^2} \\ &= \boxed{\frac{m^3}{16p^2q^2}} \end{aligned}$$

$$\text{Ex 10) } a^{\frac{1}{6}} = \sqrt[6]{a}$$

$$\text{Ex 11) } x^{\frac{3}{4}} = \sqrt[4]{x^3}$$

$$\text{Ex 12) } \sqrt[2]{5y} = (5y)^{\frac{1}{2}}$$

$$\begin{aligned} \text{Ex 13) } \sqrt[3]{a^2 b^5} &= (a^2 b^5)^{\frac{1}{3}} \\ &= a^{\frac{2}{3}} b^{\frac{5}{3}} \end{aligned}$$