4.1 & 4.2 Exponents

Exponent Rules (p. 268)

If a, b, m, & n are integers,

$a^0 = 1$

$a^m a^n = a^{m+n}$

$\frac{a^m}{a^n} = a^{m-n}$

$(a^m)^n = a^{mn}$

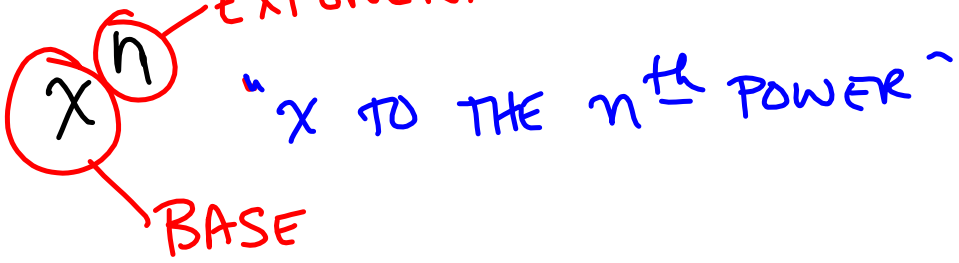
$(ab)^n = a^n b^n$

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

$a^{-1} = \frac{1}{a}$ $\quad \left(\frac{a}{b}\right)^{-1} = \frac{b}{a}$

$a^{-n} = \frac{1}{a^n}$ $\quad \left(\frac{a}{b}\right)^{-n} = \frac{b^n}{a^n}$

EXPONENTS



$$x^n = \underbrace{x \cdot x \cdot x \cdots x}_{n \text{ TIMES}}$$

$$x^2 = x \cdot x \qquad x^3 = x \cdot x \cdot x \qquad x^1 = x$$

$$x^0 = 1$$ MULTIPLICATIVE IDENTITY

$$\frac{x^m}{x^n} = x^{m-n} \qquad \frac{x^m}{x^m} = x^{m-m} = x^0 = 1$$

Ex. 1 p. 256

(a) $2^3 \cdot 2^2 = \underbrace{2 \cdot 2 \cdot 2}_{2^3} \cdot \underbrace{2 \cdot 2}_{2^2} = 2^5 = 32$

(b) $x^2 \cdot x^4 \cdot x = x^7$

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(c) $2y^3 \cdot 4y^8 = 8y^{11}$

(d) $-4a^2b^3(-3a^5b^9) = 12a^7b^{12}$

Ex. 2

(a) $5^0 = 1$ (b) $(3xy)^0 = 1$

(c) $b^0 \cdot b^9 = b^9$ (d) $2^0 + 3^0 = 2$

Ex. 3

(a) $x^7 \div x^4 = \frac{x^7}{x^4} = \frac{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x} = x^3$

(b) $w^5 \div w^3 = \frac{w^5}{w^3} = w^2$

(c) $\frac{2x^9}{-4x^3} = -\frac{x^6}{2}$ (d) $\frac{6a^{12}b^6}{-3a^9b^6} = -2a^3$

Ex. 4

(a) $(2^3)^8 = 2^{24} = 16777,216$

$2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3$

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

(b) $(x^2)^5 = x^2 \cdot x^2 \cdot x^2 \cdot x^2 \cdot x^2 = x^{10}$

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x = x^{10}$

(c) $3x^8(x^3)^6 = 3x^8x^{18} = 3x^{26}$

(d) $\dfrac{-6(b^4)^3}{3b^2} = \dfrac{-6b^{12}}{3b^2} = -2b^{10}$

Ex. 5

(a) $(-2x)^3 = (-2)^3 x^3 = -8x^3$

(b) $(-3a^2)^4 = (-3)^4 a^8 = 81a^8$

(c) $(5x^3y^2)^3 = 125x^9y^6$

Ex. 6

(a) $\left(\frac{y}{4}\right)^3 = \frac{y^3}{4^3} = \frac{y^3}{64}$

(b) $\left(\frac{2x^2}{3y}\right)^4 = \frac{16x^8}{81y^4}$

(c) $\left(\frac{x^3}{y^5}\right)^4 = \frac{x^{12}}{y^{20}}$

4.2 NEGATIVE EXPONENTS

Ex. 1

(a) $2^{-5} = \frac{1}{2^5} = \frac{1}{32}$

(b) $(-2)^{-5} = \frac{1}{(-2)^5} = -\frac{1}{32}$

(c) $-9^{-2} = -\frac{1}{9^2} = -\frac{1}{81}$

(d) $\frac{2^{-3}}{3^{-2}} = \frac{3^2}{2^3} = \frac{9}{8}$

Ex.2

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

(b) $\frac{2y^{-8}}{x^{-3}} = \frac{2x^3}{y^8}$

(c) $7^{-2} = \frac{1}{49}$

(d) $\left(\frac{3}{4}\right)^{-3} = \frac{3^{-3}}{4^{-3}} = \frac{4^3}{3^3} = \frac{64}{27}$

Ex. 3

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

(b) $$\frac{2^{-1}-2^{-2}}{3^{-1}-4^{-1}} = \frac{\frac{2}{4}-\frac{1}{4}}{\frac{4}{12}-\frac{3}{12}} = \frac{\frac{1}{4}}{\frac{1}{12}} = \frac{1}{4}\cdot\frac{12}{1} = 3$$

Ex. 4

(a) $b^{-3}b^5 = b^{-3+5} = b^2$

$\frac{b^5}{b^3} = b^{5-3} = b^2$

(b) $-3x^{-3} \cdot 5x^2 = \frac{-15}{x}$

(c) $\frac{m^{-6}}{m^{-2}} = \frac{m^2}{m^6} = m^{2-6} = m^{-4} = \frac{1}{m^4}$

(d) $\frac{4x^{-6}y^5}{-12x^{-6}y^{-3}} = \frac{y^8}{-3}$

$-\frac{y^8}{3}$

$\frac{y^5}{y^{-3}} = y^{5--3} = y^8$

$\frac{y^5}{y^{-3}} = \frac{y^5 y^3}{1} = y^{5+3} = y^8$

Ex. 5

(a) $(a^{-3})^2 = \left(\frac{1}{a^3}\right)^2 = \frac{1}{a^6}$

(b) $(10x^{-3})^{-2} = 10^{-2}x^6 = \frac{x^6}{100}$

(c) $\left(\frac{4x^{-5}}{y^2}\right)^{-2} = \left(\frac{4}{x^5y^2}\right)^{-2} = \frac{x^{10}y^4}{16}$