

Exponent Laws

Multiplication Law

$$\underline{a}^m \times \underline{a}^n = \underline{a}^{m+n}$$

When multiplying with a common base, keep the base & add the exponents.

$$2^3 \times 2^4 = 2^{3+4} = 2^7$$

$$(x^3 y^5)(x^4 y^{11}) = x^{3+4} y^{5+11} = x^7 y^{16}$$

$$(-3x^7 y^{10})(2x^3 y^1 z^1) = -6x^{7+3} y^{10+1} z^1$$

Division Law

$$\underline{a}^m \div \underline{a}^n = \underline{a}^{m-n}$$

When dividing with a common base, keep the base and subtract the exponents.

$$15^{11} \div 15^2 = 15^{11-2} = 15^9$$

$$(\underline{x}^9 \underline{y}^7) \div (\underline{x}^1 \underline{y}^2) = \underline{x}^{9-1} \underline{y}^{7-2} = x^8 y^5$$

$$\frac{-3x^3}{15x^1} = -\frac{1x^{3-1}}{5} = -\frac{1x^2}{5}$$

Power Law

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

When a power is raised to an exponent, keep the base & multiply the exponents.

$$(x^4 y^1)^5 = x^{4 \times 5} y^{1 \times 5} = x^{20} y^5$$

$$(2x^4 y^1)^5 = 2^5 x^{4 \times 5} y^{1 \times 5} = 32 x^{20} y^5$$

$$(7x^3 y^2)^2 = 7^2 x^{3 \times 2} y^{2 \times 2} = 49 x^6 y^4$$

$$\left(\frac{3x^5 y^2}{4x^4 y} \right)^3 = \frac{27x^{15} y^6}{64x^{12} y^3} \stackrel{\text{Div. Law}}{=} \frac{27x^3 y^3}{64}$$

Bracket Law

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

Zero Law

$$a^0 = 1 \quad 10^0 = 1 \quad 2^0 = 1$$

Any power raised to a zero exponent gives an answer of 1.

Negative Exponent Law

$$a^{-m} = \frac{1}{a^m} \text{ Reciprocal}$$

For a power involving a negative exponent, take the reciprocal of the base & make the exponent positive

$$x^{-1} = \frac{1}{x^1}$$

$$x^{-3} = \frac{1}{x^3}$$

$$\frac{x^{-3} y^2}{x^4 y^1} = \frac{y^2}{x^3}$$

Div Law

$$\frac{x^2 y^{-3}}{x^{-4} y^1}$$

$$\frac{x^2 y^{-3}}{x^{-4} y^1}$$

$$\frac{x^2 \cdot x^4}{y^1 \cdot y^3}$$

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

$$\frac{x^{2-(-4)} y^{-3-1}}{x^6 y^{-4}}$$

Neg. Exponent Law

$$\frac{x^6 y^{-4}}{x^6 y^{-4}} = \frac{x^6}{y^4}$$

$$-\frac{6x^2 y^{-4}}{15x^6 y^2} = -\frac{2x^{2-6} y^{-4-(-2)}}{5}$$

Div. Law

$$= -\frac{2x^{-4} y^{-4+2}}{5} \text{ Neg. Exp. Law}$$

$$= -\frac{2x^{-4} y^{-2}}{5} = -\frac{2}{5x^4 y^2}$$