Exponent Rules

Simplify (Show why)

$x^{2} \cdot x^{4} = x \cdot x \cdot x \cdot x \cdot x \cdot x = x^{6}$

base

Product Rule for exponents

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

Simplify

$2^{2} \cdot 2^{3} = 2^{5}$

$3z^{2} \cdot 4z^{4} = 12z^{6}$

You try

$(-3)^2 \cdot (-3)^3$ $\qquad$ $5x^2 \cdot (-2x^5)$

Simplify (Show Why)

$$\frac{y^6}{y^2} = \frac{y \cdot y \cdot y \cdot y \cdot y \cdot y}{y \cdot y} = y^4$$

Quotient Rule for exponents

$$\frac{a^m}{a^n} = a^{m-n} \quad \text{if } a \neq 0$$

Simplify

$$\frac{8^5}{8^3} = 8^2$$

$$\frac{27z^9}{12z^4} = \frac{9z^5}{4}$$

You try

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

$$\frac{-24b^5}{16b^3}$$

Zero-exponent Rule

$$a^0 = 1 \qquad \text{if } a \neq 0$$

Simplify

$3^0 = 1$ $\qquad \pi^0 = 1$ $\qquad (\partial\theta + \Phi\Omega - \wp^{\Diamond})^0 = 1$

Negative-exponent Rule

$$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n \qquad \text{if } a \neq 0$$

Simplify

$\frac{3^{-4}}{1} = \frac{1}{3^4}$ $\qquad 4x^{-5}$ $\qquad \frac{4}{x^5}$ $\qquad \frac{1}{3^{-2}} = 3^2$

You try

$\frac{5^{-3}}{1}$ $\frac{1}{5^3}$

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

Simplify

$1-(-4)=5$

$\frac{-24b^5}{16b^{-3}}$ $\frac{-6b^8}{4}$

$5-(-3)$
$5+3$

$\frac{-6b^5 \cdot b^3}{4}$

$\frac{-6b^8}{4}$

$\frac{50s^2t^4}{15s^5t^{-4}}$ $\frac{10s^{-3}}{3}$

$\frac{10t^5}{35^3}$

Simplify (Show Why)

$(3^2)^4$ $(3^2)(3^2)(3^2)(3^2) = 3^8$

Power rule for exponential expressions

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

Simplify

$(4^3)^5 = 4^{15}$ $[(-3)^3]^2 = (-3)^6$ $(6^3)^0 = 1$

You try

$(2^2)^3 = 2^6$

$(z^3)^{-6}$ -18

$(z)^{-18}$

$\frac{1}{(z)^{18}}$

$(s^{-3})^{-7}$

s^{21}

Product to a power

$$(a \cdot b)^n = a^n \cdot b^n$$

Simplify

$(3z)^4$

$3^4 z^4$

$81z^4$

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

$3^{-3} y^6 = \frac{y^6}{3^3} \quad \frac{y^6}{27}$

$(-3a^2)^2$

$(-3)^2 a^4 = 9a^4$

You try

$(5y)^3$

$(4a^3)^{-2}$

Quotient to a power

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad \text{if } b \neq 0$$

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \quad \text{if } a \neq 0,\ b \neq 0$$

Simplify

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

$\frac{w^3}{4^3}$ $\frac{w^3}{64}$ $\frac{2^4 w^8}{y^{12}}$ $\frac{8w^8}{y^{12}}$ $\left(\frac{2}{x^4}\right)^5 = \frac{2^5}{x^5}$ $\frac{32}{x^5}$

You try

$$\left(\frac{z}{3}\right)^4 \qquad \left(\frac{4}{3}\right)^{-2} \qquad \left(\frac{3a^{-2}}{b^4}\right)^3$$

Rules

$a^0 = 1 \quad \text{if } a \neq 0$

$a^{-n} = \frac{1}{a^n} \quad \text{or} \quad \frac{1}{a^{-n}} = a^n \quad \text{if } a \neq 0$

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

$\frac{a^m}{a^n} = a^{m-n} \quad \text{if } a \neq 0$

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

$(a \cdot b)^n = a^n \cdot b^n$

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n} \quad \text{if } b \neq 0$

$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n \quad \text{if } a \neq 0,\ b \neq 0$

Simplify

$$\frac{a^3 b^{-1}}{(a^2 b)^3}$$

Simplify

$$\left(\frac{3xy}{x^2y^{-2}}\right)\cdot\left(\frac{9x^2y^{-3}}{x^3y^2}\right)^{-1}$$