1-2 Exponent Rules

Simplify (Show why)

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

$xx \cdot xxxx = x^6$

Product Rule for exponents

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

Simplify

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

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

Simplify (Show Why)

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

$$\frac{y\,y\,y\,y\,y\,y}{y\,y}$$

Quotient Rule for exponents

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

Simplify

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

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

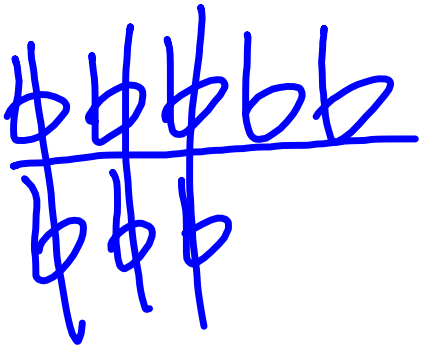
9·3

4·3

You try

$$\frac{y^8}{y^6} = y^{8-6} = y^2 \qquad \frac{-24b^5}{16b^3} = -\frac{3}{2}b^2$$

$8-6$ $5-3$ $8-2$



Zero-exponent Rule

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

Simplify

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

Negative-exponent Rule

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

Simplify

$3^{-4} = \frac{1}{3^4}$

$4x^{-5}$

$\frac{4}{x^5}$

$\frac{1}{3^{-2}} = 3^2$

You try

5^{-3}

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

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

Simplify

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

$\div 4$

$$\frac{-6}{4}\,b^{5-(-3)}$$

$\div 2$

$$-\frac{3}{2}b^8$$

$\div 5$

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

$\div 5$

$$\frac{10}{3}t^{1-(-4)}s^{5-2}$$

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

Power rule for exponential expressions

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

Simplify

$(4^3)^5$

4^{15}

$[(-3)^3]^2$

$(-3)^6$

$(6^3)^0$

1

Product to a power

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

Simplify

$(3z)^4$

$(3^1)^4(z^1)^4$

$3^4 z^4$

$81z^4$

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

$3^{-3}y^6$

$\frac{y^6}{27}$

$(-3a^2)^2$

3^2a^4

$9a^4$

$(-3)^2a^4$

Quotient to a power

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

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

$$\frac{a^{-n}}{b^{-n}} = \frac{\frac{1}{a^n}}{\frac{1}{b^n}} = \frac{1}{a^n} \cdot \frac{b^n}{1} = \frac{b^n}{a^n}$$

Simplify

$\left(\frac{w}{4}\right)^3$

$\frac{w^3}{4^3}$

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

$\frac{2^4 w^8}{y^{12}}$

$\left(\frac{x}{2}\right)^{-5}$

$\left(\frac{2}{x}\right)^5$

$\frac{2^5}{x^5}$

You try

$\left(\frac{z}{3}\right)^4$

$\frac{z^4}{3^4}$

$\left(\frac{4}{3}\right)^{-2}$

$\frac{3^2}{4^2}$

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

$\frac{3^3 a^{-6}}{b^{12}}$

$\frac{3^3}{a^6 b^{12}}$

Simplify

$$\frac{a^3b^{-1}}{(a^2b)^3} = \frac{a^3b^{-1}}{a^6b^3} \quad -3 \quad -1 \quad = \frac{1}{a^3b^4}$$

Simplify (Honors)

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

$$\frac{3x^1y^1}{x^2y^{-2}}\cdot\frac{x^3y^2}{9x^2y^{-3}} = \frac{3x^{4-4}y^{3-(-5)}}{9x^4y^{-5}}$$

$$\frac{1x^0y^8}{3} = \frac{y^8}{3}$$

Rules

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

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

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

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

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

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

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

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