

Know the following Laws of Exponents and Radicals.

Let a, b, m, n be real numbers. Then:

(1) $a^0 = 1$ (when $a \neq 0$)

(7) $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$ (when $a, b \neq 0$)

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

(3) $\frac{a^m}{a^n} = a^{m-n}$ (when $a \neq 0$)

(8) $a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$

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

(9) $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

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

(6) $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ (when $b \neq 0$)

(10) $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

1. Simplify the expressions so that they have only positive exponents.

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

$\frac{x}{y}$

(d) $\frac{x^4y^2}{x^{-3}} \div \frac{x^3y^{-2}}{y^5}$

x^4y^9

(b) $\frac{(x^3y^{-2})^6}{(y^{-5}x^{-2})^{-3}}$

$\frac{x^{12}}{y^{27}}$

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

$\frac{1}{x^4}$

(c) $\frac{(x^2y^{-3})^{-2}}{(y^{-3}x^{-2})^2}$

y^{12}

(f) $(x^{-1} + y^{-1})^{-1}$

$\frac{xy}{x+y}$

2. Simplify the expressions.

(a) $\sqrt[3]{\frac{8}{27}}$

$\frac{2}{3}$

(e) $\frac{(2^{\frac{1}{3}})^{\frac{2}{5}}}{\sqrt[5]{2}}$

$\frac{1}{\sqrt[15]{2}}$

(b) $32^{\frac{3}{5}}$

8

(f) $\frac{x^{\frac{1}{3}}y^{\frac{1}{2}}}{\sqrt[3]{x^2y}}$

$\frac{\sqrt[6]{y}}{\sqrt[3]{x}}$

(c) $(-32)^{\frac{3}{5}}$

-8

(d) $0.001^{\frac{2}{3}}$

0.01

3. Rationalize the denominator.

(a) $\frac{\sqrt{5}}{\sqrt{3}}$

$\frac{\sqrt{15}}{3}$

(d) $\frac{\sqrt{3}}{1 + \sqrt{3}}$

$\frac{3 - \sqrt{3}}{2}$

(b) $\frac{5}{\sqrt[4]{5}}$

$\sqrt[4]{5^3}$

(e) $\frac{1 + \sqrt{2}}{1 - \sqrt{2}}$

$-3 - 2\sqrt{2}$

(c) $\frac{3}{\sqrt[3]{9}}$

$\sqrt[3]{3}$

(f) $\frac{\sqrt{x} - \sqrt{3}}{\sqrt{x} + \sqrt{3}}$

$\frac{x - 2\sqrt{3x} + 3}{x - 3}$