

Radicals and Exponents

Properties of Exponents

- $a^m \cdot a^n = a^{m+n}$
- $\frac{a^m}{a^n} = a^{m-n}$
- $a^{-n} = \frac{1}{a^n}$
- $a^0 = 1$
- $(ab)^m = a^m b^m$
- $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
- $(a^m)^n = a^{mn}$

Simplify each expression. Assume that all variables are positive.

- $27^{\frac{1}{3}} = 3$
- $(81^{\frac{1}{4}})^4 = 81$
- $7^0 = 1$
- $(-1)^{\frac{1}{5}} = -1$
- $8^{\frac{2}{3}} = 4$
- $16^{\frac{1}{4}} = \pm 2$
- $x^{\frac{1}{2}} \cdot x^{\frac{1}{3}} = x^{\frac{5}{6}}$
- $2y^{\frac{1}{2}} \cdot y 2y^{\frac{3}{2}} = 4y^2$
- $9(8^2)^{\frac{1}{3}} = 4$
- $\sqrt[8]{0} = 0$
- $12y^{\frac{1}{3}} \cdot \frac{1}{4y^{\frac{1}{2}}} = 3y^{\frac{1}{6}}$
- $(3x^{\frac{1}{2}})(4x^{\frac{2}{3}}) = 12x^{\frac{7}{6}}$
- $(3a^2b^3)^2 = 9a^4b^6$
- $(y^{\frac{2}{3}})^{-9} = \frac{1}{y^6}$
- $(\frac{27}{8})^{\frac{2}{3}} = \frac{9}{4}$
- $y^{\frac{2}{3}} \cdot y^{\frac{3}{8}} = y^{\frac{17}{24}}$
- $(\frac{x^{\frac{7}{2}}}{x^{\frac{2}{3}}})^{\frac{4}{5}} = x^{\frac{7}{2} \cdot \frac{4}{5} - \frac{2}{3} \cdot \frac{4}{5}} = x^{\frac{14}{5} - \frac{8}{15}} = x^{\frac{28}{15}}$
- $(9x^4y^{-2})^{\frac{1}{2}} = 3x^2 \cdot \frac{1}{y}$

Write each expression in radical form.

- $(2y)^{\frac{1}{3}} = \sqrt[3]{2y}$
- $81^{-\frac{1}{2}} = \frac{1}{9}$
- $(ab)^{\frac{1}{4}} = \sqrt[4]{ab}$
- $m^{2.4} = 5\sqrt{m^{12}}$
- $a^{1.5} = \sqrt{a^3}$

Write each expression in exponential form.

- $\sqrt[3]{m} = m^{\frac{1}{3}}$
- $(\sqrt[4]{b})^3 = b^{\frac{3}{4}}$
- $\sqrt{-6} = (-6)^{\frac{1}{2}}$
- $(-2y^2)^{\frac{1}{3}} = \sqrt[3]{-2y^2}$
- $\sqrt[4]{(5ab)^3} = (5ab)^{\frac{3}{4}}$
- $(6a)^4 = \sqrt[4]{(6a)^2}$
- $(-c)^{\frac{1}{2}}$
- $(-2y^2)^{\frac{1}{3}} = \sqrt[3]{-2y^2}$

Properties of Radicals

- $\sqrt[n]{a^m} = \sqrt[n]{a^m}$
- $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$
- $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

Rational Exponents

- $a^{\frac{1}{n}} = \sqrt[n]{a}$
 - $a^{\frac{x}{y}} = \sqrt[y]{a^x}$
- $\frac{x}{y} = \frac{\text{power}}{\text{root}}$

Kry
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