



Radicals and Exponents

The basic properties of radicals are listed below.

$$\sqrt[r]{a^p} = a^{\frac{p}{r}} = (\sqrt[r]{a})^p$$

$$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \quad [b \neq 0]$$

$$\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$$

$$\sqrt[n]{a^n} = a$$

[if n is a positive even integer]

$$\sqrt[n]{a^n} = |a|$$

[if n is a positive odd integer]

$$\sqrt{a+b} = \sqrt{a+b} \quad \text{NOT} \quad \sqrt{a} + \sqrt{b}$$

Simplest Radical Form

- No perfect roots under the radical sign

Example: $\sqrt[3]{81}$
 $\sqrt[3]{81} = \sqrt[3]{27 \cdot 3} = 3\sqrt[3]{3}$

- No fractions under radical sign

Example: $\sqrt{\frac{5}{9}} = \frac{\sqrt{5}}{\sqrt{9}} = \frac{\sqrt{5}}{3}$

- No radical in denominator

$$\frac{1}{\sqrt[3]{3}}$$

$$\frac{1}{\sqrt[3]{3}} \cdot \frac{\sqrt[3]{9}}{\sqrt[3]{9}} = \frac{\sqrt[3]{9}}{\sqrt[3]{27}} = \frac{\sqrt[3]{9}}{3}$$



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The basic properties of exponents are listed below.

$$a^r \times a^s = a^{r+s}$$

$$(ab)^r = a^r b^r$$

$$(a^r)^s = a^{rs}$$

$$\frac{a^r}{a^s} = a^{r-s}$$

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

$$a^{-r} = \frac{1}{a^r}$$

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