

4.4 Rational Exponents

Radicals can be rewritten using rational (fraction) exponents.

Radical Form

Exponential Form

$$\sqrt[n]{x^m} \text{ or } (\sqrt[n]{x})^m$$

$$x^{\frac{m}{n}}$$

n is the index \rightarrow denominator
m is the power/exponent \rightarrow numerator

Write in exponential form:

①

$$\sqrt[3]{z^2}$$

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

②

$$(\sqrt[4]{x})^{11}$$

$$x^{\frac{11}{4}}$$

square root
has index 2

③

$$\sqrt{4m}$$

$$(4m)^{\frac{1}{2}}$$

Write in radical form:

④

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

$$\sqrt[5]{x^2} \text{ or } (\sqrt[5]{x})^2$$

⑤

$$y^{\frac{7}{4}}$$

$$\sqrt[4]{y^7} \text{ or } (\sqrt[4]{y})^7$$

⑥

$$4^{\frac{1}{3}} z^{\frac{2}{3}}$$

$$\sqrt[3]{4z^2}$$

Evaluate the power.

⑦ $25^{\frac{3}{2}}$ Best way to start $(\sqrt{25})^3$ or $\sqrt{25^3}$

$$\begin{array}{l} (5)^3 \\ 5 \cdot 5 \cdot 5 \\ 25 \cdot 5 \\ \boxed{125} \end{array} \left. \vphantom{\begin{array}{l} (5)^3 \\ 5 \cdot 5 \cdot 5 \\ 25 \cdot 5 \\ \boxed{125} \end{array}} \right\} \text{NO calc}$$

⑧ $27^{\frac{2}{3}}$ $(\sqrt[3]{27})^2$ or $\sqrt[3]{27^2}$

$$\begin{array}{l} (3)^2 \\ \boxed{9} \end{array} \left. \vphantom{\begin{array}{l} (3)^2 \\ \boxed{9} \end{array}} \right\} \text{NO calc}$$

⑨ $-16^{\frac{3}{2}}$ = $\boxed{-64}$ using calculator

⑩ $(-64)^{\frac{2}{3}}$ = $\boxed{16}$ using calculator

⑪ $\left(\frac{64}{25}\right)^{-\frac{3}{2}}$ = $\boxed{\frac{125}{512}}$ using a calculator