Simplifying Higher Roots

Simplifying Radicals of Higher Roots $\sqrt[n]{p}$

To simplify a radical containing a radicand that is not a perfect *n*th power, reverse the Product Rule for Radicals. Rewrite the radicand as the product of factors where as many factors as possible are perfect *n*th powers. Write each factor as a separate radical and evaluate each. Multiply the results.

$$\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$$

$$\sqrt[3]{27000} = \sqrt[3]{27}\cdot\sqrt[3]{1000} = 3\cdot 10 = 30$$

$$\sqrt[3]{250} = \sqrt[3]{125}\cdot\sqrt[3]{2} = 5\sqrt[3]{2}$$

TRY:

$$\sqrt[3]{8000}$$

$$\sqrt[3]{270}$$

Using the factor-tree approach works for higher roots as well. The difference is that one wants to form groups of ‘n’ like factors. That is, if the index is 3, look for 3 of the same factor; if 4, look for groups of 4 like factors, etc.

$$\sqrt[3]{8640} \qquad 8640 = \boxed{2\cdot 2\cdot 2}\cdot\boxed{2\cdot 2\cdot 2}\cdot\boxed{3\cdot 3\cdot 3}\cdot 5$$

$$\sqrt[3]{8640} = \sqrt[3]{2^3\cdot 2^3\cdot 3^3\cdot 5} = 2\cdot 2\cdot 3\cdot\sqrt[3]{5} = 12\sqrt[3]{5}$$