

Bellwork

Simplify

$$1. \sqrt{108} \rightarrow 36 \cdot 3 = 6\sqrt{3}$$

$$\begin{array}{c} \sqrt{9 \cdot 12} \\ 3\sqrt{12} \\ 4 \cdot 3 \end{array}$$

$$6\sqrt{3}$$

$$2. -3\sqrt[3]{5} + 7\sqrt[3]{5}$$

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

$$3. -2\sqrt{2}(2\sqrt{3} + 4\sqrt{6})$$

$$-4\sqrt{6} - 8\sqrt{12}$$

$$-4\sqrt{6} - 16\sqrt{3}$$

$$4. \frac{\sqrt{5}}{3\sqrt{12}}$$

$$\frac{\sqrt{5}}{6\sqrt{3}} \left(\frac{\sqrt{3}}{\sqrt{3}} \right) = \frac{\sqrt{15}}{18}$$



Is the conjecture $\sqrt{x^2} = x$ true for all numbers x ?

$$x = -3 \quad x = 3 \quad \sqrt{x^2} = |x|$$

$$\sqrt{(-3)^2} = -3 \quad \sqrt{3^2} = 3$$

$$3 \neq -3 \quad 3 = 3$$

Same exponent rules, but this time with rational exponents (fractions/decimals).

$$a^m \cdot a^n = a^{m+n}$$

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

$$5^{\frac{1}{3}} \cdot 5^{\frac{3}{2}} = 5^{\frac{1}{3} + \frac{3}{2}} = 5^{\frac{11}{6}}$$

$$2^{\frac{3}{4}} \cdot 2^{.5} =$$

$$2^{\frac{3}{4}} \cdot 2^{\frac{1(2)}{2(2)}} = 2^{\frac{5}{4}}$$

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

$$(16)^{\frac{1}{4}} \leftarrow \text{Root}$$

$$(3^{\frac{5}{2}})^2 =$$

$$4(16)^{.25} =$$

$$(3^{\frac{5}{2}})^2 =$$

$$4 \sqrt[4]{16} = 4 \cdot 2 = 8$$

$$3^{(\frac{5}{2})(\frac{2}{1})} = 3^5$$

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

$$(16 \cdot 9)^5$$

$$(16 \cdot 9)^{\frac{1}{2}}$$

$$\sqrt{16 \cdot 9}$$

$$4 \cdot 3 = 12$$

$$\begin{aligned} & \left(\sqrt{100n^4} \right)^3 \\ & (10n^2)^3 = 1000n^6 \\ & (100n^4)^{\frac{3}{2}} = \end{aligned}$$

$$100^{\frac{3}{2}} n^{\frac{3}{4}(\frac{3}{2})} =$$

$$10^3$$

$$1000 n^6$$

$$a^{-m} = \frac{1}{a^m}, a \neq 0$$

$$36^{-\frac{1}{2}} = \frac{1}{36^{\frac{1}{2}}} = \frac{1}{\sqrt{36}} = \frac{1}{6}$$

$$x^{-\frac{4}{3}} = \frac{1}{x^{\frac{4}{3}}}$$

$$\frac{1}{\sqrt[3]{x^4}} = \frac{1}{x\sqrt[3]{x}} \frac{\sqrt[3]{x^2}}{\sqrt[3]{x^2}} = \frac{\sqrt[3]{x^2}}{x^2}$$

$$\frac{1}{x^{\frac{4}{3}}} \left(\frac{x^{\frac{2}{3}}}{x^{\frac{2}{3}}} \right) = \frac{x^{\frac{2}{3}}}{x^{\frac{6}{3}}} = \frac{x^{\frac{2}{3}}}{x^2}$$

$$\frac{\sqrt[3]{x^2}}{x^2}$$

$$\frac{a^m}{a^n} = a^{m-n}, \quad a \neq 0$$

$$\frac{3^2}{3^{\frac{1}{2}}} = 3^{2-\frac{1}{2}} = 3^{\frac{3}{2}}$$

$$\frac{x^{\frac{1}{2}}}{x^2} = \frac{1}{x^{2-\frac{1}{2}}} = \frac{1}{x^{\frac{3}{2}}}$$

$$\frac{1}{x^{\frac{3}{2}}} \left(\frac{x^{\frac{1}{2}}}{x^{\frac{1}{2}}} \right) = \frac{x^{\frac{1}{2}}}{x^2} = \frac{\sqrt{x}}{x^2}$$

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

$$\left(\frac{27}{64}\right)^{\frac{1}{3}} = \sqrt[3]{\frac{27}{64}} = \frac{3}{4}$$

$$\left(\frac{2}{3}\right)^{\frac{1}{2}} = \frac{\sqrt{2}}{\sqrt{3}} \left(\frac{\sqrt{3}}{\sqrt{3}} \right) = \frac{\sqrt{6}}{3}$$

$$\frac{2^{\frac{1}{2}}}{3^{\frac{1}{2}}} \left(\frac{3^{\frac{1}{2}}}{3^{\frac{1}{2}}} \right) = \frac{2^{\frac{1}{2}} \cdot 3^{\frac{1}{2}}}{3} = \frac{\sqrt{6}}{3}$$

Product Property of Radicals

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

$$\sqrt[3]{\frac{12}{4 \cdot 3}} \cdot \sqrt[3]{\frac{18}{9 \cdot 2}} =$$

$$\sqrt[3]{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot 2}$$

$$3 \cdot 2 = 6$$

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

$$\frac{\sqrt[4]{80}}{\sqrt[4]{5}} = \sqrt[4]{16} = 2$$

$$\sqrt[3]{\frac{108}{4}} =$$

$$\sqrt[3]{27} = 3$$

Simplify:

$$\sqrt[3]{64y^6} =$$

$$4y^2$$

$$(27p^3q^{12})^{\frac{1}{3}} =$$

$$\sqrt[3]{27p^3q^{12}} =$$

$$3pq^4$$

$$\sqrt[4]{\frac{m^4}{n^8}} = \frac{m}{n^2}$$

$$\frac{14xy^{\frac{1}{3}}}{2x^{\frac{3}{4}}z^{-6}}$$

$$7x^{\frac{1-3}{4}}y^{\frac{1}{3}+6} =$$

$$7x^{\frac{1}{4}}y^{\frac{19}{3}}$$

Simplify:

*Factor out 5th powers

*make denominator a perfect cube

$$\sqrt[5]{4a^8b^{14}c^5} =$$

$$ab^2c\sqrt[5]{4a^3b^4}$$

$$\sqrt[3]{\frac{x}{y^8}} = \frac{\sqrt[3]{x}}{\sqrt[3]{y^2}\sqrt[3]{y^2}\sqrt[3]{y}}$$

$$= \frac{\sqrt[3]{xy}}{y^3}$$

$$\frac{x^{\frac{1}{3}}}{y^{\frac{8}{3}}} \left(\frac{y^{\frac{1}{3}}}{y^{\frac{1}{3}}} \right) = \frac{x^{\frac{1}{3}}y^{\frac{1}{3}}}{y^3}$$

Simplify:

$$\sqrt[2]{\sqrt[3]{x}} = \sqrt[6]{x}$$

$$(x^{\frac{1}{3}})^{\frac{1}{2}} = x^{\frac{1}{6}} = \sqrt[6]{x}$$

$$\sqrt[3]{\sqrt{64}} = \sqrt[6]{64} = 2$$

$$\sqrt[3]{8} = 2$$

$$\sqrt{5} \bullet \sqrt[3]{5} =$$

$$5^{\frac{1}{2}} \bullet 5^{\frac{1}{3}} = 5^{\frac{1}{2} + \frac{1}{3}} = 5^{\frac{5}{6}}$$

$$\sqrt[3]{n} \bullet \sqrt[4]{n} =$$

$$n^{\frac{1}{3}} \bullet n^{\frac{1}{4}} = n^{\frac{4 \cdot 1}{12} + \frac{1 \cdot 3}{12}} = n^{\frac{7}{12}}$$

Simplify:

$$\frac{\sqrt{18} \bullet \sqrt{10}}{\sqrt{24}} =$$

$$\frac{\cancel{18}^3 \cdot \cancel{10}^2}{\cancel{24}^4} = \sqrt{3} \frac{\sqrt{10}}{\sqrt{4}} = \frac{\sqrt{30}}{2}$$

$$\frac{\cancel{\sqrt{6}}^2 \bullet \cancel{\sqrt{14}}^2}{\cancel{\sqrt{24}}^2} = 2$$

$$\frac{6 \cdot \cancel{14}^2}{\cancel{24}^3} = \frac{\sqrt[2]{6} \sqrt{2}}{\sqrt{3}}$$

$$= \sqrt{2} \sqrt{2} = 2$$

True or False?

$$8^{\frac{1}{2}} + 8^{\frac{1}{3}} = 8^{\frac{5}{6}}$$

$$8^{\frac{1}{2}} - 8^{\frac{1}{3}} = 8^{\frac{1}{2} + \frac{1}{3}} = 8^{\frac{5}{6}}$$

$$\sqrt{8} + \sqrt[3]{8} =$$

$$2\sqrt{2} + 2 = 2 + 2\sqrt{2}$$

False

Write each expression in radical form.

$$(4m)^{\frac{2}{3}}$$

Power
Root

$$\left(\sqrt[3]{4m}\right)^2$$

$$4\left(\sqrt[3]{m}\right)^2$$

Write each expression in exponential form.

$$\sqrt{6n}$$

$$(6n)^{\frac{1}{2}}$$

$$6\sqrt{n}$$

$$6\boxed{n}^{\frac{1}{2}}$$

$$6n^{\frac{1}{2}}$$

Assignment: Rational Exponent WS