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1.8 Rational Expressions

***For any real number b and for any positive integer n , $b^{1/n} = \sqrt[n]{b}$, except when $b < 0$ and n is even. $\sqrt{x} = x^{1/2}$ $\sqrt[4]{y} = y^{1/4}$

Ex. 1 Radical Form- Write each expression in radical form

a. $a^{1/3} = \sqrt[3]{a}$

b. $x^{5/4} = \sqrt[4]{x^5} = (\sqrt[4]{x})^5$

Ex. 2 Exponential Form- Write each expression using rational exponents.

a. $\sqrt[3]{y^2} = y^{2/3}$

b. $\sqrt[8]{c^7} = c^{7/8}$

Ex. 3 Evaluate Expressions with Rational Exponents

a. $16^{1/4} = \sqrt[4]{16}$
 $\sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2} = 2$

$16^{1/4} = (2^4)^{1/4} = 2^{4 \cdot 1/4} = 2^1 = 2$

b. $(243)^{2/3} = (\sqrt[3]{243})^2$
 $(\sqrt[3]{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3})^2 = (3^3)^2 = 27^2 = 729$

c. $16^{-1/4} = \frac{1}{16^{1/4}} = \frac{1}{2}$

****When evaluating expressions the numerator portion of the exponent tells you which power to multiply by, and the denominator tells you what root to take****

Ex. 4 Simplifying Expressions with Rational Exponents

a. $x^{\frac{1}{5}} \cdot x^{\frac{2}{3}}$

$(\frac{1}{3}) + \frac{2}{3} = \frac{3}{3} = 1$

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

$x^{\frac{3}{5}} + \frac{10}{5}$

$x^{\frac{13}{5}}$

b. $y^{\frac{2}{3}} = \frac{1}{y^{\frac{1}{3}}}$

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

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

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

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

Ex. 5 Simplify Radical Expressions

a. $\sqrt[4]{9z^2} = \sqrt[4]{3 \cdot 3 z z}$

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

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

$\sqrt{3z}$

b. $\sqrt[3]{81} = \sqrt[3]{3 \cdot 3 \cdot 3 \cdot 3}$

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

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

*****Checklist for simplifying rational exponents*****

1. It has no negative exponents
2. It has no fractional exponents in the denominator
3. It is not a complex fraction
4. The index of any remaining radical is the least number possible

