Learning Target(s): I am able to simplify expressions involving rational exponents. I am able to use the product and quotient properties of radicals. I am able to write radicals in simplest form. I am able to add and subtract like radicals and variable expressions.

Notes: 6.2 Apply Properties of Rational Exponents

$\sqrt[n]{a}$ n is index, a is radicand

simplest form of a radical – a radical with index n is in simplest form if the radicand has no perfect nth powers as factors and any denominator has been rationalized

like radicals – two radical expressions with the same index and radicand.

Properties of Radicals

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

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

$\sqrt{27} = \sqrt{9} \cdot \sqrt{3} \rightarrow 3\sqrt{3}$

$\sqrt{\frac{9}{4}} = \frac{\sqrt{9}}{\sqrt{4}} = \frac{3}{2}$

Ex 1: Use the properties of rational exponents to simplify.

a. $9^{1/2} \cdot 9^{3/4}$

$9^{1/2 + 3/4}$

$9^{2/4 + 3/4}$

$\boxed{9^{5/4}} \rightarrow (\sqrt[4]{9})^5$

b. $(7^{2/3} \cdot 5^{1/6})^3$

power to a power = multiply

$7^{2/3 \cdot 3/1} \cdot 5^{1/6 \cdot 3/1}$

$\frac{2}{3} \cdot \frac{3}{1} = \frac{6}{3} = 2$

$\frac{1}{6} \cdot \frac{3}{1} = \frac{3}{6} = \frac{1}{2}$

$7^2 \cdot 5^{1/2}$

$\boxed{49 \cdot 5^{1/2}}$

c. $\frac{3^{5/6}}{3^{1/3}}$ same base

$3^{5/6 - 1/3}$

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

$\boxed{3^{1/2}}$

d. $\left(\frac{16^{2/3}}{4^{2/3}}\right)^4$

power to a power

$\frac{2}{3} \cdot \frac{4}{1} = \frac{8}{3}$

$\frac{16^{8/3}}{4^{8/3}}$

same exponent → simplify bases

$\frac{16}{4} = \boxed{4^{8/3}}$

Ex 2: Use the properties of radicals to simplify.

a. $\sqrt[5]{27}\cdot\sqrt[5]{9}$ same exponent/root → multiply bases

$\sqrt[5]{27\cdot 9}$

$\sqrt[5]{243} \rightarrow \boxed{3}$

b. $\dfrac{\sqrt[3]{192}}{\sqrt[3]{3}}$ $\sqrt[3]{\dfrac{192}{3}}$

work $= \sqrt[3]{64} = \boxed{4}$

Ex 3: Write the expression in simplest form: $\sqrt[5]{128}$

** Use the perfect power sheet to help

$\sqrt[5]{32}\cdot\sqrt[5]{4}$

$\boxed{2\sqrt[5]{4}}$

Look for biggest perfect 5th power that goes into 128 "nicely"

Ex 4: Simplify the expression.

a. $2\left(12^{2/3}\right)+7\left(12^{2/3}\right)$ ← same base same exponent →

$\boxed{9\left(12^{2/3}\right)}$

b. $\underbrace{\sqrt[4]{48}}_{\text{simplify}}-\sqrt[4]{3}$

$\sqrt[4]{16}\cdot\sqrt[4]{3}$

$2\sqrt[4]{3}-\sqrt[4]{3}$

$\boxed{1\sqrt[4]{3}}$

c. $\sqrt[3]{\dfrac{5}{9}}$

$\dfrac{\sqrt[3]{5}}{\sqrt[3]{9}}\cdot\dfrac{\sqrt[3]{3}}{\sqrt[3]{3}} = \dfrac{\sqrt[3]{15}}{\sqrt[3]{27}} = \boxed{\dfrac{\sqrt[3]{15}}{3}}$

perfect cube that 9 goes into 27

Ex 5: Simplify. Assume all variables are positive.

a. $\sqrt[5]{32x^{15}}$ $\sqrt[5]{x^{15}}$ $x^{15/5} = x^{3}$

$\boxed{2x^{3}}$

b. $\sqrt[4]{\dfrac{a^2}{b^6}}$ $\dfrac{\sqrt[4]{a^2}}{\sqrt[4]{b^6}}\cdot\dfrac{\sqrt[4]{b^2}}{\sqrt[4]{b^2}} = \dfrac{\sqrt[4]{a^2b^2}}{\sqrt[4]{b^8}}$

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$\boxed{\dfrac{\sqrt[4]{a^2b^2}}{b^2}}$