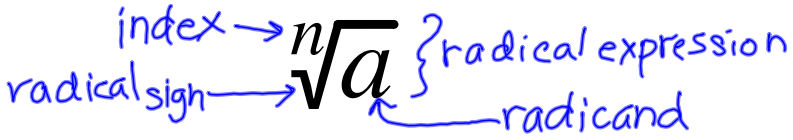
Algebra I
Lesson 7-5

Standard:

N.RN.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Learning Goal:

- I can rewrite expressions involving radicals and rational exponents.



In a radical expression, the number under the radical sign is the radicand. The number in the crook of the radical sign is the index which gives the degree of the root.

$\sqrt[2]{4} = 2$

Finding Roots

What is the simplified form of each expression?

$\sqrt[3]{125}$

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

5

$\sqrt[4]{16}$

$\sqrt[4]{16} = 16^{\frac{1}{4}}$

$= 2$

Got It?

What is the simplified form of each expression?

$\sqrt[3]{27}$ 3

$\sqrt[5]{32}$ 2

$\sqrt[3]{64}$ 4

$\sqrt[2]{36}$ 6

$\sqrt[5]{32} = 2$

$$8^{\frac{2}{3}}$$

$8^{\frac{2}{3}} = 8^{2\cdot\frac{1}{3}} = (8^2)^{\frac{1}{3}} = \sqrt[3]{8^2}$

$8^{\frac{2}{3}} = 8^{\frac{1}{3}\cdot 2} = (8^{\frac{1}{3}})^2 = (\sqrt[3]{8})^2$

So, $8^{\frac{2}{3}} = \sqrt[3]{8^2} = (\sqrt[3]{8})^2$

Equivalence of Radicals and Rational Exponents

If the nth root of a is a real number and m and n are positive integers, then

$a^{\frac{1}{n}} = \sqrt[n]{a}$

$a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

Converting to Radical Form

What is $12a^{\frac{2}{3}}$ in radical form?

$12a^{\frac{2}{3}} = 12\sqrt[3]{a^2} = 12(\sqrt[3]{a})^2$

What is $(64a)^{\frac{4}{5}}$ in radical form?

$(\sqrt[5]{64a})^4 = (\sqrt[5]{32 \cdot 2 \cdot a})^4 = (\sqrt[5]{32} \cdot \sqrt[5]{2} \cdot \sqrt[5]{a})^4$

$= (2 \cdot \sqrt[5]{2a})^4 = 16(\sqrt[5]{2a})^4 = 16\sqrt[5]{(2a)^4} = 16\sqrt[5]{16a^4}$

Got It?

What is each exponential expression in radical form?

$a^{\frac{5}{6}}$

$\sqrt[6]{a^5}$

$(64b)^{\frac{3}{4}}$

$64^{\frac{3}{4}} \cdot b^{\frac{3}{4}}$

$\sqrt[4]{64^3} \cdot \sqrt[4]{b^3}$

$(\sqrt[4]{64})^3 \cdot \sqrt[4]{b^3}$

$5x^{\frac{1}{3}}$

$5\sqrt[3]{x}$

$(\sqrt[4]{16 \cdot 4})^3 \cdot \sqrt[4]{b^3}$

$(2\sqrt[4]{4})^3 \cdot \sqrt[4]{b^3}$

$8(\sqrt[4]{4})^3 = 8\sqrt[4]{4^3} \cdot \sqrt[4]{b^3}$

$8\sqrt[4]{4b^3} = 8\sqrt[4]{64b^3}$

$(54y)^{\frac{2}{3}}$

$(\sqrt[3]{54y})^2$

$(\sqrt[3]{27 \cdot 2y})^2$

$(3\sqrt[3]{2y})^2$

$9\sqrt[3]{(2y)^2} = 9\sqrt[3]{4y^2}$

Assignment

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Converting to Exponential Form

Write each expression in exponential form. Simplify

$\sqrt[5]{b^3}$

$b^{\frac{3}{5}}$

$\sqrt[3]{27d^5} = \sqrt[3]{27 \cdot d^5}$

$27^{\frac{1}{3}} \cdot d^{\frac{5}{3}}$

$3d^{\frac{5}{3}}$

Got It?

Write each radical expression in exponential form.

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

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

$12\sqrt[3]{x^4}$

$12x^{\frac{4}{3}}$

$\sqrt{(4y)^5}$

$\sqrt{4^5 y^5}$

$(\sqrt{4})^5 \cdot \sqrt{y^5}$

$32\sqrt{y^5}$

$32y^{\frac{5}{2}}$

$\sqrt[4]{256a^8}$

$256^{\frac{1}{4}} \cdot a^{\frac{8}{4}}$

$4a^2$

Using a Radical Expression

You can estimate the metabolic rate of living organisms based on body mass using Kleiber's law. The formula $R = 73.3\sqrt[4]{M^3}$ relates metabolic rate R measured in Calories per day to body mass M measured in kilograms. What is the metabolic rate of a dog with a body mass of 18 kg?

$R = 73.3\sqrt[4]{18^3}$

$R = 73.3\sqrt[4]{5832}$

≈ 640.56

≈ 641 Calories per day

Assignment

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Lesson 7-5b

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35, 38-48 even