LESSON 5. 2b

Simplifying Expressions with Rational Exponents and Radicals

Today you will do more of yesterday:

- Use properties of rational exponents to simplify expressions with rational exponents.
- Use properties of radicals to simplify and write radical expressions in simplest form.
- Practice using English to describe math processes and equations

Previous required knowledge:

- When we decide (and why) to use $\pm$ in our answer
- Properties of exponents/radicals
- Powers of 2, 3, 4, 5, 6…

BIG IDEA OF THE DAY!

- Sometimes we need to use absolute value in our answer.

Why?

- Because $\sqrt{}$ (and even roots) are defined to give the ***principle root*** only as the answer!

What is the trick? How do we know when to use absolute value? When:

1. You are starting with an even root
2. and end with an odd exponent

Example:

$$\sqrt{x^3} = \sqrt[2]{x^3}$$ Starting with an even root (2)…

$$= \sqrt{x^2 \cdot x}$$ Split up inside

$$= \sqrt{x^2} \cdot \sqrt{x}$$ Break into pieces

$$= x \cdot \sqrt{x}$$ Simplify each piece

$$= x^1 \cdot \sqrt{x}$$ We ended up with an odd power and…

$$= |x| \cdot \sqrt{x}$$ …because we started with an even root need to ensure answer only has the principle root

***** START WITH AN EVEN ROOT, END WITH AN ODD POWER … MUST USE ABSOLUTE VALUE *****

Simplify each expression.

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

b. $\sqrt[4]{\frac{x^4}{y^8}}$

SOLUTION

Because a variable can be positive, negative, or zero, sometimes absolute value is needed when simplifying a variable expression.

	Rule
When *n* is odd	$\sqrt[n]{x^n} = x$
When *n* is even	$\sqrt[n]{x^n} = \lvert x \rvert$

STUDY TIP

You do not need to take the absolute value of *y* because *y* is being squared.

a. $\sqrt[3]{64y^6} = \sqrt[3]{4^3(y^2)^3} = \sqrt[3]{4^3} \cdot \sqrt[3]{(y^2)^3} = 4y^2$

b. $\sqrt[4]{\frac{x^4}{y^8}} = \frac{\sqrt[4]{x^4}}{\sqrt[4]{y^8}} = \frac{\sqrt[4]{x^4}}{\sqrt[4]{(y^2)^4}} = \frac{\lvert x \rvert}{y^2}$

BIG IDEA OF THE DAY!

- Sometimes we need to use absolute value in our answer.

***** START WITH AN EVEN ROOT, END WITH AN ODD POWER … MUST USE ABSOLUTE VALUE *****

Only time we don't do this is … if we are told "***assume all variable are positive***."

Write each expression in simplest form. Assume all variables are positive.

a. $\sqrt[5]{4a^8b^{14}c^5}$ **b.** $\dfrac{x}{\sqrt[3]{y^8}}$ **c.** $\dfrac{14xy^{1/3}}{2x^{3/4}z^{-6}}$

SOLUTION

COMMON ERROR

You must multiply both the numerator *and* denominator of the fraction by $\sqrt[3]{y}$ so that the value of the fraction does not change.

a. $\sqrt[5]{4a^8b^{14}c^5} = \sqrt[5]{4a^5a^3b^{10}b^4c^5}$ Factor out perfect fifth powers.

$= \sqrt[5]{a^5b^{10}c^5} \bullet \sqrt[5]{4a^3b^4}$ Product Property of Radicals

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

b. $\dfrac{x}{\sqrt[3]{y^8}} = \dfrac{x}{\sqrt[3]{y^8}} \bullet \dfrac{\sqrt[3]{y}}{\sqrt[3]{y}}$ Make denominator a perfect cube.

$= \dfrac{x\sqrt[3]{y}}{\sqrt[3]{y^9}}$ Product Property of Radicals

$= \dfrac{x\sqrt[3]{y}}{y^3}$ Simplify.

c. $\dfrac{14xy^{1/3}}{2x^{3/4}z^{-6}} = 7x^{(1-3/4)}y^{1/3}z^{-(-6)} = 7x^{1/4}y^{1/3}z^6$

Perform each indicated operation. Assume all variables are positive.

a. $5\sqrt{y} + 6\sqrt{y}$

b. $12\sqrt[3]{2z^5} - z\sqrt[3]{54z^2}$

SOLUTION

a. $5\sqrt{y} + 6\sqrt{y} = (5 + 6)\sqrt{y} = 11\sqrt{y}$

b. $12\sqrt[3]{2z^5} - z\sqrt[3]{54z^2} = 12z\sqrt[3]{2z^2} - 3z\sqrt[3]{2z^2} = (12z - 3z)\sqrt[3]{2z^2} = 9z\sqrt[3]{2z^2}$

Homework

Pg 249, #48-81