Objective: Simplify Radical Expressions with variable radicands

Concept

Properties of nth Roots		
For $a > 0$ and $b > 0$		
Words	**Numbers**	**Algebra**
Product Property of Roots: The nth root of a product is equal to the product of the nth roots.	$\sqrt[3]{16} = \sqrt[3]{8} \cdot \sqrt[3]{2} = 2\sqrt[3]{2}$	$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$
Quotient Property of Roots: The nth root of a quotient is equal to the quotient of the nth roots.	$\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$	$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$
Inverse Property of Powers of Roots	$\sqrt[3]{(2)^3} = 2$ and $\sqrt{(6)^2} = 6$	$\sqrt[n]{(b)^n} = b$

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Ex) Simplify the expression. Assume all variables are positive. Simplify numerical values as much as possible.

$\sqrt[4]{6^5}$

$= \sqrt[4]{6^4} \cdot \sqrt[4]{6}$

$= \boxed{6\sqrt[4]{6}}$

simplified

$\sqrt[8]{x^{11}}$

$= \sqrt[8]{x^8} \cdot \sqrt[8]{x^3}$

$= \boxed{x\sqrt[8]{x^3}}$

simplified

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Ex) Simplify the expression. Assume all variables are positive. Simplify numerical values as much as possible.

$$\sqrt{27x^5y^3z^6}$$

$\sqrt{27} \cdot \sqrt{x^5} \cdot \sqrt{y^3} \cdot \sqrt{z^6}$

$\sqrt{9} \cdot \sqrt{3}$ $\sqrt{x^4} \cdot \sqrt{x^1}$ $\sqrt{y^2} \sqrt{y^1}$ $\sqrt{(z^3)^2}$

$\sqrt{(x^2)^2} \cdot \sqrt{x}$

$3x^2yz^3\sqrt{3xy}$ simplified

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Ex) Simplify the expression. Assume all variables are positive. Simplify numerical values as much as possible.

$$\sqrt{50x^8y^7z^9}$$

$\sqrt{50} \cdot \sqrt{x^8} \cdot \sqrt{y^7} \cdot \sqrt{z^9}$

$\sqrt{25} \cdot \sqrt{2} \quad \sqrt{(x^4)^2} \quad \sqrt{y^6} \cdot \sqrt{y^1} \quad \sqrt{z^8} \cdot \sqrt{z^1}$

$\sqrt{(y^3)^2} \qquad \sqrt{(z^4)^2}$

$5x^4y^3z^4\sqrt{2yz}$

simplified

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Ex) Simplify the expression. Assume all variables are positive. Simplify numerical values as much as possible.

$$\sqrt[3]{16x^6y^8z^4}$$

$\sqrt[3]{16} \cdot \sqrt[3]{x^6} \cdot \sqrt[3]{y^8} \cdot \sqrt[3]{z^4}$

$\sqrt[3]{8} \cdot \sqrt[3]{2} \quad \sqrt[3]{(x^2)^3} \quad \sqrt[3]{y^6} \cdot \sqrt[3]{y^2} \quad \sqrt[3]{z^3} \cdot \sqrt[3]{z^1}$

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

$2x^2y^2z\sqrt[3]{2y^2z}$

simplified

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Ex) Simplify the expression. Assume all variables are positive. Simplify numerical values as much as possible.

$$\sqrt[3]{250x^7y^{12}z^5}$$

$\sqrt[3]{250} \cdot \sqrt[3]{x^7} \cdot \sqrt[3]{y^{12}} \cdot \sqrt[3]{z^5}$

$\sqrt[3]{125} \cdot \sqrt[3]{2} \quad \sqrt[3]{x^6} \cdot \sqrt[3]{x^1} \quad \sqrt[3]{(y^4)^3} \quad \sqrt[3]{z^3} \cdot \sqrt[3]{z^2}$

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

$5x^2y^4z\sqrt[3]{2xz^2}$ simplified

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Closure

How is simplifying $\sqrt{24}$ different from simplifying $\sqrt[3]{24}$?

To simplify $\sqrt{24}$ you would use the factors of $\sqrt{4} \cdot \sqrt{6}$ because 4 is a perfect square.

To simplify $\sqrt[3]{24}$ you would use the factors of $\sqrt[3]{8} \cdot \sqrt[3]{3}$ because 8 is a perfect cube.