Name: _____ Date: _____

Learning Goal 5.1	Express an entire radical as a simplified mixed radical and vice versa. Identify and order irrational numbers.

Multiple Strategies exist for evaluating radicals.

8 → 4, 2 → 2, 2

$\sqrt[3]{8 \cdot 27} =$	
Direct (with a calculator)	Indirect (without a calculator)
6	$\sqrt[3]{2^3 \times 3^3}$ $= 2\sqrt[3]{3^3}$ $= 2 \times 3 = 6$ 27 → 9, 3 → 3, 3

$\sqrt{0.0169} =$	
Direct (with a calculator)	Indirect (without a calculator)
0.13	$\sqrt{\frac{169}{10000}} = \frac{\sqrt{169}}{\sqrt{10000}} = \frac{\sqrt{13^2}}{\sqrt{100^2}} = \frac{13}{100}$

Guess which one we're more interested in … indirect !!!

Consider

$\sqrt{24x^5} =$	
Direct (with a calculator)	Indirect (without a calculator)
X	$\sqrt{24x^5} = \sqrt[2]{2^3 \times 3 \times x^5}$ $= \sqrt{2^2 \times 2 \times 3 \times x^2 \times x^2 \times x}$ $= 2\sqrt{2 \times 3 \times x^2 \times x^2 \times x}$ $= 2 \times x\sqrt{2 \times 3 \times x^2 \times x}$ $= 2 \times x \times x\sqrt{2 \times 3 \times x} = 2x^2\sqrt{6x}$ 24 → 6, 4 → 3, 2, 2, 2

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everything under the radical IS simplified

This process is going from an entire radical to a mixed radical.

Again! Write the radical in simplest form. What are the restrictions on the variables, if any?

1. $\sqrt{63}$ $= \sqrt{3^2 \times 7}$ $= 3\sqrt{7}$ (9 7; 3 3)

2. $\sqrt[3]{108}$ $= \sqrt[3]{2^2 \times 3^3}$ $= 3\sqrt[3]{2^2}$ $(= 3\sqrt[3]{4})$ (2 54; 27 2; 9 3; 3 3)

3. $\sqrt[4]{128}$ $= \sqrt[4]{2^7}$ $= \sqrt[4]{2^4 \times 2^3}$ $= 2\sqrt[4]{2^3}$ $= 2\sqrt[4]{8}$ (2 64; 8 8; 2 4 4 2; 2 2 2 2)

4. $\sqrt{30x^4}$ $= \sqrt{2 \times 3 \times 5 \times x^4}$ $= x^2\sqrt{2 \times 3 \times 5}$ $= x^2\sqrt{30}$ (5 6; 3 2)

5. $\sqrt[3]{32y^5}$ $= \sqrt[3]{2^5 y^5}$ $5 - 3 = 2$ $= 2y\sqrt[3]{2^2 y^2}$ (16 2; 4 4; 2 2 2 2)

6. $\sqrt[4]{48a^2b^7}$ $= \sqrt[4]{2^4 \times 3 \times a^2 \times b^7}$ $7 - 4$ $= 2b\sqrt[4]{3a^2b^3}$ (12 4; 4 3 2 2; 2 2)

Backwards! Write each mixed radical as an entire radical. What are the restrictions on the variables, if any?

1. $7\sqrt{3}$ $= \sqrt{3 \times 7^2}$ $= \sqrt{147}$

2. $2\sqrt[3]{4}$ $= \sqrt[3]{2^3 \times 4}$ $(= \sqrt[3]{2^5})$ $(= \sqrt[3]{32})$

3. $2\sqrt[5]{3}$ $= \sqrt[5]{2^5 \times 3}$ $(= \sqrt[5]{96})$

4. $3x\sqrt[3]{5x}$ $= \sqrt[3]{(3x)^3 \times 5x}$ $= \sqrt[3]{3^3 \times x^3 \times 5 \times x}$ $= \sqrt[3]{3^3 \times 5 \times x^4}$

5. $8p\sqrt{2q}$ $= \sqrt{(8p)^2 \times 2q}$ $= \sqrt{8^2 p^2 \times 2q}$ $= \sqrt{2 \times 8^2 \times p^2 \times q}$ $(= \sqrt{128p^2q})$

6. $3m^3\sqrt[3]{4m^3}$ $3m^3 \times \sqrt[3]{4m^3}$ $= \sqrt[3]{(3m^3)^3 \times 4m^3}$ $= \sqrt[3]{3^3 m^9 \times 4m^3}$ $= \sqrt[3]{3^3 \times 4 \times m^{12}}$ $(= \sqrt[3]{108m^{12}})$

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