

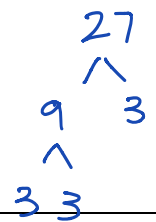
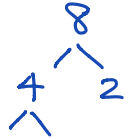
Name: \_\_\_\_\_

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.

$\sqrt[3]{8 \cdot 27} =$	
Direct (with a calculator)	Indirect (without a calculator)
6	$\begin{aligned} & \sqrt[3]{2^3 \times 3^3} \\ &= 2^1 \times 3^1 \\ &= 2 \times 3 = 6 \end{aligned}$

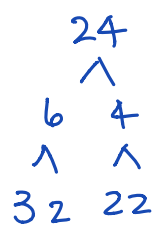


$\sqrt{0.0169} =$	
Direct (with a calculator)	Indirect (without a calculator)
0.13	$\sqrt{\frac{169}{10000}} = \frac{\sqrt{169}}{\sqrt{10000}} = \frac{\sqrt{13^2}}{\sqrt{100^2}} = \frac{13}{100}$

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

Consider

$\sqrt{24x^5} =$	
Direct (with a calculator)	Indirect (without a calculator)
X	$\begin{aligned} \sqrt{24x^5} &= \sqrt{2^3 \times 3 \times x^5} \\ &= \sqrt{2^2 \times 2 \times 3 \times x^2 \times x^2 \times x} \\ &= 2 \sqrt{2 \times 3 \times x^2 \times x^2 \times x} \\ &= 2x \sqrt{2 \times 3 \times x^2 \times x} \\ &= 2x \times x \sqrt{2 \times 3 \times x} = 2x^2 \sqrt{6x} \end{aligned}$



everything is under the radical

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?

$$1. \sqrt{63} = \sqrt{3^2 \times 7}$$

$$\begin{matrix} \wedge \\ 9 & 7 \\ \wedge \\ 3 & 3 \end{matrix} = 3\sqrt{7}$$

$$2. \sqrt[3]{108} = \sqrt[3]{2^2 \times 3^3}$$

$$\begin{matrix} \wedge \\ 2 & 54 \\ \wedge \\ 27 & 2 \\ \wedge \\ 9 & 3 \\ \wedge \\ 3 & 3 \end{matrix} = 3\sqrt[3]{2^2}$$

$$= 3\sqrt[3]{4}$$

$$3. \sqrt[4]{128} = \sqrt[4]{2^7}$$

$$\begin{matrix} \wedge \\ 2 & 64 \\ \wedge \\ 8 & 8 \\ \wedge \\ 2 & 4 & 2 \\ \wedge \\ 2 & 2 & 2 & 2 \end{matrix} = \sqrt[4]{2^4 \times 2^3}$$

$$= 2\sqrt[4]{2^3}$$

$$= 2\sqrt[4]{8}$$

$$4. \sqrt{30x^4} = \sqrt{2 \times 3 \times 5 \times x^4}$$

$$\begin{matrix} \wedge \\ 5 & 6 \\ \wedge \\ 3 & 2 \end{matrix} = x^2 \sqrt{2 \times 3 \times 5}$$

$$= x^2 \sqrt{30}$$

$$5. \sqrt[3]{32y^5} = \sqrt[3]{2^5 y^5}$$

$$\begin{matrix} \wedge \\ 16 & 2 \\ \wedge \\ 4 & 4 \\ \wedge \\ 2 & 2 & 2 & 2 \end{matrix} = 2y \sqrt[3]{2^2 y^2}$$

$$5 - 3 = 2$$

$$6. \sqrt[4]{48a^2b^7} = \sqrt[4]{2^4 \times 3 \times a^2 \times b^7}$$

$$\begin{matrix} \wedge \\ 12 & 4 \\ \wedge \\ 4 & 3 & 2 & 2 \\ \wedge \\ 2 & 2 \end{matrix} = 2b \sqrt[4]{3a^2b^3}$$

$$7 - 4 = 3$$

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

$$1. 7\sqrt{3}$$

$$= \sqrt{3 \times 7^2}$$

$$= \sqrt{147}$$

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

$$= \sqrt[3]{2^3 \times 4}$$

$$= \sqrt[3]{2^5}$$

$$= \sqrt[3]{32}$$

$$3. 2\sqrt[5]{3}$$

$$= \sqrt[5]{2^5 \times 3}$$

$$= \sqrt[5]{96}$$

$$4. 3x\sqrt[3]{5x}$$

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

$$= \sqrt[3]{3^3 \times x^3 \times 5 \times x}$$

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

$$5. 8p\sqrt{2q}$$

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

$$= \sqrt{8^2 p^2 \times 2q}$$

$$= \sqrt{2 \times 8^2 \times p^2 \times q}$$

$$= \sqrt{128p^2q}$$

$$6. 3m^3\sqrt[3]{4m^3}$$

$$= \sqrt[3]{(3m^3)^3 \times 4m^3}$$

$$= \sqrt[3]{3^3 m^9 \times 4m^3}$$

$$= \sqrt[3]{3^3 \times 4 \times m^{12}}$$

$$= \sqrt[3]{108m^{12}}$$