

Sec. 10.2 Simplifying Radicals

$$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

Simplify:

a. $\sqrt{125} = \sqrt{5 \cdot 5 \cdot 5} = 5\sqrt{5}$

Handwritten work for 125: 125 is broken down into 5, 25, and 5. The 25 is further broken down into 5 and 5. The final result is $5\sqrt{5}$.

Handwritten work for 125 (green): $\sqrt{25 \cdot 5} = \sqrt{25} \cdot \sqrt{5} = 5\sqrt{5}$

b. $\sqrt{72} = \sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3} = 2 \cdot 3\sqrt{2} = 6\sqrt{2}$

Handwritten work for 72: 72 is broken down into 9 and 8. 9 is broken down into 3 and 3. 8 is broken down into 2 and 4. 4 is broken down into 2 and 2. The final result is $2 \cdot 3\sqrt{2} = 6\sqrt{2}$.

Handwritten work for 72 (green): $\sqrt{36} \sqrt{2} = 6\sqrt{2}$

$$c. \sqrt{243x^5} = \sqrt{\boxed{3 \cdot 3} \boxed{3 \cdot 3} \boxed{3} \boxed{x \cdot x} \boxed{x \cdot x} \boxed{x}}$$

$$\begin{array}{c} \textcircled{3} \text{ } 81 \\ \text{ } \wedge \text{ } \wedge \\ \text{ } 9 \text{ } 9 \\ \textcircled{3} \textcircled{3} \textcircled{3} \textcircled{3} \end{array}$$

$$3 \cdot 3 \cdot x \cdot x \sqrt{3x}$$

$$9x^2 \sqrt{3x}$$

$$d. \sqrt[2]{12x^2} \cdot \sqrt[2]{4x}$$

$$3 \cdot 5 \sqrt{12x^2 \cdot 4x}$$

$$\begin{array}{c} \textcircled{3} \text{ } 4 \quad \textcircled{2} \textcircled{2} \\ \text{ } \wedge \quad \wedge \\ \text{ } 2 \text{ } 2 \end{array}$$

$$15 \sqrt{\boxed{2 \cdot 2} \cdot \boxed{2 \cdot 2} \cdot \boxed{3} \cdot \boxed{x \cdot x} \cdot \boxed{x}}$$

$$15 \cdot 2 \cdot 2 \cdot x \sqrt{3x}$$

$$60x \sqrt{3x}$$

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$$

$$e. \sqrt[3]{5x} \cdot \sqrt[3]{20x^5} = 21 \sqrt[3]{100x^6}$$

$$7 \cdot 3 \sqrt[3]{\textcircled{5}x \cdot \textcircled{4} \textcircled{5}x^5}$$

$$\begin{array}{c} \text{ } \wedge \text{ } \wedge \\ \text{ } 2 \text{ } 2 \end{array}$$

$$21 \sqrt[3]{\boxed{2 \cdot 2} \cdot \boxed{5 \cdot 5} \cdot \boxed{x \cdot x} \cdot \boxed{x \cdot x} \cdot \boxed{x}}$$

$$21 \cdot 2 \cdot 5 \cdot x \cdot x \cdot x$$

$$210x^3$$

$$21 \cdot 10x^3$$

$$210x^3$$

Simplify

$$a. \sqrt{\frac{121}{81}} = \frac{\sqrt{121}}{\sqrt{81}} = \frac{11}{9}$$

$$b. \sqrt{\frac{27x^5}{48x}} = \sqrt{\frac{\cancel{3} \cdot 9 \cancel{x} \cdot \boxed{xx} \cdot \boxed{xx}}{\cancel{3} \cdot 16 \cancel{x}}} = \frac{3}{4}x^2$$

Simplify

$$c. \sqrt{\frac{36a}{4a^3}} = \sqrt{\frac{9}{a^2}} = \frac{3}{a}$$

$$\frac{\sqrt{36}}{\sqrt{4}} = \frac{6}{2a} \sqrt{\frac{a}{\cancel{a} \cdot \cancel{a} \cdot a}} = \frac{3}{a}$$

Rationalizing the denominator

$$a. \frac{\sqrt{2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{2 \cdot 3}}{\sqrt{\boxed{3 \cdot 3}}} = \frac{\sqrt{6}}{3}$$

$$b. \sqrt{\frac{7s}{5} \cdot \frac{5}{5}} = \sqrt{\frac{5 \cdot 7 \cdot s}{\boxed{5 \cdot 5}}} = \frac{\sqrt{35s}}{5}$$