

LESSON #2 SIMPLIFYING RADICALS

The simplest form of a radical expression is an expression that has:

- no perfect square factors other than 1 in the radicand
- no fractions in the radicand
- no radicals in the denominator of a fraction

Product Property of Radicals

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

EXAMPLES: Simplify the expression.

$$1. \sqrt{50}$$

$$\sqrt{2 \cdot 5 \cdot 5}$$

$$5\sqrt{2}$$

$$\begin{array}{r} 2 \overline{)50} \\ 5 \overline{)25} \\ \hline 5 \end{array}$$

$$2. \sqrt{6} \cdot \sqrt{10}$$

$$\sqrt{6 \cdot 10}$$

$$\sqrt{60}$$

$$\sqrt{2 \cdot 2 \cdot 5 \cdot 3}$$

$$2\sqrt{15}$$

$$\begin{array}{r} 2 \overline{)60} \\ 2 \overline{)30} \\ 5 \overline{)15} \\ \hline 3 \end{array}$$

You try a few!

$$\begin{array}{r} 2 \overline{)90} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ 5 \end{array}$$

$$3. \sqrt{12}$$

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

$$2\sqrt{3}$$

$$4. \sqrt{15} \cdot \sqrt{6}$$

$$\sqrt{90} \text{ or } \sqrt{5 \cdot 3 \cdot 3 \cdot 2}$$

$$3\sqrt{10}$$

$$\begin{array}{r} 2 \overline{)180} \\ 2 \overline{)90} \\ 3 \overline{)45} \\ 3 \overline{)15} \\ 5 \end{array}$$

$$5. \sqrt{135}$$

$$\sqrt{3 \cdot 3 \cdot 3 \cdot 5}$$

$$3\sqrt{15}$$

$$6. \sqrt{10} \cdot \sqrt{18}$$

$$\sqrt{180} \text{ or } \sqrt{5 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$$

$$6\sqrt{5}$$

$$7. \sqrt{8a^2b^3}$$

$$\sqrt{2 \cdot 2 \cdot 2 \cdot a \cdot a \cdot b \cdot b \cdot b}$$

$$2ab\sqrt{2b}$$

$$8. \sqrt{72cd^4}$$

$$\sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot c \cdot d \cdot d \cdot d \cdot d}$$

$$6d^2\sqrt{2c}$$

$$\begin{array}{r} 2 \overline{)72} \\ 2 \overline{)36} \\ 2 \overline{)18} \\ 3 \overline{)9} \\ 3 \end{array}$$

$$9. -2\sqrt{18x^5}$$

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

$$-2 \cdot 3x^2\sqrt{2x}$$

$$-6x^2\sqrt{2x}$$

$$\begin{array}{r} 2 \overline{)18} \\ 3 \overline{)9} \\ 3 \end{array}$$

$$10. 3\sqrt{2y} \cdot 5\sqrt{6y^3}$$

$$15\sqrt{12y^4}$$

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

$$15 \cdot 2y^2\sqrt{3}$$

$$30y^2\sqrt{3}$$

$$\begin{array}{r} 2 \overline{)12} \\ 2 \overline{)6} \\ 3 \end{array}$$

Quotient Property of Radicals

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

If you can reduce, do it first!

EXAMPLES: Simplify the expression.

11. $\sqrt{\frac{32 \div 2}{50 \div 2}}$

$$\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \boxed{\frac{4}{5}}$$

12. $\frac{\sqrt{11}}{\sqrt{81}} = \boxed{\frac{\sqrt{11}}{9}}$

You try a few!

13. $\sqrt{\frac{4}{9}} = \frac{\sqrt{4}}{\sqrt{9}} = \boxed{\frac{2}{3}}$

14. $\frac{\sqrt{7}}{\sqrt{16}} = \boxed{\frac{\sqrt{7}}{4}}$

15. $\frac{\sqrt{18 \div 2}}{\sqrt{32 \div 2}}$

$$\frac{\sqrt{9}}{\sqrt{16}} = \boxed{\frac{3}{4}}$$

16. $\sqrt{\frac{2}{25}} = \frac{\sqrt{2}}{\sqrt{25}} = \boxed{\frac{\sqrt{2}}{5}}$

Rationalizing the Denominator

$$17. \frac{\sqrt{1}}{\sqrt{18}} = \frac{1}{\sqrt{2 \cdot 3 \cdot 3}}$$

$$\frac{1 \cdot \sqrt{2}}{3\sqrt{2 \cdot 2}} = \frac{\sqrt{2}}{6}$$

$$18. \sqrt{\frac{2}{3}} = \frac{\sqrt{2} \cdot \sqrt{3}}{\sqrt{3 \cdot 3}} = \frac{\sqrt{6}}{3}$$

Rationalizing the Denominator

$$\begin{array}{r} 3 \overline{)12} \\ 2 \overline{)4} \\ 2 \end{array}$$

$$19. \sqrt{\frac{27 \div 3}{15 \div 3}} = \frac{\sqrt{9}}{\sqrt{5}}$$

$$\downarrow$$

$$\frac{3 \cdot \sqrt{5}}{\sqrt{5} \cdot \sqrt{5}}$$

$$\downarrow$$

$$\frac{3\sqrt{5}}{5}$$

$$20. \frac{4\sqrt{5}}{\sqrt{12}} = \frac{4\sqrt{5} \cdot \sqrt{3}}{\sqrt{3 \cdot 2 \cdot 2} \cdot \sqrt{3}}$$

$$\frac{4\sqrt{15}}{6}$$

You try a few!

21. $\sqrt{\frac{1}{5}} = \frac{\sqrt{1}}{\sqrt{5}}$

$$\frac{1 \cdot \sqrt{5}}{\sqrt{5 \cdot 5}} = \frac{\sqrt{5}}{5}$$

22. $\frac{2\sqrt{7}}{\sqrt{72}} = \frac{2\sqrt{7}}{\sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$$\frac{\cancel{2}\sqrt{14}}{\cancel{2} \cdot 2 \cdot 3}$$

$$\frac{\sqrt{14}}{6}$$

$$\begin{array}{r} 2 \overline{) 72} \\ \underline{36} \\ 36 \\ \underline{36} \\ 0 \end{array}$$

You try a few!

23. $\frac{\sqrt{28} \div 4}{\sqrt{20} \div 4}$

$$\frac{\sqrt{7}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$$

$$\frac{\sqrt{35}}{5}$$

24. $\frac{3\sqrt{6}}{\sqrt{36}} = \frac{3\sqrt{6}}{6 \div 3}$

$$\frac{1\sqrt{6}}{2}$$