

Simplifying Radicals

simplifying a radical means to find another expression with the same value

You need to remember:

Perfect Squares
4 = 2 x 2
9 = 3 x 3
16 = 4 x 4
25 = 5 x 5
36 = 6 x 6
49 = 7 x 7
64 = 8 x 8
81 = 9 x 9
100 = 10 x 10

Radicals (square roots)
$\sqrt{4} = 2$
$\sqrt{9} = 3$
$\sqrt{16} = 4$
$\sqrt{25} = 5$
$\sqrt{36} = 6$
$\sqrt{49} = 7$
$\sqrt{64} = 8$
$\sqrt{81} = 9$
$\sqrt{100} = 10$

Steps:

1. Find the largest perfect square which will divide evenly into the number under your radical sign. This means that when you divide, you get no remainders, no decimals, no fractions.
2. If the number under your radical cannot be divided evenly by any perfect square then your radical is already in its simplest form.

#4 Simplify

$$\begin{aligned} & \sqrt{40} \\ & \sqrt{4 \cdot 10} = \sqrt{4} \cdot \sqrt{10} \\ & = 2 \cdot \sqrt{10} \\ & = \boxed{2\sqrt{10}} \end{aligned}$$

#5

$$\begin{aligned} & \text{Simplify } \sqrt{125} \\ & \sqrt{25 \cdot 5} = \sqrt{25} \cdot \sqrt{5} \\ & \quad \downarrow \\ & = 5 \cdot \sqrt{5} \\ & = \boxed{5\sqrt{5}} \end{aligned}$$

#12

$$\begin{aligned} & \text{Simplify } \sqrt{200} \\ & \sqrt{100 \cdot 2} \\ & \sqrt{100} \cdot \sqrt{2} \\ & = \boxed{10\sqrt{2}} \end{aligned}$$

#15

Simplify $\sqrt{124}$

$$\frac{124}{2} = 62$$

$$\frac{62}{2} = 31$$

$$2 \cdot 62 = 124$$

$$2 \cdot 2 \cdot 31 = 124$$

$$4 \cdot 31$$

$$\sqrt{4 \cdot 31}$$

$$\sqrt{4} \cdot \sqrt{31}$$

$$2\sqrt{31}$$

#20

Simplify $\sqrt{180}$

$$\sqrt{4 \cdot 45}$$

$$\sqrt{4} \sqrt{45}$$

$$2 \sqrt{9 \cdot 5}$$

$$2 \cdot \sqrt{9} \cdot \sqrt{5}$$

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

$$6\sqrt{5}$$

$$\sqrt{9 \cdot 20}$$

$$\sqrt{9} \cdot \sqrt{20}$$

$$3 \cdot \sqrt{20}$$

$$3 \cdot \sqrt{4 \cdot 5}$$

$$3 \cdot \sqrt{4} \cdot \sqrt{5}$$

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

$$6\sqrt{5}$$

#39

Simplify $\sqrt{9x^2}$

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

$$3 \cdot x$$

$$= 3x$$

#41

Simplify $-\sqrt{28x^4}$ $\sqrt{7}$

$$-\sqrt{28} \cdot \sqrt{x^4}$$

$$-\sqrt{4 \cdot 7} \cdot \sqrt{x^2 \cdot x^2}$$

$$-\sqrt{4} \cdot \sqrt{7} \cdot \sqrt{x^2} \cdot \sqrt{x^2}$$

$$-2 \cdot \sqrt{7} \cdot x \cdot x$$

$$-2 \cdot x^2 \cdot \sqrt{7}$$

$$-2x^2\sqrt{7}$$

#44

Simplify $-\sqrt{45x^2y^9}$