Lesson 3 Mixed and Entire Radicals

Radicals can be written in different forms in order to simplify complex radicals.

$\sqrt{25 \cdot 4}$ is equivalent to $\sqrt{25} \cdot \sqrt{4}$ because:

$\sqrt{100}$ $5 \cdot 2$

10 10

Similarly, $\sqrt[3]{8 \cdot 27}$ is equivalent to $\sqrt[3]{8} \cdot \sqrt[3]{27}$ because:

$\sqrt[3]{216}$ $2 \cdot 3$

6 6

Multiplication Property of Radicals:

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$,

Where n is a natural number, and a and b are real numbers

Steps to Simplifying Radicals

Example 1 change to a mixed radical

Simplify $\sqrt{18}$ ← entire radical

$2^2 = 4$
$3^2 = 9$
$4^2 = 16$

1. Find the ***largest*** perfect square that will divide evenly into the number under your radical sign.

   9

2. Write the number under the radical as a product of the perfect square and its corresponding number.

   $\sqrt{9 \cdot 2}$

3. Separate each number with its own radical sign.

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

   square root

4. Simplify.

   $3\sqrt{2}$ ← mixed radical

Note:

- If you cannot find a perfect square that divides evenly then it is already in simplest form. (simple radical)
- If you do not choose the ***largest*** perfect square, you will need to repeat the process.

72 has 9 and 36 as perfect square factor. we choose 36

$\sqrt{72}$
$\sqrt{36 \cdot 2}$
$\sqrt{36} \cdot \sqrt{2}$
$6\sqrt{2}$

$\sqrt{72}$
$\sqrt{9}\ \sqrt{8}$
$3\sqrt{8}$ ← has a perfect square factor of 4
repeat
$3\sqrt{4 \cdot 2}$
$3\sqrt{4}\sqrt{2}$
$3(2)\sqrt{2}$
$6\sqrt{2}$

Example 2: Writing Radicals in Simplest Form

Simplify each radical.

$2^2 = 4$
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
$6^2 = 36$

a) $\sqrt{63}$

$\sqrt{9 \cdot 7}$
$\sqrt{9} \cdot \sqrt{7}$
$3\sqrt{7}$

b) $\sqrt{75}$

$\sqrt{25 \cdot 3}$
$\sqrt{25} \cdot \sqrt{3}$
$5\sqrt{3}$

c) $\sqrt[3]{108}$ ← entire

$\sqrt[3]{27 \cdot 4}$
$\sqrt[3]{27} \cdot \sqrt[3]{4}$
$3\sqrt[3]{4}$ ← mixed

d) $\sqrt[3]{56}$

$\sqrt[3]{8 \cdot 7}$
$2\sqrt[3]{7}$

$2^3 = 8$
$3^3 = 27$
$4^3 = 64$

Example 3 - Writing Mixed Radicals as Entire Radicals

Write each mixed radical as an entire radical.

a) $7\sqrt{3}$ ← mixed

$\sqrt{7^2} \cdot \sqrt{3}$
$\sqrt{49} \cdot \sqrt{3}$
$\sqrt{147}$

b) $2\sqrt[3]{4}$

$\sqrt[3]{2^3}\ \sqrt[3]{4}$
$\sqrt[3]{8}\ \sqrt[3]{4}$
$\sqrt[3]{32}$

c) $2\sqrt{7}$

$\sqrt{2^2}\ \sqrt{7}$
$\sqrt{4}\ \sqrt{7}$
$\sqrt{28}$