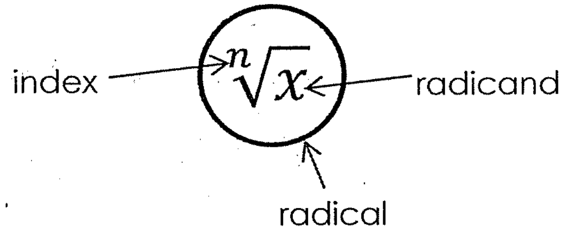
KEY

Pre-Calculus 11
Lesson 5.1 ~ Working With Radicals



A **mixed radical** is made up of a coefficient and a radical (for example: $4\sqrt{2}$).
An **entire radical** does not have a coefficient in front of the radical (for example: $\sqrt[3]{17}$).

Multiplication Property of Radicals

$\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ For example: $\sqrt{70} = \sqrt{7} \cdot \sqrt{10}$

Simplifying Radicals (entire radical → mixed radical)

Method 1 (prime factorization)

$$\sqrt{80} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$$
$$= \sqrt{2 \cdot 2} \cdot \sqrt{2 \cdot 2} \cdot \sqrt{5}$$
$$= 2 \cdot 2 \cdot \sqrt{5}$$
$$= 4\sqrt{5}$$

Method 2 (perfect squares)

$$\sqrt{80} = \sqrt{16 \cdot 5}$$
$$= \sqrt{16} \cdot \sqrt{5}$$
$$= 4\sqrt{5}$$

Example #1: Simplify each radical.

a) $\sqrt{52} = \sqrt{2 \cdot 2 \cdot 13}$

$= \boxed{2\sqrt{13}}$

or $= \sqrt{4 \cdot 13}$

$= 2\sqrt{13}$

b) $\sqrt[4]{m^7} = \sqrt[4]{m^4 \cdot m^3}$

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

c) $\sqrt{63n^7p^4}$

$= \sqrt{9 \cdot 7 \cdot n^2 \cdot n^2 \cdot n^2 \cdot n \cdot p^2 \cdot p^2}$

$= 3 \cdot n \cdot n \cdot n \cdot p \cdot p\sqrt{7n}$

$= \boxed{3n^3p^2\sqrt{7n}}$

Rewriting Radicals (mixed radical → entire radical)

$$7\sqrt{3} = \sqrt{7 \cdot 7 \cdot 3}$$
$$= \sqrt{147}$$

Example#2: Rewrite each mixed radical as an entire radical.

a) $4\sqrt{3}$

$= \sqrt{4^2 \cdot 3}$

$= \boxed{\sqrt{48}}$

b) $j^3\sqrt{j}$

$= \sqrt{(j^3)^2 \cdot j}$

$= \boxed{\sqrt{j^7}}$

c) $2k^2(\sqrt[3]{4k})$

$= \sqrt[3]{(2k^2)^3 \cdot 4k}$

$= \sqrt[3]{8k^6 \cdot 4k}$

$= \boxed{\sqrt[3]{32k^7}}$

Example #3: Order the following number from least to greatest.

$5, 3\sqrt{3}, 2\sqrt{6}, \sqrt{23}$

$5 = \sqrt{25}$

$3\sqrt{3} = \sqrt{27}$

$2\sqrt{6} = \sqrt{24}$

$\sqrt{23} = \sqrt{23}$

Least to Greatest:

$\boxed{\sqrt{23}, 2\sqrt{6}, 5, 3\sqrt{3}}$

Example #4: Simplify radicals and combine like terms.

a) $2\sqrt{7} + 13\sqrt{7}$

$= \boxed{15\sqrt{7}}$

b) $\sqrt{24} - \sqrt{6} = 2\sqrt{6} - \sqrt{6}$

$= \boxed{\sqrt{6}}$

c) $\sqrt{20x} - 3\sqrt{45x}, x \geq 0$

$= 2\sqrt{5x} - 9\sqrt{5x}$

$= \boxed{-7\sqrt{5x}}, x \geq 0$