4.4B Radicals Containing Variables

Some radicals can contain variables. In Mathematics 1201, students expressed a radical as a power with rational exponents. The focus here will be exclusive to the square root of a radical with variable radicands, for example, $\sqrt{x^n} = x^{\frac{n}{2}}$.

Simplifying Algebraic Expressions Involving Radicals

 \sqrt{x} cannot be simplified, since x is the smallest possible variable radicand. However, other powers of x under a root sign can be simplified.

Example 1:

Simplify the following.

$$(A) \quad \sqrt[4]{x^2}$$

$$= \times$$

$$(B) \sqrt{x^{3}}$$

$$= \sqrt{(\times \cdot \times) \times}$$

$$= \sqrt{\times^{2} \times}$$

$$= \sqrt{\times^{2} \times}$$

$$= \sqrt{\times^{2} \times}$$

$$= \sqrt{\times}$$

$$(C) \sqrt{x^{4}}$$

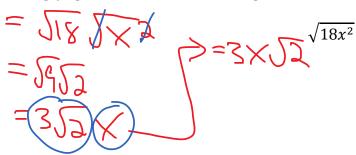
$$= \sqrt{\times \cdot \times}$$

Example 2:

Complete the table:

	Greatest Perfect Square	Prime Factorization
$\sqrt{125}$	$\sqrt{25 \times 5} = 5\sqrt{5}$	$\sqrt{5 \times 5 \times 5} = 5\sqrt{5}$
$\sqrt{x^3}$	$\sqrt{x^2 \times x} = x\sqrt{x}$	$\sqrt{x \times x} \times x = x\sqrt{x}$
$\sqrt{x^4}$	$\sqrt{x^2 \times x^2} = x \times x = x^2$	$\sqrt{x \times x \times x \times x} = x \times x = x^2$
$\sqrt{x^5}$	Xx X X = X.x 1x = x2x	JXXXXX = X·XIX=X3X
$\sqrt{x^6}$		KXXXX = X.x.X = X3

When the radical consists of a radicand that contains a variable and a numerical coefficient, simply split the radical into two separate radicals. For example:



Example 3:

Simplify the following and state any restrictions:

$$= \int_{A}^{A} \int_{X}^{A} \times = 2 \times \times \in \mathbb{R}$$

$$(C) \sqrt{54x^{5}}$$

$$= \sqrt{54}\sqrt{x^{5}}$$

$$= \sqrt{54}\sqrt{x^$$

(B)
$$4\sqrt{18x^3}$$

 $= 4\sqrt{18}\sqrt{x^3}$
 $= 4\sqrt{1}\sqrt{2}\sqrt{x}$
 $= 4\sqrt{3}\sqrt{2}\sqrt{x}$
 $= 12\times\sqrt{2}\sqrt{2}\sqrt{x}$

$$\frac{\sqrt{y-5}}{\text{Simplest for } }$$

$$\sqrt{-5} \ge 0$$

$$\sqrt{25}$$

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