

## Roots of Real Numbers and Radical Expressions

### Definition of $n^{\text{th}}$ Root

Square Root

### Notation

### Principal Root

Ex:  $\sqrt{64}$   
 $-\sqrt{64}$   
 $\pm\sqrt{64}$

The $n^{\text{th}}$ root of $b$			$\sqrt[n]{b}$
$n$	$b > 0$	$b < 0$	$b = 0$

### Examples:

1.  $\pm\sqrt{169x^4}$

2.  $-\sqrt{(8x-)^{\frac{4}{3}}}$

3.  $\sqrt[3]{125x^6}$

4.  $\sqrt[3]{-m^3n^3}$

**Taking nth roots of variable expressions - Using absolute value signs**Examples:

1.  $\sqrt[4]{(an)^4}$

2.  $\sqrt[6]{(xy^2)^6}$

3.  $\sqrt{x^6}$

4.  $\sqrt[6]{(3-y^2)^{18}}$

**Product Property of Radicals**Examples:

1.  $\sqrt{30a^{34}}$

2.  $\sqrt{54x^4y^5z^7}$

3.  $\sqrt[3]{54a^3b^7}$

4.  $\sqrt{60xy^3}$

## Quotient Property of Radicals

Examples:

$$1. \sqrt{\frac{7}{16}}$$

$$2. \sqrt{\frac{32}{25}}$$

$$3. \frac{\sqrt{48}}{\sqrt{3}}$$

$$4. \sqrt{\frac{45}{4}}$$

## Rationalizing the denominator

Ex: Simplify  $\sqrt{\frac{5}{3}}$

## Simplest Radical Form

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Examples:

$$1. \sqrt{\frac{5}{4}}$$

$$2. \frac{20\sqrt{8}}{2\sqrt{2}}$$

$$3. \frac{5}{2\sqrt{2}}$$

$$4. 4\sqrt{\frac{5}{7x}}$$

**Adding radicals** – we can only combine terms with radicals if we have like radicals

Example: Simplify  $6\sqrt{7} + 5\sqrt{7} - 3\sqrt{7}$

Examples:

1.  $2\sqrt{3} + 5 + 7\sqrt{3} - 2$

2.  $\sqrt{6} - 3\sqrt{24} + \sqrt{150}$

**Multiplying radicals**

• *Distributing* – Simplify  $\sqrt{3}(\sqrt{2} + 4\sqrt{3})$

• *FOIL* – Simplify  $\sqrt{3} \times \sqrt{5} \times \sqrt{2} \times \sqrt{3}$

Examples:

1.  $(2\sqrt{3} + 4\sqrt{5})(\sqrt{3} + 6\sqrt{5})$

2.  $(5\sqrt{4} + 2\sqrt{7})(5\sqrt{4} - 2\sqrt{7})$

**Conjugates**

Examples:

1.  $\frac{\sqrt{3} + 2}{\sqrt{3} - 5}$

2.  $\frac{1 + 2\sqrt{5}}{6 - \sqrt{5}}$