1-3: Simplifying Radicals

*1-2 n*th Roots

Definition
*n*th root

$$\sqrt[n]{b} = a \quad \text{means} \quad b = a^n$$

- if $n \geq 2$ and even then a and b must be greater than or equal to 0.
- if $n \geq 3$ and odd, then a and b can be any real number.

In $\sqrt[n]{b}$:

The symbol $\sqrt{\ }$ is called the radical

n is called the index

b is called the radicand

Square Roots - Cube Roots: MEMORIZE all in black!!!

$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	$6^3 = 216$
$7^2 = 49$	$7^3 = 343$
$8^2 = 64$	$8^3 = 512$
$9^2 = 81$	$9^3 = 729$
$10^2 = 100$	$10^3 = 1{,}000$
$11^2 = 121$	$11^3 = 1{,}331$
$12^2 = 144$	$12^3 = 1{,}728$

Prime Factorization: Whatever is under the radical, break the number up into all prime numbers.

Simplifying: Pull out groups the size of the index.

Evaluate: Pull out groups the size of the index

$\sqrt[3]{64}$

$\sqrt[4]{16}$

$\sqrt[3]{-8}$

$\sqrt[4]{81}$

You try:

$\sqrt[3]{125}$ $\sqrt[4]{81}$

$\sqrt[3]{-216}$ $\sqrt[4]{32}$

Simplifying
If n≥2 is a positive integer and a is a real number, then

$$\sqrt[n]{a^n} = a \quad \text{if } n \geq 3 \text{ is odd}$$

$$\sqrt[n]{a^n} = |a| \quad \text{if } n \geq 2 \text{ is even}$$

Reduce (remember: even index requires absolute value!)

$\sqrt{x^2}$ $\sqrt[5]{x^5}$

You try!

$\sqrt[3]{x^3}$ $\sqrt[6]{z^6}$

Simplify

$\sqrt{18}$

Simplify

$5\sqrt[3]{24}$

(remember $\sqrt{x^2} = |x|$)

$\sqrt{128x^2}$

$\sqrt[4]{20}$

You try!

$\sqrt{48}$

$4\sqrt[3]{54}$

$\sqrt{200a^2}$

$\sqrt[4]{40}$

Simplify

$\sqrt{12p^2q}$

Remember that

$$\sqrt[n]{a^n} = a \quad \text{if } n \geq 3 \text{ is odd}$$

$$\sqrt[n]{a^n} = |a| \quad \text{if } n \geq 2 \text{ is even}$$

For example

$$\sqrt{x^2} = |x| \qquad \sqrt[3]{x^3} = x \qquad \sqrt[4]{x^4} = |x| \qquad \text{and so on}$$

But to make our life easier some instructions will say "Assume all variables are greater then or equal to zero." In which case:

$$\sqrt{x^2} = x \qquad \sqrt[3]{x^3} = x \qquad \sqrt[4]{x^4} = x \qquad \text{and so on}$$

SO READ YOUR INSTRUCTIONS!!!

Reduce, assuming all variables are greater than or equal to zero.

$$\sqrt{x^6}$$

$$\sqrt[3]{x^{12}}$$

You try! Assume all variables are greater than or equal to zero

$\sqrt{48}$

$4\sqrt[3]{54}$

$\sqrt{200a^2}$

$\sqrt[4]{40}$

Reduce, assuming all variables are greater than or equal to zero.

$\sqrt{20x^{10}}$

You try! Assume all variables are greater than or equal to zero.

$$\sqrt{75a^6}$$

Simplify Assuming all variables are greater than or equal to zero.

$$\sqrt{80a^3} \qquad \sqrt[3]{27m^4n^{14}}$$

You Try! Assume all variables are greater than or equal to zero!

$\sqrt[3]{128x^6y^{10}}$

$\sqrt[4]{16a^5b^{11}}$