By the end of the lesson, we will be able to:

~Simplify Radical Expressions

What is a Square Root?

What is its symbol?

Definition of a Square Root:

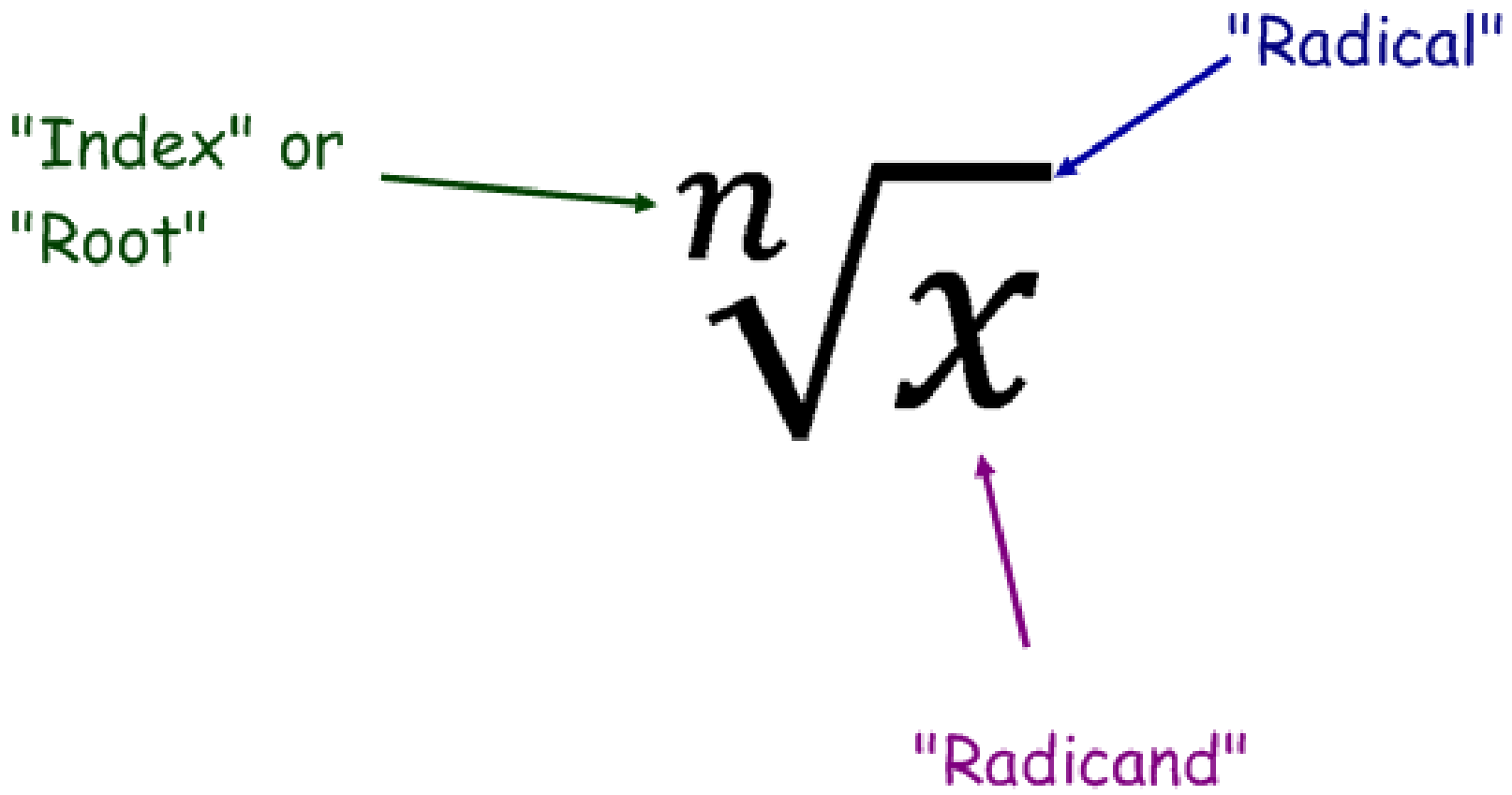
$For\ any\ real\ numbers\ a\ and\ b,$

$if\ a^2 = b, then\ a\ is\ a\ square\ root\ of\ b.$

Example: $If\ 13^2 = 169,$

$then\ 13\ is\ the\ square\ root\ of\ 169.$

Parts of a Radical:



Since finding the square root of a number and squaring a number are inverse operations, it makes sense that the inverse of raising a number to the *nth* power is finding the *nth* root of the number.

Powers	Factors	Roots
$4^3 = 64$	$4 \cdot 4 \cdot 4 = 64$	*4 is a cube root of 64*
$2^4 = 16$	$2 \cdot 2 \cdot 2 \cdot 2 = 16$	*2 is a fourth root of 16*
$3^5 = 243$	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = 243$	*3 is the fifth root of 243*
$a^n = b$	$a \cdot a \cdot a \cdot \cdots \cdot a = b$	*a is the nth root of b*

For any real numbers a and b,

and any positive integer n,

if $a^n = b$, *then a is an nth root of b.*

What is the square root of 49?

Hint: What number multiplied by itself equals 49?

When there is more than one real root, the nonnegative (or positive) root is the called the **principal root**. We use this when there is nothing in front of the square root sign.

$\sqrt{49} = 7$ $\pm\sqrt{49} = \pm 7$ $-\sqrt{49} = -7$

Real *nth* Roots of b, $\sqrt[n]{b}$, or $-\sqrt[n]{b}$			
n	**b>0**	**b<0**	**b=0**
even	one positive root one negative root	no real roots	one real root, 0
odd	one positive root no negative roots	no positive roots one negative root	

What is:

$-\sqrt{16}$ $\sqrt{-100}$ $\sqrt[3]{-27}$ $\sqrt[4]{16}$

Example 1 ~ Find each root:

a.) $\pm\sqrt{169x^4}$

b.) $-\sqrt[2]{(8x-3)^4}$

Example 1 ~ Find each root:

c.) $\sqrt[3]{125a^6}$

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

Example 1 ~ Find each root:

e.) $\sqrt{x^2 + 6x + 9}$

f.) $\sqrt{x^2 - 2xy + y^2}$

When you take the ***nth*** root of an even power and an odd power is the result, you must take the absolute value of the result to ensure that the value is nonnegative.

** The back of the book has absolute values, but we don't really care. We are just going to assume that all variables are positive. **

Example 2 ~ Find each root:

a.) $\sqrt[4]{(an)^4}$ b.) $\sqrt[6]{(xy^2)^6}$ c.) $\sqrt[6]{(3-y^2)^{18}}$

By the end of the lesson, we will be able to:

~Simplify Radical Expressions

Can you do these things?

Homework:

Assignment 20