In this section we will look at exponential expressions again and will focus on exponentials which are rational numbers. This type of expression is also called a radical expression because fractions in an exponent mean radicals in the math language.

In this sections we will discuss

* Square Roots and Square Root Functions
* Expressions of the form
* Cube Roots
* Odd and Even nth Roots

## First Recall some basic facts of exponents:

Def: In the exponential expression the number 2 is called the **base** and the number 3 is called the **exponent.**

Def: The notation is **exponential notation** for *repeated multiplication*. **It means the base number is being multiplied the number of times equal to the exponent**.

Recall *Rules of Exponents* (unless you already have these at your fingertips, need to review these rules)

|  |
| --- |
|  |
|  |
|  |

These rules were presented to you where and are integers. The same rules apply even if the exponents are rational.

## Square Roots and Square Root Functions

## Def: Square Root

The number is a **square root** of if

Ex:

3 is the square root of 9 if which it is.

5 is the square root of 25 if which it is.

9 is the square root of 81 if which it is.

So

is the square root of if .

## Def: Principal Square Root

The **principal square root**  of a nonnegative number is its nonnegative square root. The symbol is called a **radical sign** and is used to indicate the principal square root of the number over which it appears. The number/expression the radical sign is over is called the **radicand.**

Ex:

Ex: Given

1. Find
2. Find a such that

Consider the following: What is the difference between these two equations?

## Expressions of the form

Consider:

what is wrong with this?

What is the consequence of this mistake?

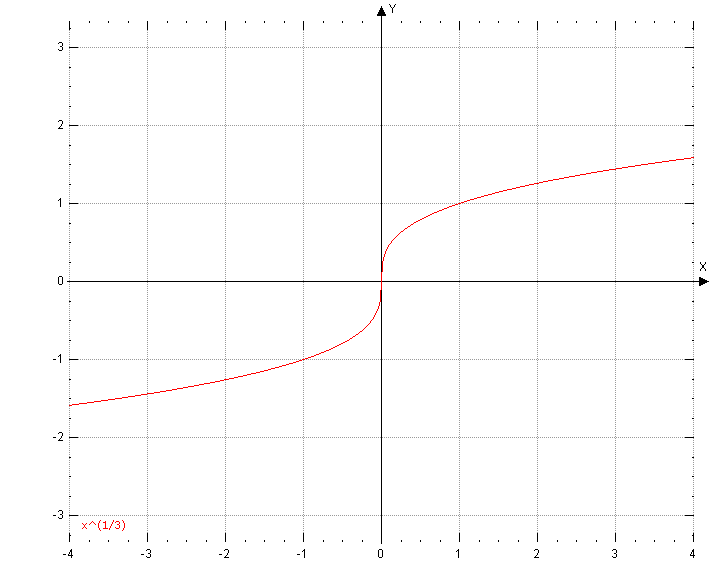
## Simplifying

For any real number

The principal square root of is the absolute value of .

Ex: Simplify each expression.

a) b) c) d)



## Cube Roots

## Def: Cube Root

The number is a **cube root** of if

In math symbols, we write to denote the cube root of .

Ex: Simplify:

a) b) c) d) e)

## Odd and Even nth Roots

Ex: simplify

a) b) c) d) e) f) g)

Summary of taking odd roots of negative numbers and taking even roots of negative numbers: