Foundations and Pre-Calculus 10
Chapter 4: Roots and Powers

4.1 and 4.2 Estimating Roots and Irrational Numbers

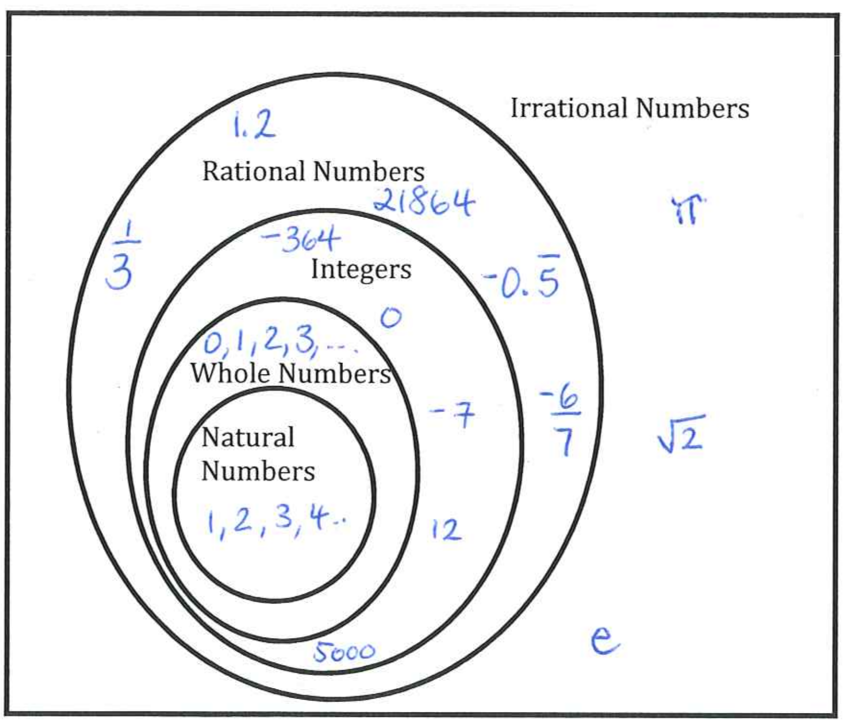
Vocabulary that we will use in this unit:

Rational number	Radical	Reciprocal
Irrational number	Entire radical	Rational exponent
Real number	Mixed radical	
Integers		
Cube root, Fourth root, n^{th} root		

A rational number can be written in the form $\frac{m}{n}$ where m and n are integers and $n \neq 0$. This includes integers, fractions, terminating decimals and repeating decimals.

An irrational number is a real number that is not rational. The decimal representation of an irrational number neither terminates nor repeats.

The following Venn Diagram represents the set of **Real Numbers**.



Complete the table below:

Radical	Value	Is the value exact or approximate?	Is the radical rational or irrational? Explain.
$\sqrt{16}$	4	Exact	R — All of the rational numbers are integers and/or can be written as fractions (or have repeating decimals)
$\sqrt{27}$	5.1962	Approximate	I
$\sqrt{\frac{16}{81}}$	$\frac{4}{9}$	Exact	R
$\sqrt{0.64}$	0.8	Exact	R
$\sqrt[3]{16}$	2.5198421	Approximate	I
$\sqrt[3]{27}$	3	Exact	R
$\sqrt[3]{\frac{16}{81}}$	0.5823869765	Approximate.	I — All of the irrational numbers have non-repeating non-terminating decimals.
$\sqrt[3]{0.64}$	0.861773876	Approximate.	I
$\sqrt[3]{-0.64}$	-0.861773876	Approximate	I
$\sqrt[4]{16}$	2	Exact	R
$\sqrt[4]{27}$	2.279507057	Approximate.	I
$\sqrt[4]{\frac{16}{81}}$	$\frac{2}{3}$	Exact	R
$\sqrt[4]{0.64}$	2.828427125	Approximate	I

Example: Approximate each of the following to one decimal place (without a calculator).

$\sqrt{32} \doteq 5.7$ $\quad \sqrt[3]{72} \doteq 4.2$ $\quad \sqrt[4]{50} \doteq 2.5$ $\quad \sqrt{65} \doteq 8.1$ $\quad \sqrt[3]{50} \doteq 3.7$

$\sqrt{36} = 6$ $\quad \sqrt[3]{64} = 4$ $\quad \sqrt[4]{16} = 2$ $\quad \sqrt{64} = 8$ $\quad \sqrt[3]{27} = 3$

$\sqrt{25} = 5$ $\quad \sqrt[3]{125} = 5$ $\quad \sqrt[4]{81} = 3$ $\quad \sqrt{81} = 9$ $\quad \sqrt[3]{64} = 4$

Example: When a radicand is negative, which types of radicals can be evaluated? And which types of radicals cannot be evaluated?

Odd radicals can be evaluated regardless of the radicand being positive or negative. ex $\sqrt[3]{-8} = -2$
Even radicals must have a positive radicand.