Sec 4.1 Estimating Roots
Sec 4.2 Irrational Numbers

The concept of square roots and cube roots, is now extended to include the n^{th} root.

$$\sqrt[n]{x}$$

Example 1 What is the index and radicand of each radical?

a) $\sqrt[3]{27}$

b) $\sqrt{36}$

c) $\sqrt[4]{16}$

d) $\sqrt[5]{1024}$

Example 2 Notice the relationship between the exponent in the power and the index number.

a) If $\sqrt[3]{8} =$, then

b) If $\sqrt[4]{81} =$, then

c) If $\sqrt[4]{\frac{16}{81}} =$, then

Example 3 Estimate the following radicals. Verify the answer using your calculator.

a) $\sqrt{80}$

b) $\sqrt{49}$

Note:

Did you know that all radicals with an even index, for example, square root, $\sqrt{\ }$, and 4th root, $\sqrt[4]{\ }$, etc, has two possible answers?

$\sqrt{49}$ $\sqrt[4]{16}$

However, we will focus on the **positive or principle square root** only.

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c) $\sqrt[3]{30}$

Note: All real numbers are either rational or irrational.

Example 4

Can you tell which answers from Example 2 result in a rational number? An irrational number?

a) $\sqrt{80}$ b) $\sqrt{49}$ c) $\sqrt[3]{30}$

Hint:

- Rational numbers have EXACT answers.
- The best we can do with an irrational number is give an estimate or approximate value.

Example 5

Why is the cube root of a negative number possible but the square root of a negative number impossible?

$\sqrt[3]{-8}$ $\sqrt{-16}$

Definitions: Number Set

1.

- "counting numbers." Numbers greater than zero, with no decimals or fractions. 1, 2, 3, 4, ..., etc.

2.

- include numbers greater than or equal to zero, with no decimals or fractions. 0, 1, 2, 3, 4, ..., etc.

3.

- includes all positive and negative numbers, with no decimals or fractions. $-3, -2, -1, 0, 1, 2, 3, etc$

4.

- any number that can be written in the form $\frac{m}{n}$, $n \neq 0$, where m and n are integers. The decimal representation either terminates or repeats.

5.

- any number that cannot be written in the form $\frac{m}{n}$, $n \neq 0$, where m and n are integers. The decimal representation does not terminate or repeat.

6.

- includes all numbers, both rational and irrational.

Example 6 Refer to the 6 number sets. To which set(s) does each number belong?

a) -4

b) $\sqrt[3]{27}$

c) $\frac{3}{4}$

d) π

Venn Diagram ★

Example 7

a) Determine whether each number is rational or irrational. Explain how you know.

$$\frac{1}{2}\ ,\ 4\ ,\ -6\ ,\ \sqrt{9}\ ,\ \sqrt{17}\ ,\ \pi\ ,\ -\frac{2}{3}\ ,\ \sqrt[3]{-8}$$

b) Place these numbers in order from least to greatest.

Work Book Questions	Extra Practice Questions
p.211 #4, 12	p.211 #3, 5, 9 and 14.