Chapter 4: Roots and Powers

BUILDING ON

Determining the square root of a positive rational number
Applying the exponent laws for powers with integral bases and whole number exponents

BIG IDEAS

- Any number that can be written as the fraction $\frac{m}{n}, n \neq 0$, where m and n are integers, is rational
- Exponents can be used to represent roots and reciprocals of rational numbers
- The exponent laws can be extended to include powers with rational and variable bases, and rational exponents

New Vocabulary

Irrational number $\sqrt{3}$, π

Real number 3.72

Entire radical $\sqrt{27}$

Mixed radical $3\sqrt{2}$

4.1 Estimating Roots

Lesson Focus

Explore decimal representation of different roots of numbers

Reminder from Math 9

- *Repeated Multiplication*
  - *Multiplying a number by itself repeatedly*
  - *Ex.* $(4)(4)(4)(4)(4)(4)$
- *Power Expression*
  - *Short-cut to writing repeated multiplication*
  - *Ex.* $(4)^6$

$3^4 = 3 \cdot 3 \cdot 3 \cdot 3$

Roots

We use roots to do the opposite of ~~powers~~

$\sqrt{9}$

Since $3^2 = 9$, 3 is a square root of 9.

We write: $3 = \sqrt{9}$

$\sqrt[3]{27}$

Since $3^3 = 27$, 3 is the cube root of 27.

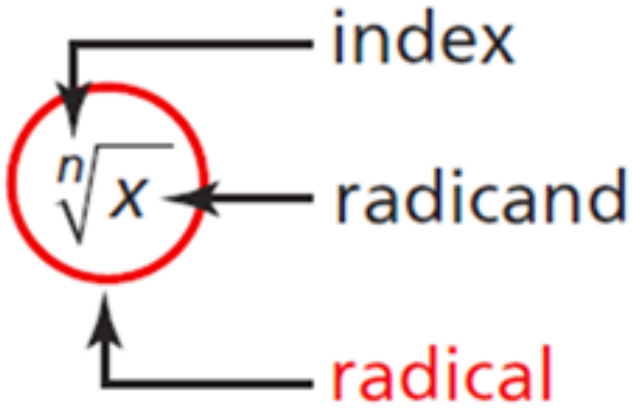
We write: $3 = \sqrt[3]{27}$

Since $3^4 = 81$, 3 is a fourth root of 81.

We write: $3 = \sqrt[4]{81}$

Terminology

There are different parts to a root, also known as a ***radical***

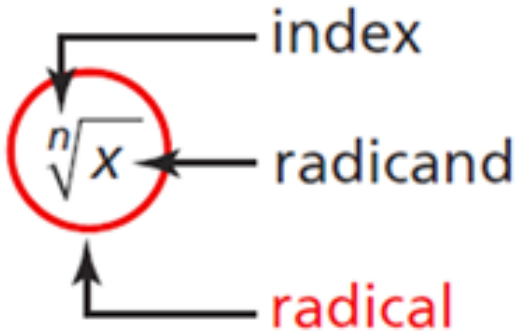


We're looking for a ***number (the answer)*** *such that when multiplied by itself* ***n times (the index)*** *will give us the* ***radicand***

Example

- *Indicate the **index** and the **radicand** for each **radical** below, then evaluate*
- *Ex.* $\sqrt[2]{9}$
- *Ex.* $\sqrt[3]{125}$
- *Ex.* $\sqrt[5]{-243}$
- *Ex.* $\sqrt{81}$
- *Ex.* $\sqrt[4]{16}$
- *Ex.* $\sqrt{3}$

I	R
2	9
3	125
5	-243
2	81
4	16
2	3



Roots

- *Unlike powers, with roots we don't always get a rational number*
  - ***Rational Number – any number that can be written as*** $\frac{a}{b}$ ***such that a and b are integers and*** $b \neq 0$

$\frac{1}{4} = 0.25$

$\frac{1}{3} = 0.\overline{333}$

- *Ex.* $\sqrt{2}$
- *Ex.* $\sqrt{3}$
- *Ex.* $\sqrt{5}$
- *This means that we'll sometimes have to* ***approximate*** *our answers*

Irrational cannot be written as

- $\frac{a}{b}$, where $a, b \in I$
- are non-terminating and non-repeating

$\sqrt{4}$ $\sqrt{7}$ $\sqrt{9}$

$\frac{2}{1}$ $\frac{3}{1}$

Example

- *Let's approximate the value of* $\sqrt{20}$

$\sqrt{16}$ $\sqrt{20}$ $\sqrt{25}$

4 4.4 5

4.47

Example

- *Let's approximate the value of* $\sqrt{85}$

$\sqrt{81}$ $\sqrt{85}$ $\sqrt{100}$

9 9.27 10

9.21

Example

- *Let's approximate the value of* $\sqrt[3]{12}$

$\sqrt[3]{8}$ $\sqrt[3]{12}$ $\sqrt[3]{27}$

2 2.3 3

2.29

Explore

- *Determine the following radicals*
- *Ex.* $\sqrt[3]{-8}$ = - 2
- *Ex.* $\sqrt{-16}$
- ***Explain your answers!!!***

(-2)(-2)(-2)
(4)(-2)
-8

Homework

P. 206

 # 1, 2, 3, 4, 5, 6