# 4.1 Estimating Roots

MATH LAB

**LESSON FOCUS** Explore decimal representations of different roots of numbers.

## Make Connections

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

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

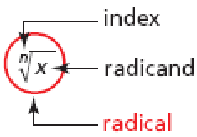
Since $3^3 = 27$, 3 is the cube root of 27.

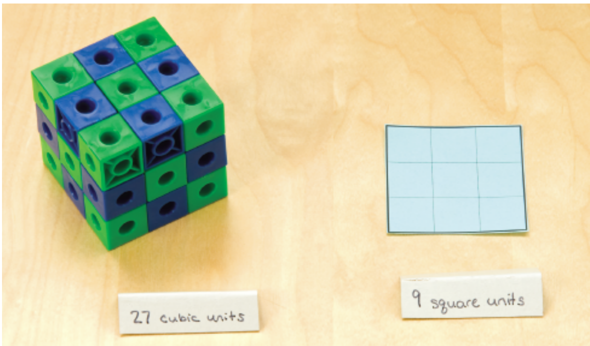
We write: $3 = \sqrt[3]{27}$

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

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

How would you write 5 as a square root? A cube root? A fourth root?



List all perfect squares up to 225...

| | | |
|---|---|---|
| 1 | 36 | 121 |
| 4 | 49 | 144 |
| 9 | 64 | 169 |
| 16 | 81 | 196 |
| 25 | 100 | 225 |

$\sqrt{81} = 9$

$\sqrt{9} = 3$

$\sqrt{1.0} = 3$

$\sqrt{16} = 4$

List all perfect cubes up to 125...

1

index

8 $\Rightarrow$ $\sqrt[3]{8} = 2$

27 $\Rightarrow$ $\sqrt[3]{27} = 3$

64 $=$ $\sqrt[3]{64} = 4$

125 $=$ $\sqrt[3]{125} = 5$

Using Technology to evaluate roots and powers...

- Identify Power Function on calculator $x^n$

$\boxed{\wedge}$ OR $\boxed{x^y}$

- Identify Radical Function on calculator $\sqrt{x}$ OR $\sqrt[n]{x}$

$\boxed{\sqrt{\ }}$ VS $\boxed{\sqrt[3]{x}}$ VS $\boxed{\sqrt[n]{x}}$

$3^5 =$

```
3^5
                243
```

$\sqrt{10} =$

```
√(10)
         3.16227766
```

(Approximation)

$\sqrt{9} = \underline{\underline{3}}$ (Exact)

$\sqrt[3]{17} =$

```
³√(17
       2.571281591
```

Approx.

$\sqrt[3]{8} = 2$

$\sqrt[3]{27} = 3$

$\sqrt[5]{18} =$

```
5 ˣ√18
       1.782602458
```

$\sqrt[7]{200} \doteq 2.13$

$3^{7.5} = 3787.995$

$\sqrt[8]{14} \doteq \underline{1.39}$

$2^{0.74} = 1.67$

Exact or Approximate??

# EXERCISE...

2. Evaluate each radical. Justify your answer.

a) $\sqrt{36} = 6$

b) $\sqrt[3]{8} = 2$

c) $\sqrt[4]{10\,000} = 10$

d) $\sqrt[5]{-32} = -2$

e) $\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{3}{5}$

f) $\sqrt{2.25} = 1.5$

g) $\sqrt[3]{0.125} = 0.5$

h) $\sqrt[4]{625} = 5$

$\sqrt[4]{10^4} = 10$

$\sqrt{-36} =$ Impossible

4.1 Math Lab: Estimating Roots

# Practice Questions...

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Check-Up on Calculator

Definition: **rational number:** any number that can be written in the form $\frac{m}{n}$, $n \neq 0$, where $m$ and $n$ are integers

- Every integer is rational (n = 1 or n = -1)
- In decimal form they will be either terminating or repeating
- The symbol Q is used to represent this set of numbers...
  Any ideas why???

**Examples??**

Q

# Definition:

## Irrational Numbers

An **irrational number** *cannot* be written in the form $\frac{m}{n}$, where $m$ and $n$ are integers, $n \neq 0$. The decimal representation of an irrational number neither terminates nor repeats.

- The symbol $\overline{Q}$ is used to represent this set of numbers

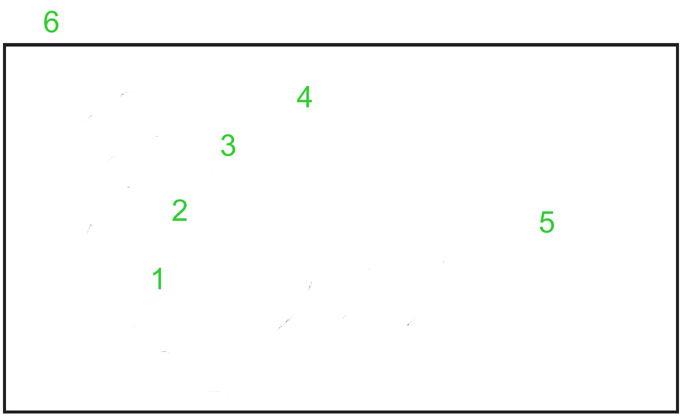
**Examples??**

$\overline{Q}$ $\sqrt{7}$ Radical

$\sqrt{49} = 7$

$Q$

Together, the rational numbers and irrational numbers form the set of **real numbers**. This diagram shows how these number systems are related.




4
$-6$

4.2 Irrational Numbers

Which of these radicals are rational numbers?
Which are not rational numbers? How do you know?

$\sqrt{1.44}$ $\sqrt{\frac{64}{81}}$ $\sqrt[3]{-27}$ $\sqrt{\frac{4}{5}}$ $\sqrt{5}$

$Q$ $Q$ $Q$ $\overline{Q}$ $\overline{Q}$

Write 3 other radicals that are rational numbers. Why are they rational?

Write 3 other radicals that are not rational numbers. Why are they not rational?

4.2 Irrational Numbers

**Example 1** Classifying Numbers

Tell whether each number is rational or irrational. Explain how you know.

a) $-\frac{3}{5}$

$Q$

b) $\sqrt{14}$

$\overline{Q}$

c) $\sqrt[3]{\frac{8}{27}}$

$Q$

CHECK YOUR UNDERSTANDING

4.2 Irrational Numbers

## Example 2 Ordering Irrational Numbers on a Number Line

Use a number line to order these numbers from least to greatest.

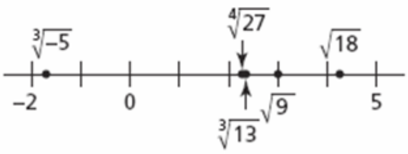
$\sqrt[3]{13}, \sqrt{18}, \sqrt{9}, \sqrt[4]{27}, \sqrt[3]{-5}$

1.03 1.05

3 5 4 2 1

$$\boxed{\sqrt[3]{13}, \sqrt{18}, \sqrt{9}, \sqrt[4]{27}, \sqrt[3]{-5}}$$

Mark each number on a number line.




From least to greatest: $\sqrt[3]{-5}, \sqrt[4]{27}, \sqrt[3]{13}, \sqrt{9}, \sqrt{18}$

4.2 Irrational Numbers

Practice Problems:

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5, 6, 10, 12, 14, 15, 18 a, b 19, 22, 23

Attachments

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