



Natural Numbers

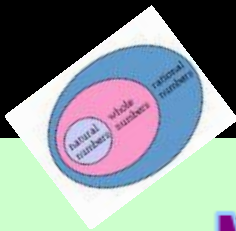
Whole Numbers

Integers

Rational

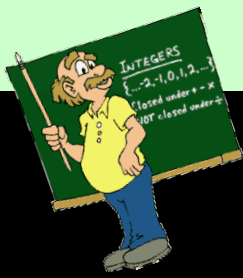
Irrational

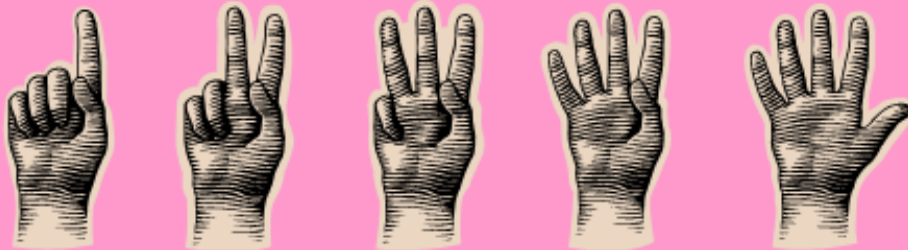
Real



0

# Natural Numbers, Whole Numbers and Integers





# Natural Numbers

Natural numbers are the numbers we use everyday for counting.

**$N \{ 1, 2, 3, 4, 5, \dots \}$**



# Whole Numbers

The set of whole numbers includes zero,  
as well as all the natural numbers

**W {0, 1, 2, 3, 4, 5, ...}**



# Integers

Integers are whole numbers  
and their opposites.

**$\{ -3, -2, -1, 0, 1, 2, \dots \}$**

*Be  
Rational!* *Get  
Real!*

$i$   $\pi$

# Rational or Irrational ??





# Irrational Numbers

**Irrational Numbers** can not be written as a fraction  $m/n$ , where  $n \neq 0$ . It is represented by a decimal that **does not** terminate or repeat.

**Examples :**  $\sqrt{26} = 5.099019514\dots\dots$   
 $\sqrt[4]{15} = 1.967989671\dots\dots$   
 $\sqrt[3]{10} = 2.15443469\dots\dots$

They go  
on forever  
with no  
pattern!!



# Rational Numbers



Any number that **can** be written in the form  $m/n$ , where  $n \neq 0$ .  
Rational numbers **terminate** or **repeat**.

$$4/5 = 0.8$$

$$1/3 = 0.3333... \\ = 0.\overline{3}$$

$$\sqrt{25} = 5$$



Rational  
Numbers

$$\sqrt{25}$$

$$0.5$$

$$\sqrt{\frac{9}{64}}$$

$$\sqrt{64}$$

$$\sqrt{100}$$

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

$$0.8^2$$

Irrational  
Numbers

$$\sqrt{0.24}$$

$$\frac{\sqrt{18}}{3}$$

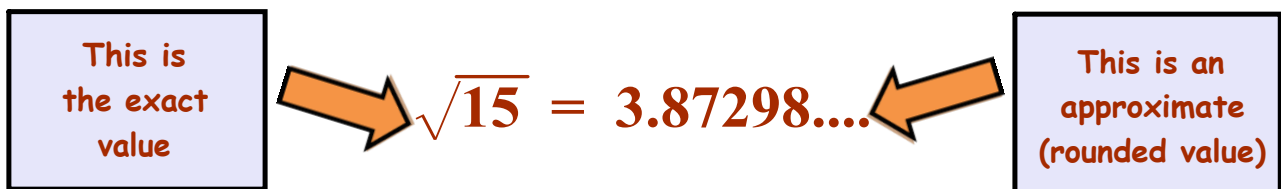
$$\sqrt[3]{9}$$

$$\sqrt[4]{12}$$

$$\sqrt{1/3}$$

# *Irrational Radicals*

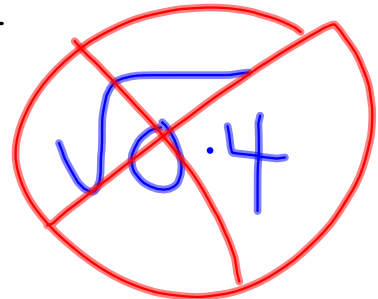
When an irrational number is written as a **radical**, the radical is the **exact value** of the **irrational number**.



# *Rational Radicals*

Radicals that are square roots of perfect squares, cube roots of perfect cubes, and so on are rational numbers.

$$\sqrt[3]{8} = 2 \quad \sqrt[4]{256} \quad \sqrt{16/25}$$



What about  $\sqrt{0.04}$  ?

# Let's Check Your Understanding!

Tell whether each number is rational or irrational.

a)  $\sqrt{49/16}$   
Rat.

b)  $\sqrt[3]{-30}$   
Irrat.

c) 1.21  
Rat.

d)  $-3/5$   
Rat.

e)  $\sqrt[3]{8/27}$  Rat.

h)  $\sqrt{0.9}$   
Irrat.

f)  $\sqrt{-16}$   
Irrat.

g)  $\sqrt{0.16}$   
Rat.

# Ordering Irrational Numbers

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

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

$$\begin{array}{ccc} \sqrt[3]{8} & \sqrt[3]{13} & \sqrt[3]{27} \\ \downarrow & \downarrow & \downarrow \\ 2 & ? & 3 \end{array}$$

**Estimate = 2.3**

$$\begin{array}{ccc} \sqrt[3]{-1} & \sqrt[3]{-5} & \sqrt[3]{-8} \\ \downarrow & \downarrow & \downarrow \\ -1 & ? & -2 \end{array}$$

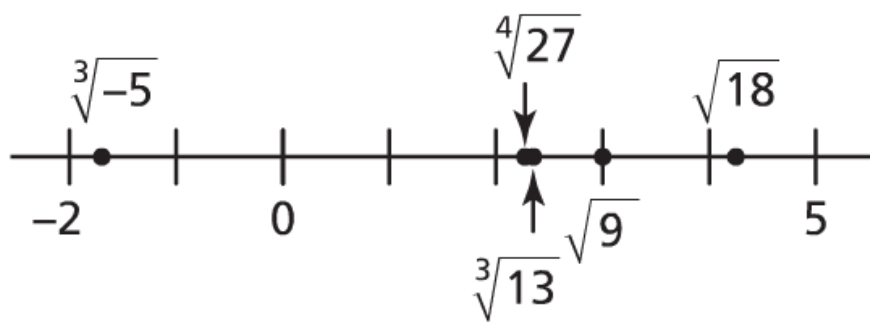
**Estimate = -1.6**

$$\begin{array}{ccc} \sqrt[4]{16} & \sqrt[4]{27} & \sqrt[4]{81} \\ \downarrow & \downarrow & \downarrow \\ 2 & ? & 3 \end{array}$$

**Estimate = 2.2**

$$\begin{array}{ccc} \sqrt{16} & \sqrt{18} & \sqrt{25} \\ \downarrow & \downarrow & \downarrow \\ 4 & ? & 5 \end{array}$$

**Estimate = 4.2**



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

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