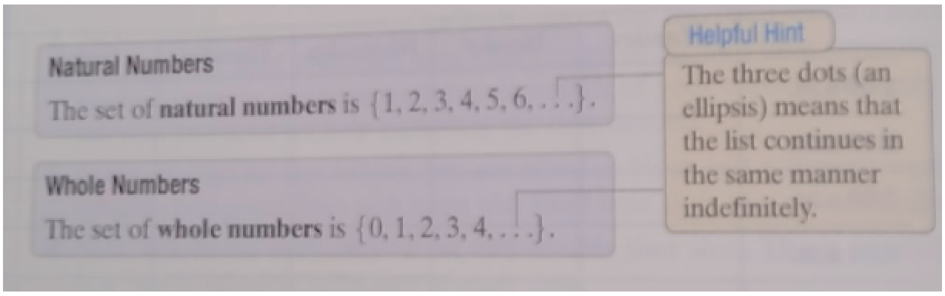
1.2 Symbols & Sets of Numbers

4 objectives

Objective 1: Using a Number Line to Order Numbers

A set is a collection of objects, each of which is called a member or element of the set. The brace symbols { } encloses the list of elements and is translated as "the set of."


Natural Numbers

The set of **natural numbers** is {1, 2, 3, 4, 5, 6, . . .}.

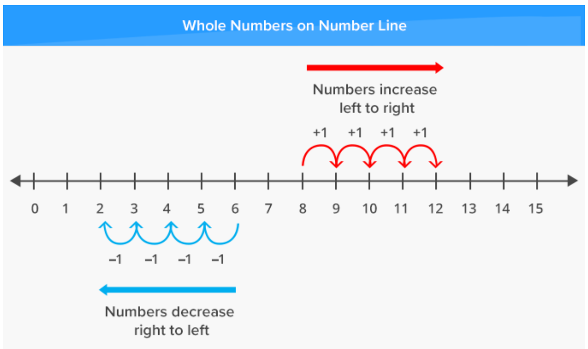
Whole Numbers

The set of **whole numbers** is {0, 1, 2, 3, 4, . . .}.

Helpful Hint

The three dots (an ellipsis) means that the list continues in the same manner indefinitely.

Natural numbers and whole numbers can be pictured on a number line. Number lines help visualize distance and relationships between numbers.



The equal symbol (=) means "is equal to"

The symbol (≠) means "is not equal to"

These symbols may be used to form a mathematical statement. This statement is either TRUE or FALSE. These statements are both true:

- $2 = 2$ states that "two is equal to two"
- $2 \neq 6$ states that "two is NOT equal to six"

If two numbers are NOT equal, one number is larger than the other, you use inequalities:

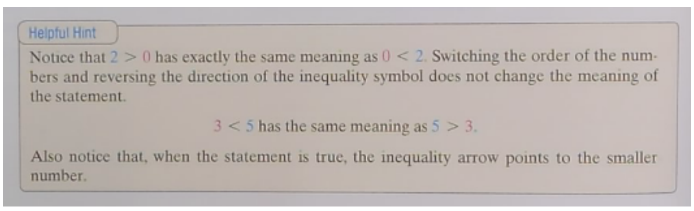
- The symbol > means "is greater than"
- The symbol < means "is less than"

Both of these statements are true:

- $3 < 5$ states that "three is less than five"
- $2 > 0$ states that "two is greater than zero"

On a number line, numbers to the right are larger and the opposite is also true. The numbers to the left are smaller.

We use inequalities to communicate numbers on a number line: <, >, ≠, ≤, ≥.

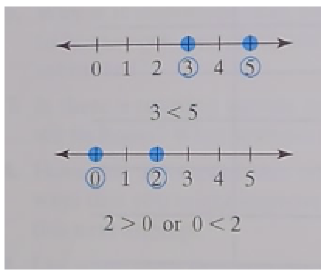


Helpful Hint

Notice that $2 > 0$ has exactly the same meaning as $0 < 2$. Switching the order of the numbers and reversing the direction of the inequality symbol does not change the meaning of the statement.

$3 < 5$ has the same meaning as $5 > 3$.

Also notice that, when the statement is true, the inequality arrow points to the smaller number.



Example 1:

Insert an inequality (< > ≠) in the space between each pair of numbers to make each statement true.

a) $2 < 3$

b) $7 > 4$

c) $72 > 27$

Practice 1:

Insert an inequality (< > ≠) in the space between each pair of numbers to make each statement true.

a) $5 < 8$

b) $6 > 4$

c) $16 < 82$

Example 2:

Tell whether each statement is true or false .

a) $8 \geq 8$ true

b) $8 \leq 8$ true

c) $23 \leq 0$ false

d) $23 \geq 0$ true

Practice 2:

Tell whether each statement is true or false .

a) $9 \geq 3$ true

b) $3 \geq 8$ false

c) $25 \leq 25$ true

d) $4 \leq 14$ true

Objective 2: Translating Sentences

Example 3:

Translate each sentence into a mathematical statement.

a) Nine is less than or equal to eleven.

$9 \leq 11$

b) Eight is greater than one.

$8 > 1$

c) Three is not equal to four.

$3 \neq 4$

Practice 3:

Translate each sentence into a mathematical statement.

a) Three is less than eight.

$3 < 8$

b) Fifteen is greater than or equal to nine.

$15 \geq 9$

c) Six is not equal to seven.

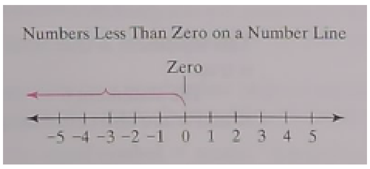
$6 \neq 7$

1.2 Day One Assignment

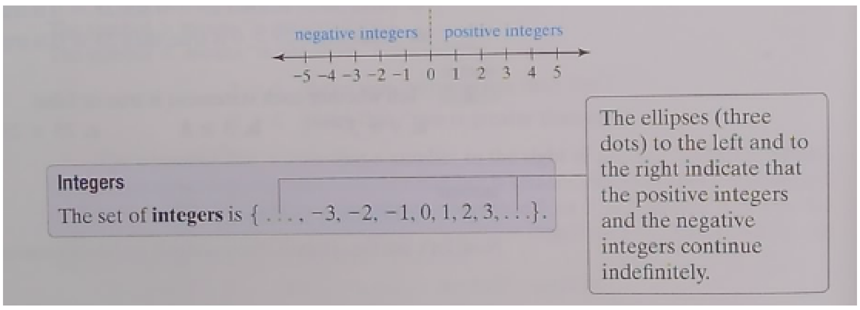
Pg. 15: 1 - 27 (o), 71, 73

Objective 3: Identifying Common Sets of Numbers

Whole numbers do not always work. Sometimes we need negative numbers. For example: temperature.



The numbers above on the number line represent integers. Positive (to the right of 0) and negative integers (to the left of 0) and 0 is neutral (neither positive or negative).



Example 4: Use an integer to express the number in the following.

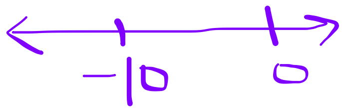
"Pole of Inaccessibility, Antarctica, is the coldest location in the world, with an average annual temperature of 72 degrees below zero."

-72°

Practice 4:

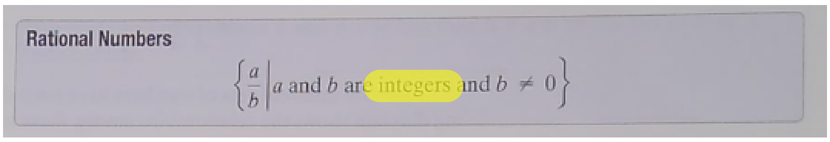
The elevation of Laguna Salada in Mexico is 10 meters below sea level.

-10m



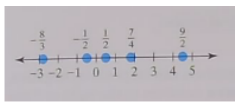
The problem is that we need numbers that are not always an integer. For example: shoe sizes. Not all feet are completely a 9 some are an 8.5.

When you divide integers together you get rational numbers.
1 divided by 2 is one half.



Rational Numbers

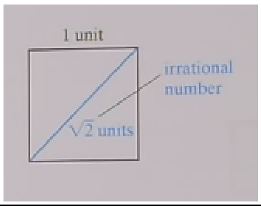
$$\left\{ \frac{a}{b} \,\middle|\, a \text{ and } b \text{ are integers and } b \neq 0 \right\}$$



This is read: "the set of all numbers a/b such that a and b are integers and b is not equal to 0."

1.2 Symbols & Sets of Numbers DAY TWO with work

The number line also contains points that cannot be expressed as quotients of integers. These numbers are called irrational numbers because they cannot be represented by a rational number. For example: the length of a diagonal of a one unit square is an irrational number, √(2) or π is irrational too.



Irrational Numbers

The set of **irrational numbers** is

{Nonrational numbers that correspond to points on a number line}.

That is, an irrational number is a number that cannot be expressed as a quotient of integers.

Rational and Irrational Numbers

Both of these can be written as a decimal.

Rational Numbers

$\frac{3}{4}$ decimal number terminates/ends

$\frac{2}{3}$ decimal number that repeats in pattern

Irrational Numbers

decimal number does not terminate or repeat in pattern

$\sqrt{2} = 1.414213562...$

$\pi = 3.141592653...$

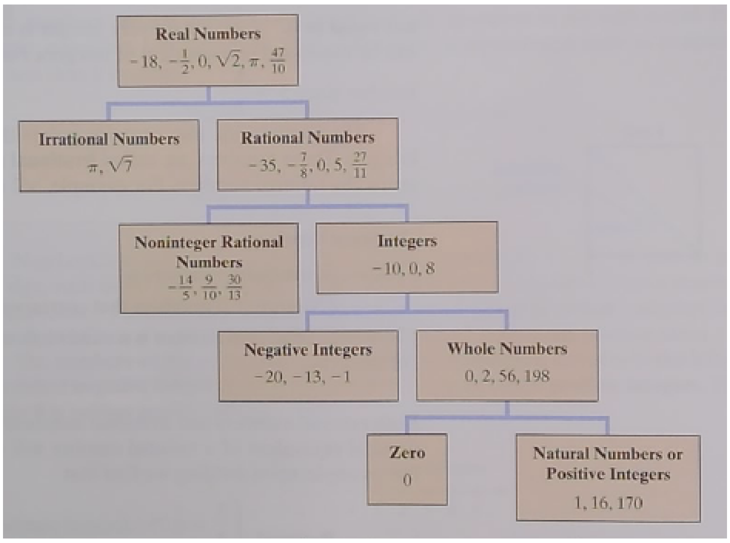
When you combine rational and irrational numbers you get the set of real numbers.

Real Numbers

The set of **real numbers** is

{All numbers that correspond to points on a number line}

Relationship of Common Sets of Numbers



Example 5:

Given the set below, list the number in this set that belong to the set of:

$$\{-2, 0, \frac{1}{4}, -1.5, 112, -3, 11, \sqrt{3}\}$$

a) Natural Numbers 11 112

b) Whole Numbers 0 11 112

c) Integers -3 -2 0 11 112

d) Rational Numbers -3 -2 -1.5 0 $\frac{1}{4}$ 11 112

e) Irrational Numbers $\sqrt{3}$

f) Real Numbers -2 0 $\frac{1}{4}$ -1.5 112 -3 11 $\sqrt{3}$

Example 5:

Given the set below, list the number in this set that belong to the set of:

$$\{-2, 0, \frac{1}{4}, -1.5, 112, -3, 11, \sqrt{3}\}$$

a) Natural Numbers 11 112

b) Whole Numbers 0 11 112

c) Integers -3 -2 0 11 112

d) Rational Numbers -3 -2 -1.5 0 $\frac{1}{4}$ 11 112

e) Irrational Numbers $\sqrt{3}$

f) Real Numbers all the numbers in the set are real

Practice 5:

$$\{\frac{7}{3}, 25, -15, -\frac{3}{4}, \sqrt{5}, -3.7, 8.8, -99\}$$

a) Natural Numbers 25

b) Whole Numbers 25

c) Integers 25 -15 -99

d) Rational Numbers 25 $\frac{7}{3}$ -15 $-\frac{3}{4}$ -3.7 8.8 -99

e) Irrational Numbers $\sqrt{5}$

f) Real Numbers $\frac{7}{3}$ 25 -15 $-\frac{3}{4}$ $\sqrt{5}$ -3.7 8.8 -99

Practice 5:

$\{\frac{7}{3}, 25, -15, -\frac{3}{4}, \sqrt{5}, -3.7, 8.8, -99\}$

a) Natural Numbers 25

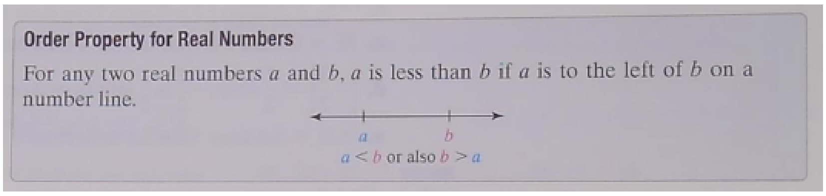
b) Whole Numbers 25

c) Integers 25 -15 -99

d) Rational Numbers 25 $\frac{7}{3}$ -15 $-\frac{3}{4}$ -3.7 8.8 -99

e) Irrational Numbers $\sqrt{5}$

f) Real Numbers 25 $\frac{7}{3}$ -15 $-\frac{3}{4}$ $\sqrt{5}$ -3.7 8.8 -99



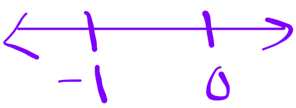
Order Property for Real Numbers

For any two real numbers *a* and *b*, *a* is less than *b* if *a* is to the left of *b* on a number line.

Example 6:

Insert <, >, = in the appropriate space to make each statement true.

a) -1 < 0



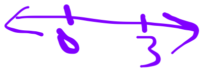
b) 7 = $\frac{14}{2}$

c) -5 > -6

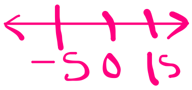
Practice 6:

Insert >, <, = in the appropriate space to make each statement true.

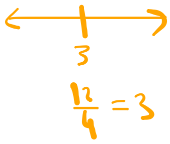
a) 0 < 3



b) 15 > -5

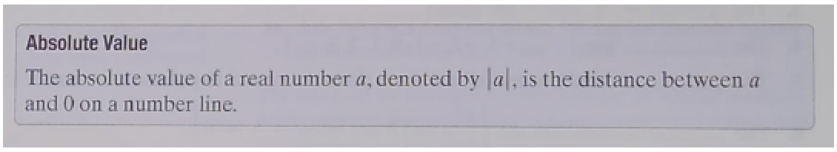


c) 3 = $\frac{12}{4}$



Objective 4: Finding the Absolute Value of a Real Number

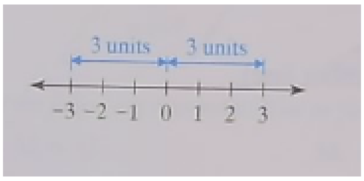
The distance between a real number a and 0 is given a special name called the absolute value, | a |.



Absolute Value

The absolute value of a real number a, denoted by $|a|$, is the distance between a and 0 on a number line.

|3| = 3 and |-3| = 3 because the distance from 0 on a number line is 3 either direction.



Example 7:

Find the absolute value of each number.

a) $|4|$ b) $|-5|$ c) $|0|$ d) $|-\frac{1}{2}|$ e) $|5.6|$

4 5 0 $\frac{1}{2}$ 5.6

Practice 7:

a) $|-8|$ b) $|9|$ c) $|-2.5|$ d) $|\frac{5}{11}|$ e) $|\sqrt{3}|$

8 9 2.5 $\frac{5}{11}$ $\sqrt{3}$

Example 8:

Insert $>$, $<$, $=$ in the appropriate space to make each statement true.

a) $|0| < 2$ b) $|-5| = 5$ c) $|-3| > |-2|$

d) $|5| < |6|$ e) $|-7| > |6|$

Practice 8:

Insert >, < , = in the appropriate space to make each statement true.

a) |8| = |-8| b) |-3| > 0   c) |-7| < |-11|

d) |3| > |2| e) |0| < |-4|

Number your slip of paper 1 - 8. Write the correct answer on next to the number and turn it in with your name on it prior to starting your assignment.

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real	natural	whole	irrational
$\lvert b \rvert$	inequality	integers	rational

1. The whole numbers are $\{0, 1, 2, 3, 4, \ldots\}$.
2. The natural numbers are $\{1, 2, 3, 4, 5, \ldots\}$.
3. The symbols $\neq$, $\leq$, and $>$ are called inequality symbols.
4. The integers are $\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$.
5. The real numbers are {all numbers that correspond to points on a number line}.
6. The rational numbers are $\left\{ \frac{a}{b} \middle| a \text{ and } b \text{ are integers}, b \neq 0 \right\}$.
7. The irrational numbers are {nonrational numbers that correspond to points on a number line}.
8. The distance between a number b and 0 on a number line is $\lvert b \rvert$.

1.2 Day Two Assignment

pg. 15 - 17: 29 - 69 (o), 87 - 93 (o)