Section R.2: Real Numbers & Sets

Objectives:

- Use Set Notation.
- Understand the Classification of Numbers.
- Approximate Decimals by Rounding or Truncating.
- Plot Points on the Real Number Line.
- Use Inequalities to Order Real Numbers.

Properties of Real Numbers

Natural Numbers: Symbol: $\mathbb{N}$

Are counting numbers (positive numbers).

ex: 1, 2, 3, 4, ...

Whole Numbers: Symbol: ω

Are all of the natural numbers including 0.

[remember whole #'s have a "hole" (0) in it]

ex: 0, 1, 2, 3 ...

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Integers: Symbol: $\mathbb{Z}$

Are the whole numbers plus all of the negative numbers.

ex: $\ldots -3, -2, -1, 0, 1, 2, 3 \ldots$

Rational Numbers: Symbol: $\mathbb{Q}$

Can be expressed as a ratio of two integers. *The decimal form of rational numbers are either a terminating or repeating decimal.*

ratio?: Fraction

ex: $3.3\overline{3}$ $3\frac{1}{3}$ $-\frac{3}{4}$ 1.25 $1\frac{1}{4}$ -2 15 0

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Irrational Numbers: **Symbol:** $\mathbb{I}$

Are any numbers that are NOT rational. *Irrationals have deicmals that go on forever and do not repeat in a pattern.*

ex: π $\mathbb{Q}$ $\sqrt{5}$ $\sqrt{3}$ $\sqrt{7}$

3.14..... 2.71...

Real Numbers: **Symbol:** $\mathbb{R}$

Are all the numbers that you use in everday life, they are rational and irrational numbers combined.

ex: $\sqrt{3}$ 4.7 -3 $\frac{3}{4}$

$\sqrt{4}$ 0 2

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$\mathbb{R}$ - All real numbers.

Rational Numbers (Q)

Any number that can be expressed as a **Q**uotient (or fraction). This includes Repeating and terminating decimals.

Examples: $.\overline{3}$, 2, ¼, .075

Integers (Z)

Negative and positive whole numbers (no decimals or fractions). {..., -2, -1, 0, 1, 2 ...}

Whole Numbers (W)

0 plus all the positive numbers. {0, 1, 2, ...}

Natural (or Counting) Numbers (N)

Positive integers only. {1, 2, 3, 4...}

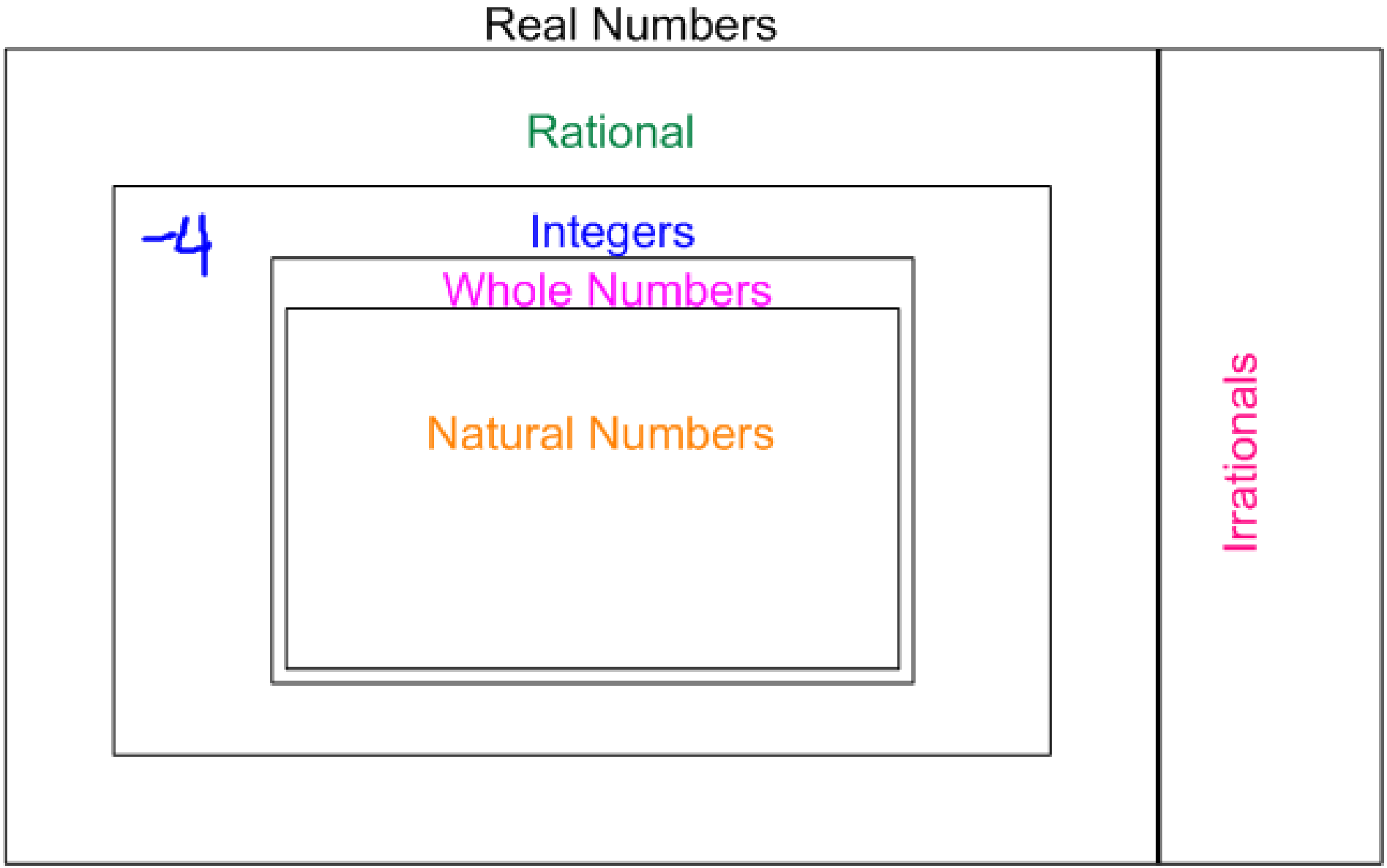
Irrational Numbers (I)

Any number that has a non-repeating and/or non-terminating decimal.

Examples: 3.1214323..., π, $\sqrt{2}$

-4 : ℤ, ℚ, ℝ

CLASSIFYING REAL NUMBERS



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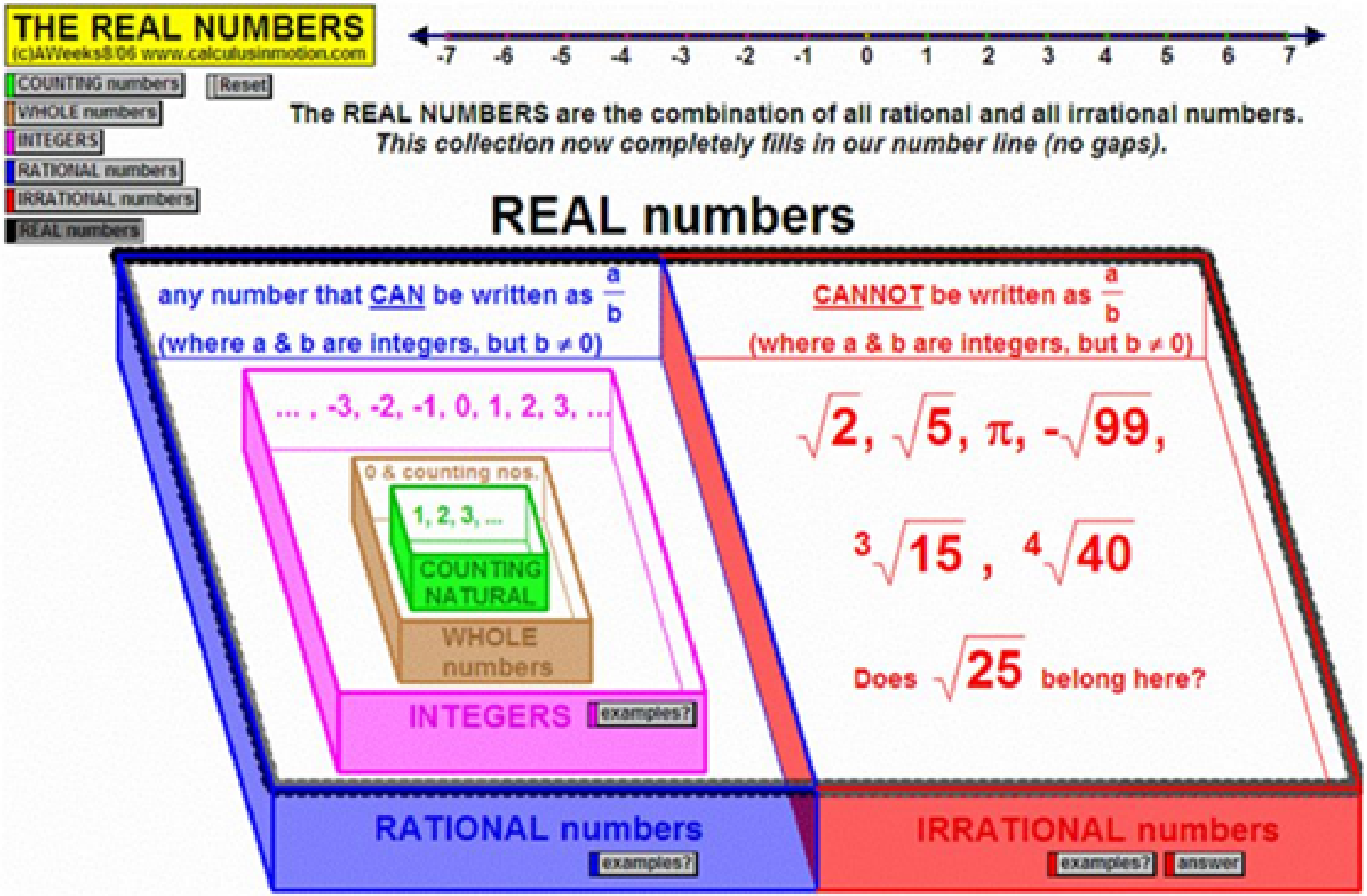

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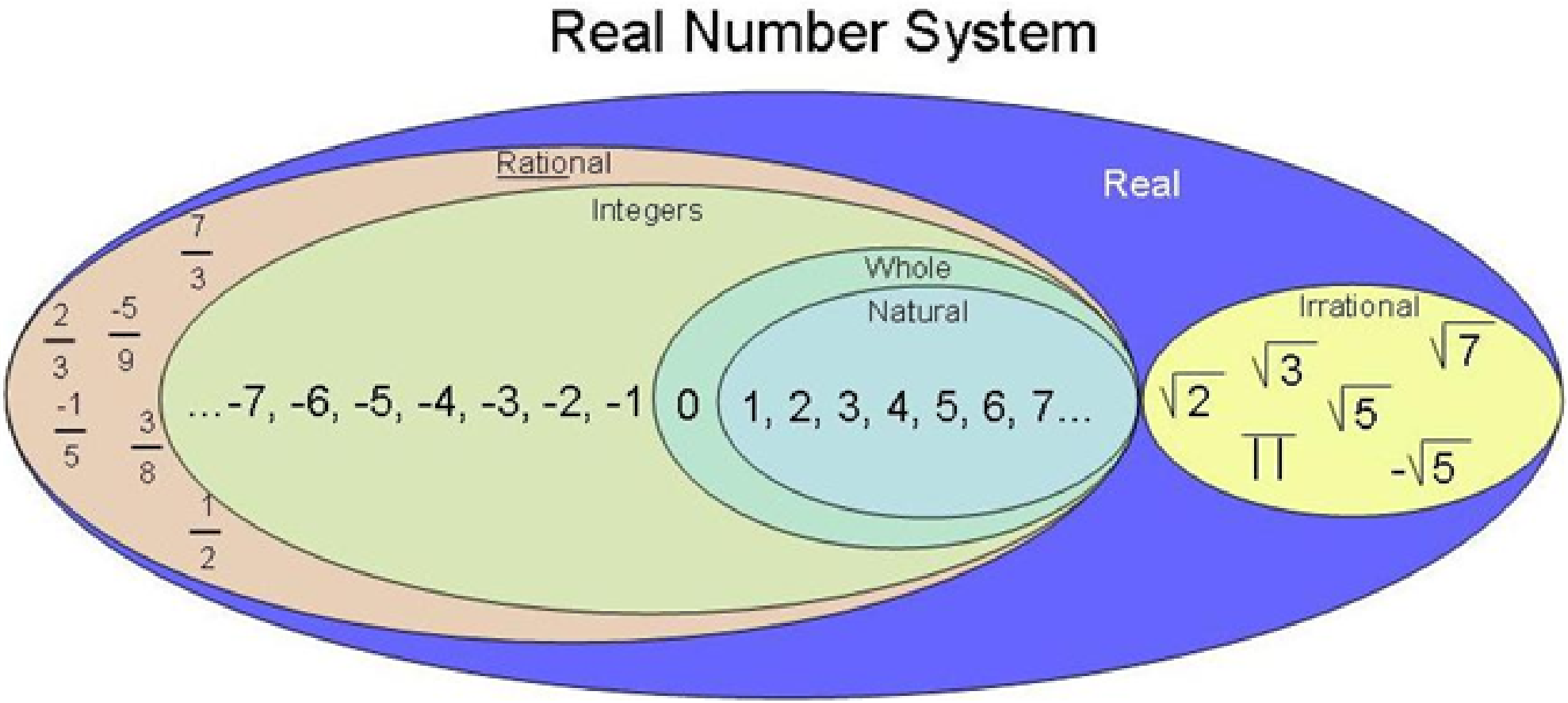

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Set Notation

A *Set* is a collection of "well-defined" objects.

"well-defined" means that there is a rule for determining whether or not the object is in the set.

Elements are the objects in a set.

We use curly braces { } to enclose the elements.

If we have set D that includes elements 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, then we would write it like:

D={0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

When we list the elements out like this, we are representing the set using the *Roster Method*.

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Example: Use the Roster Method to represent the set of all even digits. (E)

$E = \{0, 2, 4, 6, 8\}$

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Set Notation Cont.

Set-Builder Notation is a way to denote a set.

For Example: The numbers in set D={0, 1, 2, 3, 4, 5, 6, 7, 8, 9} are called Digits. Set-Builder Notation would be D={x|x is a digit}.

a.) Use Set-Builder Notation to represent the set of all even digits. (E)

$E = \{x \mid x \text{ is an even digit}\}$

b.) Use Set-Builder Notation to represent the set of all odd digits. (O)

$O = \{x \mid x \text{ is an odd digit}\}$

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Set Notation Cont.

We name sets by using capital letters.

Ex: We could name the set of even numbers E.
So, $E=\{x|x \text{ is an even number}\}$

When we talk about rules for sets, we usually use the sets A and B.

Most of our definitions will have sets A and B.

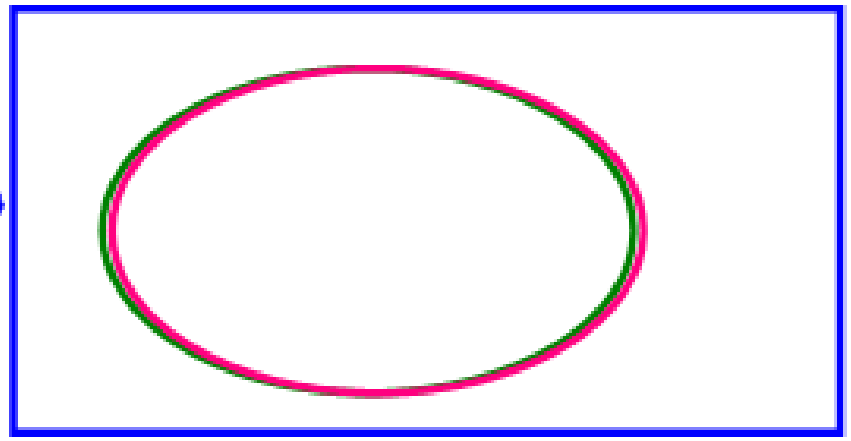
Set Notation Cont.

Equals

If two sets A and B have the SAME elements, then we can say that A equals B.

-write $A = B$

pink green

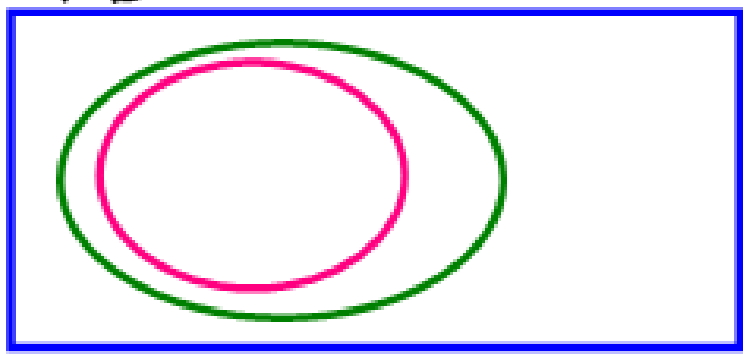


Subset

If every element of set A is also an element in set B, then we say that A is a subset of B.

-write $A \subseteq B$

ex: $A = \{1,2,3\}$ $B = \{1,2,3,4\}$



Set Notation Cont.

Proper Subset

If every element of set A is also an element in set B, BUT $A \neq B$, then we say that A is a **proper subset** of B.

-write $A \subset B$

ex: $A = \{1, 2, 3\}$ $B = \{1, 2, 3, 4, 5\}$

Empty Set or Null Set

If set A has no elements, it is called the "empty set" or the null set. (The empty set is a subset of every set.)

-write $\{\}$ or $\emptyset$

Set Notation Cont.

Example:

Let A={2, 4, 6, 8}, B={1, 2, 3, 4, 5}, C={2, 3, 4}, D={4, 6}.

Write True or False.

a.) D is a Subset of A $D \subseteq A$

T

b.) D is a Subset of B $D \subseteq B$

F because of 6

c.) C is a Subset of B $C \subseteq B$

T

Set Notation Cont.

Example:

Let A={2, 4, 6, 8}, B={1, 2, 3, 4, 5}, C={2, 3, 4}, D={4, 6}.

Write True or False.

d.) The Empty set is a subset of C. T

$\{\} \subseteq C$ or $\emptyset \subseteq C$

e.) B=C

F

Set Notation Cont.

Answers:

Let A={2, 4, 6, 8}, B={1, 2, 3, 4, 5}, C={2, 3, 4}, D={4, 6}.

a.) D is a Subset of A
True

b.) D is a Subset of B
False

c.) C is a subset of B
True

d.) The Empty set is a subset of C.
True

e.) B=C **False**

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Definitions- Set Notation Cont.

Element of

Element of means that the number (or element) is part of the set.

-write $\in$

ex: $A: \{1, 2, 3\}$

$3 \in A$

If an element is not in the set, write $\notin$

ex: $4 \notin A$

Section R.2: Real Numbers & Sets

Example - "Element of"

Write True or false.

a.) $3 \in \{x|x \text{ is a digit}\}$

T

b.) $1/2 \notin \{x|x=p/q, \text{ where } p \text{ and } q \text{ are digits, } q \neq 0\}$

F

c.) $a \in \{a, e, i, o, u\}$

T

APPROXIMATING DECIMALS:

There are two ways of approximating a decimal - rounding and truncation.

Truncating: drop all of the digits immediately following the specified final digit.

Rounding: look at the number immediately to the right of the final digit (example: if you want to round to the nearest thousandth, that's 3 digits after the decimal, so you will look at the 4 th digit). If the number is greater than or equal to 5, round the final digit up. If the number is 4 or smaller, leave the final digit as is. Truncate the rest of the digits.

Example: Approximate 7.7291 to 2 decimal places

a) by truncating:

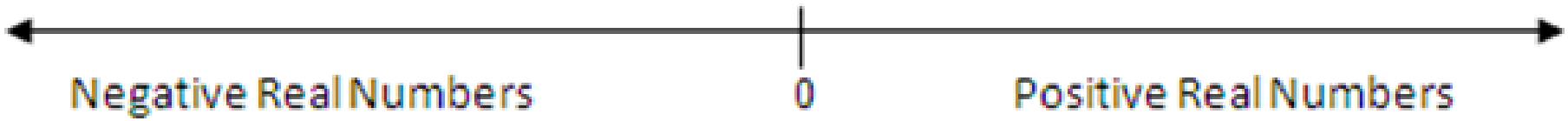
7.72

b) by rounding:

7.73

NUMBER LINES:

A number line is a way to visually describe the set of all real numbers. Zero (0) is called the "center" point or "origin". Positive real numbers extend to the right from zero, negative real numbers go to the left of zero.



If a number lies to the left of another number on the number line, we say that it's less than the number (<).

If a number lies to the right of another number on the number line, we say that it's greater than the number (>).

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Example: Put "<" or ">" in the blank.

a) $7 \_\_\_\_ 1$ $\quad 7 > 1$

b) $-8 \_\_\_\_ -3$ $\quad -8 < -3$

c) $2/5 \_\_\_\_ 0.4$ $\quad \frac{2}{5} = .4$

d) $3/8 \_\_\_\_ 1/3$ $\quad \frac{3}{8} > \frac{1}{3}$

$\frac{9}{24}$ $\qquad$ $\frac{8}{24}$

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We can also express word problems as values on a number line. If the value is "below" or "less than", we can show it as a negative integer.

Example: Express the following as an integer:
Death Valley is 282 feet below sea level.

-282 ft

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Can You?

Homework:

Pages 17-18

#11, 13, 19-38 all, 53,54

Alternative Homework:

Pages 17-18

#11, 13, 19-32 evens, 33-38 all, 53,54