COLLEGE PREP
SECTION R.2 - Sets & Classifications of Numbers

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.

DEFINITIONS:
<u>Set:</u> a collection of objects that follow a defining rule (ex: "all real numbers less than zero" or x<0). A set is named by using any capital letter.
<u>Roster Method:</u> Lists the set within curly braces. (Remember: a *list* of baseball teams is called a *roster*) S = {…}
<u>Set Builder notation:</u> Defines the name of the variable, then describes the rule that the set follows. (Tells how you would "build" the set. S= { variable| rule defining the set } The line | is read as "such that". So if you have a set of "x, such that x is greater than 4", you would write it as: S= {x | x>4 }
<u>Universal Set:</u> A set of all the elements that are of interest to us.

How do you choose whether to use roster method or set builder notation? If your set is a limited, well-defined group, use the roster method. If your set is never ending, or can include decimals or fractions, use the set builder notation.

<u>Example:</u> Express the set of all digits (digits are positive counting numbers) that are less than 5.
Roster method: D = { 0, 1, 2, 3, 4} (Note that it said "less than" 5, not "less than or equal to" 5)
Set Builder: D = {x | x is a digit less than 5} OR D = { x | x < 5}

<u>Notes:</u>

- When writing out sets in roster method, include elements only one time, even if the group you're pulling from contains an element more than once. YES: {1, 2, 3, 4} NO: { 1, 1, 2, 2, 3, 4}
- The "Empty Set" has no elements, and is shown using either empty curly braces { }, or ∅. -- **<u>NOT</u>** {∅}

SET NOTATION: These symbols are used to describe sets and how they relate to each other. We will use sets A and B to describe the relationships.

$\boldsymbol{A = B}$ Set A is **<u>equal to</u>** (or identical to) Set B.

$\boldsymbol{A \subseteq B}$ Set A is **<u>a subset of or is equal to</u>** Set B. Every element in set A is contained in set B. This is the more generic subset notation, because it can mean that the set or the same, or that A is smaller than B.

$\boldsymbol{A \subset B}$ Set A is a **<u>proper subset</u>** of Set B. Every element in A is contained in B, but B has other elements as well. (B is bigger.)

∈ Means "element of". So if A= { 3, 4, 5 }, then $4 \in A$. ∉ means "not an element of".

<u>Example:</u> Let A = {2, 4, 6, 8}, B = {1,2, 3, 4, 5}, C = {2, 3, 4}, and D = { 4, 6}. Are the following TRUE or FALSE?

a) $D \subseteq A$ True. The elements in D are contained in A as well.
b) $D \subseteq B$ False. B does not contain a 6, so D can't be a subset.
c) $C \subset B$ True. B contains all of the elements in C, AND it is a larger set.
d) $B = C$ False. B and C are not the same sets.
e) $4 \in B$ True. Set B contains the number 4.
f) $\emptyset \subseteq D$ True. The Empty Set is a subset of every set.

Example: True or False?

a) $5 \in \{1, 2, 3, 4\}$ False.

b) $-2 \in \{\ldots 2, 4, 6, 8, \ldots\}$ True. The set is even numbers. The ". . ." means the pattern continues before and after the listed elements.

c) Ohio $\in$ {states that border the Pacific Ocean} False.

CLASSIFYING NUMBERS: All numbers fall within subsets of the universal set "$\mathbb{R} - all\ real\ numbers$", which contains any number you can think of – decimal, fraction, giant, tiny, etc. They have letters that represent the sets. These letters are for convenience when classifying the numbers, because when we classify, we list ***every*** set the number is in.

$\mathbb{R}$ - 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, $\sqrt{2}$

Example: Classify the following numbers:

a) 2.1713456029.. Non-repeating, so Irrational, and also Real **Answer: I, R**

b) 6 It's a positive integer, so it's a Natural number, as well as everything above, so **Answer: N, W, Z, Q, R**

c) -4.25 It has a decimal that terminates, which means it's Rational, so **Answer: Q, R**

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.

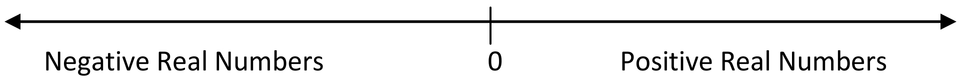
Rounding: look at the number immediately to the right of the final digit (example: if you want to round to the nearest thousandth, that's 3 digits after the decimal, so you will look at the 4th digit). If the number is greater than or equal to 5, round the final digit up. If the number is 4 or smaller, 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 (Just drop the 91)

b) by rounding: 7.73 (the number in the 3rd place is 9, so round the 2 up to 3)

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 (>).

Example:

a) 7 _______ 1 Answer: **>.** 7 lies to the right of 1 (It's bigger.)

b) -8 _______ -3 Answer: **<.** Be careful with negatives! The farther to the left, the larger the negative numbers!, So large negative numbers are really less than smaller negative numbers.

c) 2/5 ______0.4 Answer: **=.** Translate fractions to decimal places to help you decide.

d) 3/8 ______ 1/3 Answer: **>.** 3/8 = .375 and 1/3 = .333, so 3/8 is bigger.

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.

Answer: If we consider sea level as the "zero" in elevation, than Death Valley would be -282.

Homework: Pg. 17: #11, 13, 19-38 all, 53, 54 (24 problems)