SET THEORY

A Brief Introduction
Let’s Begin with an Activity

- Partner up with 2 of your neighbors
- Find out your similarities and differences. (Do you all like chocolate ice cream? Have you read Harry Potter? Etc…)
- Fill in each section of the Venn Diagram

Ita and Kim eat croissants every morning

Kim, Ita and Kate love Artemis!
What is a Set?

่า set is a collection of distinct objects.

Example: \{Book, Chair, Pen\}

In a set, order does not matter

Example: \{Book, Chair, Pen\} = \{Pen, Book, Chair\}

Your Venn Diagram is made of 3 sets of words describing you and your partners
Two Important Sets

- Empty (Null) Set: A set with no elements
  - Denoted by \( \emptyset \) or \{\}

- Universal Set: A set that contains all objects in the universe
  - Denoted by \( \Omega \)
The objects in a set are called “elements”

Let $S = \{\text{Emily, Kimerah, Katherine}\}$

Emily is said to be “an element of” set $S$ because she is part of that set

The shorthand notation for this is ‘$\in$’

“Emily $\in S$” translates to “Emily is an element of set $S$”
Union: The union of 2 sets is all the elements that are in both sets

- Denoted by ‘U’
- Example: Let A={1,2,3} and B={1,4,5}
- $A \cup B = \{1,2,3,4,5\}$
Basic Operations

- **Intersection:** The intersection of 2 sets is the set of elements they have in common.
  - Denoted by ‘∩’
  - Example: Let $A = \{1, 2, 3\}$ and $B = \{1, 4, 5\}$
  - $A \cap B = \{1\}$
Basic Operations

Set Difference: The set of elements in one set and not the other

- Denoted by ‘\’
- Example: Let A={1,2,3} and B={1,4,5}
- A\B = {2, 3}
Back to your Venn Diagram

- Identify ...
  - the union
  - the intersection
  - the set difference
Solutions: Union
Solutions: Intersection
Solutions: Set Difference
Why is Set Theory Important?

- It is a foundational tool in Mathematics.
- The idea of grouping objects is really useful.

**Examples:**

- **Complexity Theory:** Branch in Comp. Sci. that focuses on classifying problems by difficulty.
  - I.e. Problems are sorted into different sets based on how hard they are to solve.

- The formal, mathematical definition of Probability is defined in terms of sets.
SET: The Game

Rules

- Each card is unique in 4 characteristics: color, shape, number, and shading
- 3 cards form a SET if each characteristic is the same for all cards or different for all cards
- Yell SET to claim cards
- Player with the most SETs wins
This is a SET

COLOR: ALL red
SHAPE: ALL ovals
NUMBER: ALL twos
SHADING: ALL different
This is NOT a SET

SHAPE: ALL Squiggly
NUMBER: ALL twos
SHADING: ALL different
COLOR: NOT ALL red → NOT a SET
Is this a SET? Yes

SHAPE: ALL different
NUMBER: ALL different
SHADING: ALL striped
COLOR: ALL different
Is this a SET? No

Magic Rule: If two are _______ and one is not, then it is not a SET

SHAPE: ALL diamonds
NUMBER: ALL ones
COLOR: ALL different
SHADING: NOT ALL hollow
Let’s Play!