Lab 1

Set Models. Factors, Multiples & Set Model Applications

Objectives:

1. The teacher will understand how to work with sets and will use appropriate set terminology to describe sets and set operations.

2. The teacher will understand how to model set intersection and union with attribute blocks and in general with numbers as set elements.

3. The teacher will use rectangular cube arrays to show the factors and multiples of numbers and use appropriate terminology when describing factors, multiples and divisors.

4. The teacher will use set models to determine greatest common factors and least common multiples (given 2 or more numbers).

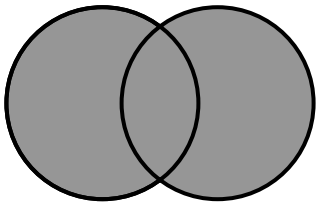
Terms and Ideas to Know

- A **SET** is a collection of objects called **ELEMENTS**.

- A set can be described by:
  - Listing the elements, for example S ={1, 2, 3}. Here we say "The set S consists of the elements 1, 2 and 3" or "The set S contains the elements 1, 2 and 3"
  - Describing the elements with words, for example S = {apple, pear}. Here we might say "The set S is an apple and a pear".

- The **UNION** of two or more sets is the set containing ***all of the COMBINED elements*** of the two or more sets. The symbol for union is ∪**.**

SET A **SET B**

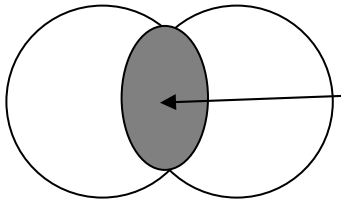


SET A ∪ SET B =
All of the elements in all of Set A and in all of Set B

These set pictures are **VENN DIAGRAMS**

- The **INTERSECTION** of two or more sets is the set containing ***all of the SHARED elements*** of the two or more sets. The symbol for intersection is ∩**.**

SET A **SET B**



SET A ∩ SET B =
All of the elements that Set A and Set B share

- The **EMPTY SET** is a set containing no elements. We denote the empty set by {}.

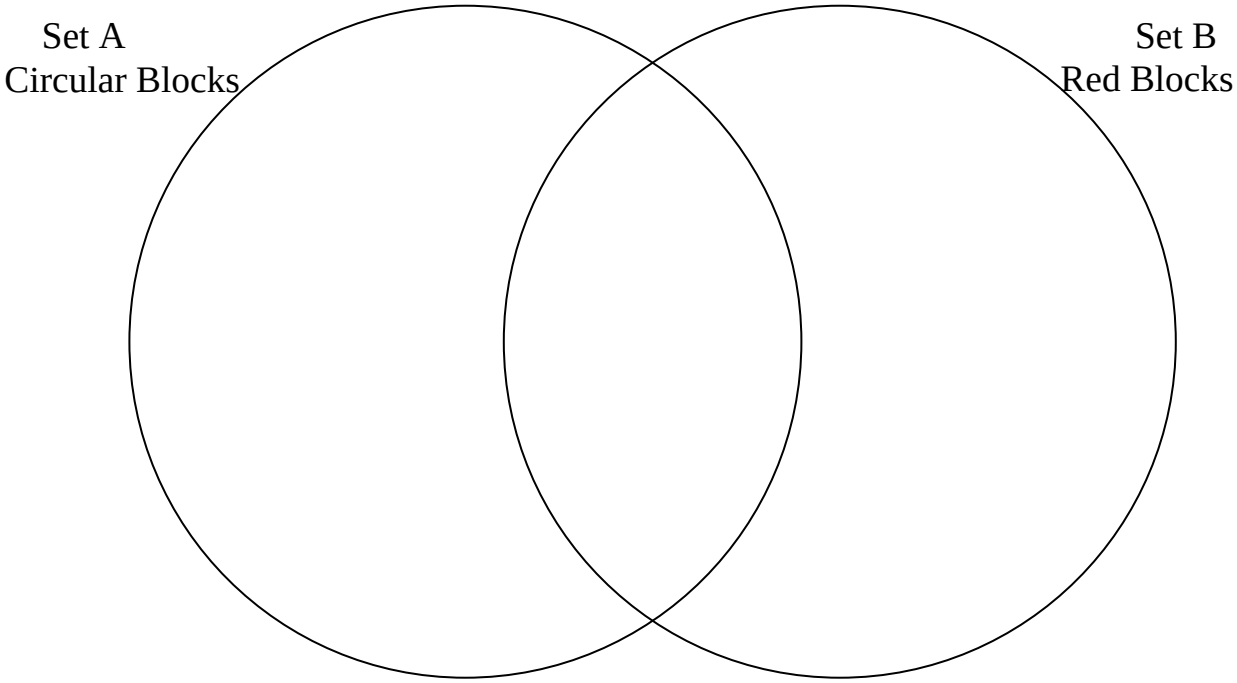
- If the intersection of two sets is empty, we say these sets are **DISJOINT SETS**

TOPIC: SET MODELS

- ***Materials: ATTRIBUTE BLOCKS***

1. Look at the attribute blocks, the small box containing a variety of colored shapes. An attribute is a characteristic or aspect of a particular object. Look at all of the blocks. These blocks can be classified as having four attributes. What are the four attributes?

2. a. Using the attribute blocks, place all the circular pieces in the circle marked Set A and place all the red pieces in the circle marked Set B in the following Venn Diagram (you don't have to write in the circles)



b. Where do you place the blocks that are both red and circular in the Venn Diagram?

c. Pick one of the blocks that is both red and circular. Does this block belong to the set of circular blocks, the set of red blocks, both of these sets or neither of these sets?

d. All of the blocks in Set A combined with all of the blocks in Set B is called the UNION of Set A and Set B.

Describe SET A $\cup$ SET B, use a complete sentence that includes the attribute words: Red / Circular.

Describe SET A $\cap$ SET B, use a complete sentence that includes the attribute words: Red / Circular.

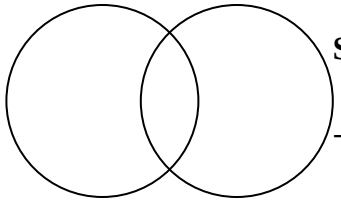
3. ***Your Turn:*** (Use the attribute blocks) For each listed pair in the table below:

- Describe (make up) new sets of blocks that have the properties listed in the gray bands
- LABEL each Venn Diagrams with attribute words. Use attribute words to fill in any blanks.
- Working with your group, use complete sentences to describe the **union** of these sets and to describe the **intersection** of these sets. Use appropriate attribute words (blue, circle, small, etc.)

PAIR ONE Set A and Set B have at least one common element	
Set A	***Set B***

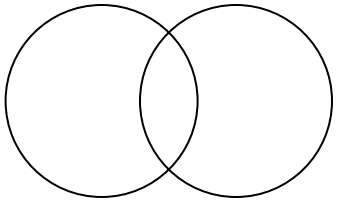
SET A **SET B**

_____ _____



Shade the sets to show Set A ∪ Set B

SET A **SET B**



Shade the sets to show Set A ∩ Set B

Set A ∪ Set B = _____ **Set A ∩ Set B = _____**

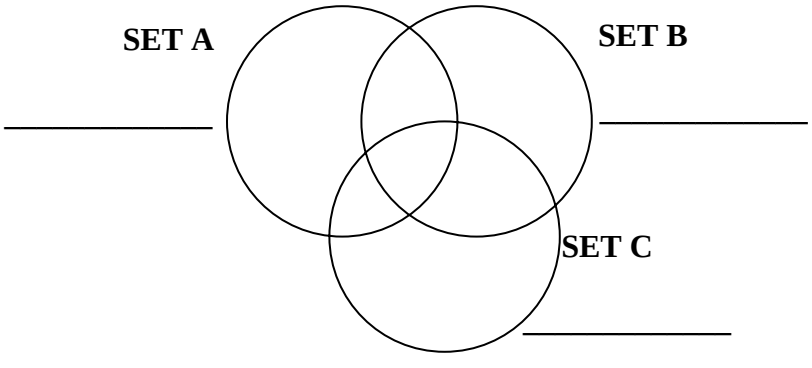
PAIR TWO ***Set A is completely contained in Set B, but not exactly the same as Set B***	
Set A	***Set B***
Set A ∩ Set B	
Set A ∪ Set B	

As a group, discuss how to draw the Venn Diagram for this scenario to show Set A contained in Set B. Draw two Venn Diagrams, shade one to show union, shade one to show intersection. Label everything with attribute words.

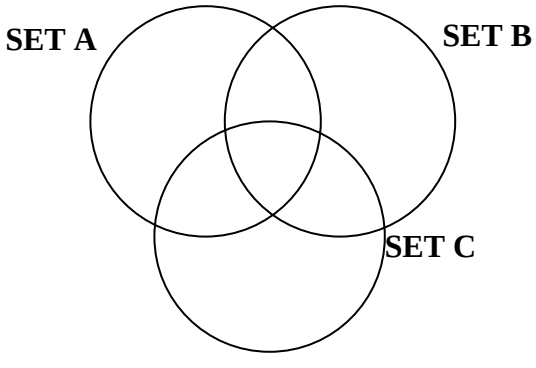
PAIR THREE ***Set A and Set B have no common elements***	
Set A	***Set B***
Set A ∩ Set B ***What word(s) describes this intersection?*** ***What set word describes how Set A and Set B are related to each other?***	
Set A ∪ Set B	

As a group, discuss how to draw the Venn Diagram for this scenario to show Set A disjoint from Set B. Draw two Venn Diagrams, shade one to show union, shade one to show intersection. Label everything with attribute words.

TRIPLE FOUR ***Set A, Set B and Set C have at least one common element in each intersection***			
Set A	***Set B***	***Set C***	
Set A ∩ Set B	***Set A ∩ Set C***	***Set B ∩ Set C***	***Set A ∩ Set B ∩ Set C*** ***Label the diagram***
Set A ∪ Set B	***Set A ∪ Set C***	***Set B ∪ Set C***	***Set A ∪ Set B ∪ Set C*** ***Label the diagram***



Shade the sets to show Set A ∪ Set B ∪ Set C



Shade the sets to show Set A ∩ Set B ∩ Set C

Set A ∪ Set B ∪ Set C = _____ **Set A ∩ Set B ∩ Set C= _____**

NUMBER TERMS: We know that 6 = 2 x 3.

- We say that 6 is a **MULTIPLE** of 2
- We say that 2 is a **FACTOR** of 6
- We say that 6 is a **MULTIPLE** of 3
- We say that 3 is a **FACTOR** of 6

TOPIC: FACTORS, MULTIPLES & SET MODEL APPLICATIONS

- ***Materials: COLOR TILES***

4.

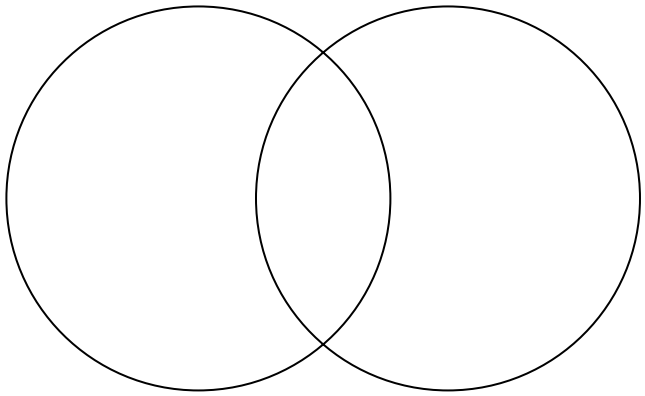
a. (Each group member) Take out 12 color tiles. How many ways can you arrange all of the color tiles in a (solid) rectangular shape? Draw a picture of each rectangular shape here, label the edges with the number of color tiles along that edge.

b. You should have 6 different numbers listed as edges in a. What are these numbers called?

c. (Each group member) Take out 18 color tiles. How many ways can you arrange all of the color tiles in a (solid) rectangular shape? Draw a picture of each rectangular shape here, label the edges with the number of color tiles along that edge.

d. List all of the different numbers from a. in the first circle and all of the different numbers from c. in the second circle. Using the appropriate word (from b) fill in the blanks.

Set A = _____of 12 Set B = _____of 18



e. Describe the intersection of Set A and Set B.

5. Suppose that you wish to explain how to find the **GREATEST COMMON FACTOR** of two numbers to a student. Using the above steps as a general guide, explain how you would share finding the GCF(6, 8) with a student. Discuss this with your group members and show all of the (completed) steps here.

6. Would your procedure still work for finding the GCF of three numbers? What steps would change?

7. What happens when you try your procedure on 12 and 25? What does this tell you about 12 and 25?

LAB ONE DISCUSSION QUESTIONS

As a group, discuss and answer the following questions. Feel free to also discuss/talk with the other groups.

1. What mathematical knowledge would you want your students to KNOW prior to introducing SET MODELS?

2. What mathematical knowledge would you want to EMPHASIZE while introducing SET MODELS?

3. Suppose your students have learned about SET MODELS by using manipulatives and you tell them that Set A={All Girls} and Set B={All people with blond hair}. You then pick a random person Pat from the class. You then ask them:
    a. "Is Pat in $A \cap B$?" What would they do to find out the answer to this question?

    b. "Is Pat in $A \cup B$?" What would they do to find out the answer to this question?

4. What mathematical knowledge would you want your students to KNOW prior to introducing FACTORS AND MULTIPLES?

5. What mathematical knowledge would you want to EMPHASIZE while introducing FACTORS AND MULTIPLES?

6. Suppose your students have learned about FACTORS and MULTIPLES by using manipulatives and you ask them "Is number A a factor/multiple of number B?"

    a. How can a student answer that question by using manipulatives?

    b. How can a student answer that question by using a pencil and paper (or calculator)?