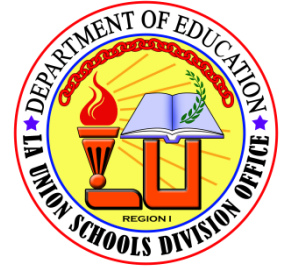


7



Mathematics

Quarter 1 – Module 1: Sets



AIRs - LM

MATHEMATICS 7

Quarter 1 – Week 1 - Module 1: Sets

First Edition, 2021

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La Union Schools Division

Region I

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7

Mathematics

**Quarter 1 – Week – 1 Module 1:
Sets**

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.



Target

“School of fishes” is a phrase we use to refer to a group of fish. Every fish is a member of this school. “A pride of lions” is a phrase used to refer to a group of lions. “A troop of monkeys” refers to a group of monkeys. What do you call a group of birds?

As individuals grow up, they experience groups of things such as family, group of playmates, group of toys, group of books and many more. Any group or collection of objects is called a set.

The concept of sets is used in all areas of Mathematics. You have been working with sets of numbers and the relationship among them.

After going through this module, you are expected to:

Learning Competencies:

- illustrate well-defined sets, subsets, universal sets, null set, cardinality of sets, union and intersection of sets and the difference of two sets
- solve problems involving sets with the use of Venn Diagram.

Learning Objectives:

1. Describe and illustrate well define sets and null sets.
2. Describe and illustrate universal set and subsets.
3. Define and describe the union and intersection of sets and the complement of a set.
4. Identify the elements of a set.
5. Differentiate between finite and infinite sets.
6. Use Venn diagrams to represent sets, subsets and set operations.
7. Solve problems involving sets using Venn diagrams.

Before we start the lesson, find out how much you already know about these topics.

PRE – ASSESSMENT

Directions: Read carefully each statement below. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following is a well-defined group of elements that share a common characteristic?

- A. cardinality B. elements C. set D. diagram

2. How do you call the number of elements in a set?

- A. cardinality B. complement C. intersection D. union

3. Which of the following is a well-defined set?

- A. { a happy child }
B. { a popular TV series }
C. { a favorite book by my classmates }
D. { a Mathematics book in the school library }

4. What are the elements in set A = letters in the word BOOK?

- A. $A = \emptyset$ B. $A = \{ B, K \}$
C. $A = \{ B, O, K \}$ D. $A = \{ B, O, O, K \}$

5. Which symbol completes the statement $\{ 6 \} ___ \{ 1, 3, 6 \}$ correctly?

- A. \in B. \subset C. \notin D. $\not\subset$

6. Given sets A and B, how do you call all elements that are found in both sets?

- A. intersection B. subset C. union D. universal

7. Which of the following shows the intersection of sets A and B?

- A. $A \cup B$ B. $A \cap B$ C. $A \not\subseteq B$ D. $A \in B$

8. Consider $M = \{ G, A, M, E \}$. What is $n(M)$?

- A. 1 B. 2 C. 3 D. 4

$U = \{ 0, 1, 2, 3, 4, 5, 6, 7 \}$, $A = \{ 1, 3, 5, 7 \}$, $B = \{ 0, 2, 4, 6 \}$, and $C = \{ 0, 1, 2, 3, 4 \}$

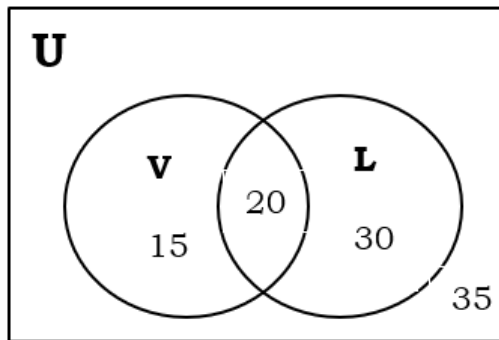
9. What is $A \cup C$?

- A. $\{ \}$ B. $\{ 1, 3 \}$
C. $\{ 0, 2, 4 \}$ D. $\{ 0, 1, 2, 3, 4, 5, 7 \}$

10. How about $A \cap B$?

- A. $\{ \}$ B. $\{ 0 \}$
C. $\{ 2, 4, 6 \}$ D. $\{ 0, 1, 2, 3, 4, 5, 6, 7 \}$

The Venn diagram shows students involvement in two sports – volleyball and lawn tennis.



How many students were

11. surveyed?

- A. 100 B. 101 C. 102 D. 103

12. into volleyball only?

- A. 15 B. 20 C. 30 D. 35

13. into Lawn tennis only?

- A. 15 B. 20 C. 30 D. 35

14. into both volleyball and lawn tennis?

- A. 15 B. 20 C. 30 D. 35













15. neither into volleyball nor lawn tennis?

- A. 15 B. 20 C. 30 D. 35



Jumpstart

Look at the objects below:

			
t-shirt	orange	daisy	ball
			
doll	short	kalachuchi	lemon
			
gumamela	tomato	helmet	toy car

Questions:

1. How can you group the objects? Name each group.
2. How many groups can you form?
3. Is there an object that belongs to more than one group?



Discover

A set is a group or collection of objects. If an object belongs to the set, it is called a member or an element of the set denoted by the symbol " \in ". If the object does not belong to the set, it is not an element of the set denoted by the symbol " \notin ". Capital letters are usually used as names of sets.

Examples:

$$A = \{a, e, i, o, u\}$$

Set A is the set of vowel letters in the English alphabet.

$a \in A$, read as "a is an element of set A"

$b \notin A$, read as "b is not an element of set A"

A set is said to be well-defined set if we know exactly if an object is an element of the set.

Examples:

Set B = { whole numbers less than 5 }

Since we can give directly the elements of the set which are 0, 1, 2, 3, and 4,

Set B is a **well-defined** set.

Set C = { beautiful girl in the school }

A girl may be beautiful to someone but for others she is not.

Set C is **not well-defined** set.

Two Ways of Defining a Set:

1. Roster Method or Tabular Form (Listing the elements)

We may indicate a set by **listing the elements** and enclosing them in braces.

Examples:

Set D is the set containing letters in the word Mathematics

Using the roster method:

$$D = \{m, a, t, h, e, i, c, s\} \text{ or } D = \{a, e, i, c, h, m, t, s\}$$

The order of enumeration of elements of a set does not affect the set itself.

2. Rule Method or Set- Builder Notation. (Describing the elements)

We may indicate a set by enclosing in braces a **descriptive phrase**.

Examples:

$$E = \{ 1, 2, 3, 4, 5 \}$$

Using the rule method: $E = \{ \text{counting numbers less than six} \}$ or

$E = \{ x | x \text{ is a counting number less than } 6 \}$, read as “E is the set of all x such that x is a counting number less than 6.

The **cardinality of Set A** denoted by $n(A)$ is the number of elements in a given set.

Example:

$$F = \{ 1, 2, 3, 4, 5 \}$$

$n(F) = 5$, read as “the cardinality of set F is 5”

$$G = \{ \}$$

$n(G) = 0$, read as “the cardinality of set G is 0”

A set with no members is called an **empty set** or **null set**. It is denoted by the symbol $\{ \}$ or the Danish letter \emptyset .

Examples:

$H = \{ \text{positive whole numbers less than } 0 \}$, since there are no positive whole numbers less than 0 then set H is an empty set of $H = \{ \}$ or \emptyset .

$I = \{ \text{triangle with 4 sides} \}$, since triangle has only 3 sides then set I is an empty set or $I = \{ \}$ or \emptyset .

A set whose elements can be counted regardless of how difficult the counting maybe is called a **finite set**. Empty set is also called a finite set.

Examples:

$$J = \{ 1, 3, 5, 7 \}$$

$$K = \{ \text{colors of the rainbow} \}$$

A set with an unlimited number of elements is called an **infinite set**.

Examples:

$$L = \{ 0, 1, 2, 3, \dots \}$$

The 3 dots are called **ellipsis** which indicated that the element continues in that pattern.

$$M = \{ x / x \text{ is an integer} \}$$

Universal Sets and Subsets

A **universal set** is a set that consists of all the elements being considered in a particular problem. The universal set is represented by the letter U.

Examples:

- a. Suppose we are considering whole numbers, then:

$$U = \{ 0, 1, 2, 3, 4, \dots \}$$

- b. If set $A = \{ 1, 2, 3, 4 \}$ Set $B = \{ 5, 6, 7, 8 \}$ and $C = \{ 2, 4, 6, 8, 10 \}$, then:

$$U = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \}$$

Set A is said to be a **subset** of set B if every element of A is also an element of B. We symbolize this concept by $A \subseteq B$ read as “A is a subset B” or “A contained in B”

Set A is said to be a **proper subset** of B if every element of A is also an element of B and B contains at least one element which is not in A. We symbolize this concept by $A \subset B$.

Set A is said to be an **improper subset** of B if all the elements of A are also the elements of B or simply they are equal sets. We symbolize this concept as $A \subseteq B$.

Power Set is the set of all the subsets of a given set.

Examples:

Find all the subsets of $A = \{ 1, 2, 3 \}$

Proper Subset: $\{ 1 \}, \{ 2 \}, \{ 3 \}, \{ 1, 2 \}, \{ 1, 3 \}, \{ 2, 3 \}, \{ \}$

$\{ 1 \} \subset A$, read as “ $\{ 1 \}$ is a proper subset of A” because not all the elements in A are found in $\{ 1 \}$ and 1 is an element of A.

Improper Subset: $\{ 1, 2, 3 \}$

$\{ 1, 2, 3 \} \subseteq A$, read as “ $\{ 1, 2, 3 \}$ is an improper subset of A” because all the elements in A are also in $\{ 1, 2, 3 \}$

Power Set: $\{ \{ \}, \{ 1 \}, \{ 2 \}, \{ 3 \}, \{ 1, 2 \}, \{ 1, 3 \}, \{ 2, 3 \}, \{ 1, 2, 3 \} \}$

$\{ 4 \} \not\subset A$, read as “ $\{ 4 \}$ is not a subset of A” because A only contains the elements 1, 2 and 3.

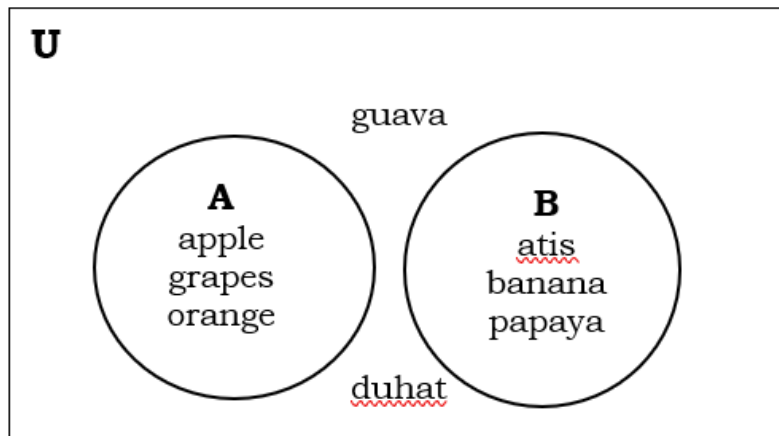
$3 \not\subset A$, read as “3 is not a subset of A”, because 3 is only an element.

Note: Empty set is always a proper subset of any set with at least one element.

Venn Diagram

A Venn diagram, which was first introduced by John Venn, is a diagram that shows relationship among different finite sets.

Examples:

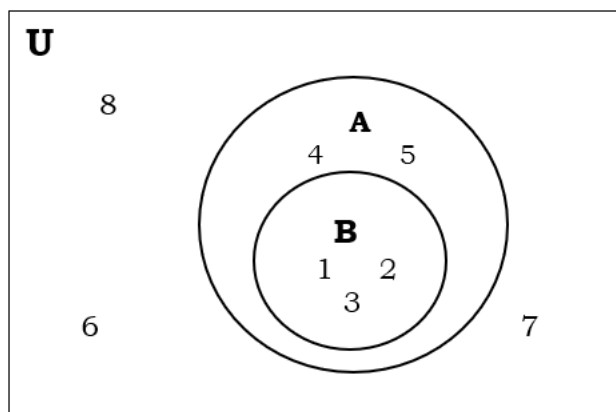


$U = \{ \text{apple, grapes, orange, atis, banana, papaya, guava, duhat} \}$

$A = \{ \text{apple, grapes, orange} \}$

$B = \{ \text{atis, banana, papaya} \}$

A and B are **disjoint sets** because they have no elements in common.



$U = \{ 1, 2, 3, 4, 5, 6, 7, 8 \}$

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

$B = \{ 1, 2, 3 \}$

$B \subset A$ since the elements of B are found in A.

A and B are **joint sets** because they have common elements.

Operations on Sets

Intersection and Union

The intersection of two sets A and B denoted by $A \cap B$ is the set of all elements which are common to both A and B.

The union of two sets A and B denoted by $A \cup B$ is the set of all elements which belong to A or B or to both A and B.

Examples:

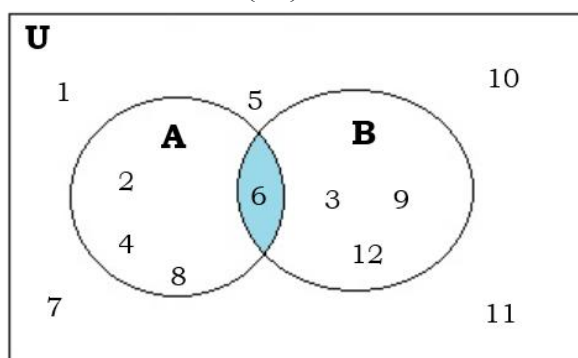
Given: $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

$A = \{2, 4, 6, 8\}$

$B = \{3, 6, 9, 12\}$

- a) Find $A \cap B$.
- b) Draw a Venn diagram to show the intersection.

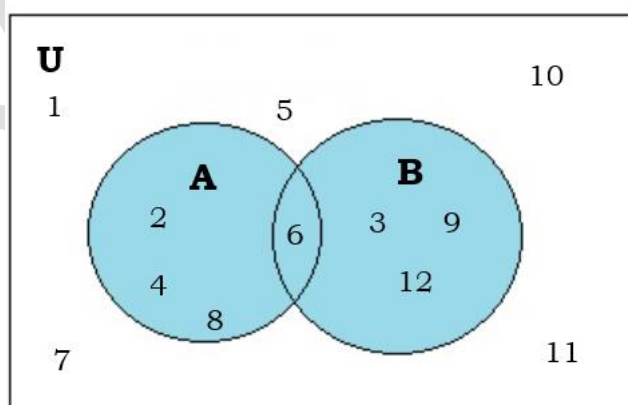
Answer: $A \cap B = \{6\}$



Note: The shaded area with the element is the answer.

- c) Find $A \cup B$.
- d) Draw a Venn diagram to show the union.

Answer: $A \cup B = \{2, 3, 4, 6, 8, 9, 12\}$



Note: The shaded areas with the elements are the answer.

Complement of a Set and Difference of Two Sets

The **complement** of a set A denoted by A' is the set of all elements in the universal set that are not in A.

The **difference** of sets A and B denoted by $A - B$ is the set of all elements which belongs to A but do not belong to B.

Examples:

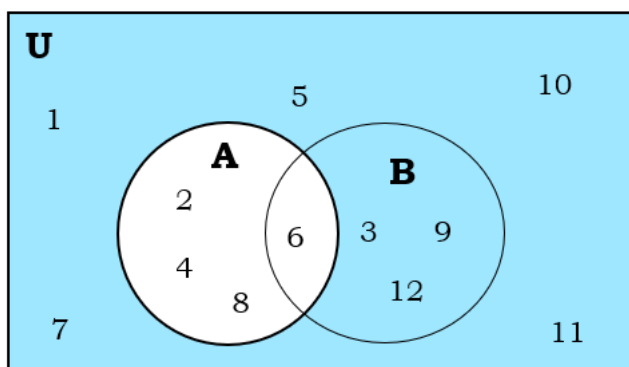
Given: $U = \{ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 \}$

$A = \{ 2, 4, 6, 8 \}$

$B = \{ 3, 6, 9, 12 \}$

- a) Find A' .
- b) Draw a Venn diagram to illustrate A' .

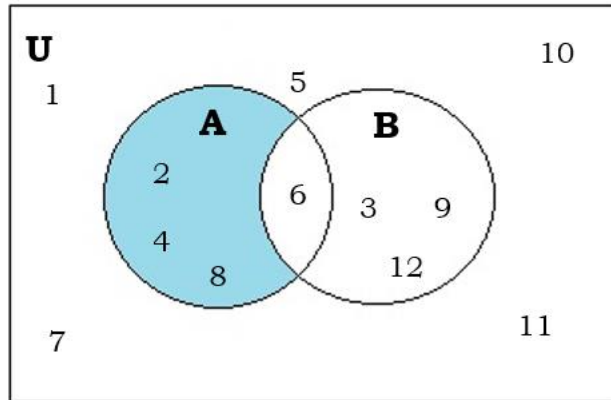
Answer: $A' = \{ 1, 3, 5, 7, 9, 10, 11, 12 \}$



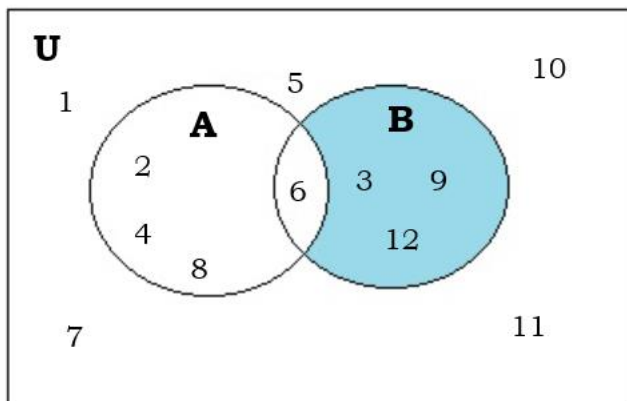
Note: The shaded areas with the elements are the answer.

- c) Find $A - B$ and $B - A$.
- d) Draw a Venn diagram illustrating $A - B$ and $B - A$.

Answers: $A - B = \{2, 4, 8\}$



$$B - A = \{3, 9, 12\}$$



Note: The shaded areas with the elements are the answer.

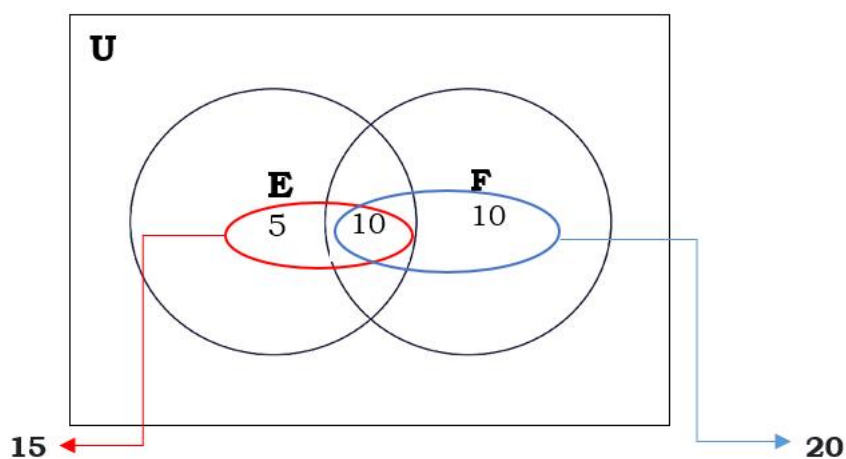
Solving Problems Using Venn Diagram

To solve problems using Venn diagram we must consider these coordinating conjunctions: “and” if we are referring to intersection and “or” if we are referring to union.

Example:

In a class, 15 like English, 20 like Filipino and 10 like both English and Filipino. How many students are there in all?

Solution:

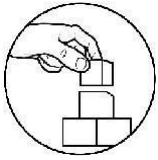


Let $n(E)$ = number of students who like English

$n(F)$ = number of students who like Filipino

$n(E \cap F)$ = number of students who like both English and Filipino

So $n(E \cup F) = 25$



Explore

A. Determine if the given is a well – defined set or not well – defined set.

1. The set of all cities in the Philippines.
2. The set of all rich people in Metro Manila.
3. The set of all Math Teachers in a particular school.

B. Tell whether the statement is TRUE or FALSE

Given: $A = \{ 1, 3, 5, 7, 9, 11 \}$

$B = \{ \text{even numbers less than } 14 \}$

$C = \{ \text{whole numbers between } 8 \text{ to } 14 \}$

1. $1 \in A$
2. $14 \in B$
3. $5 \in C$

C. Determine whether the set is finite or infinite. If it is a finite set, give its cardinality.

1. The set of first five odd counting numbers.
2. The set of all prime numbers.
3. $\{ a, b, c, \dots, y, z \}$

D. Tell whether the set is an empty set or not.

1. The set of polar bears living in the Sahara desert
2. The set of even numbers in the set: $A = \{ \text{prime numbers} \}$
3. The set of cars with 2 doors

E. Use the roster or tabulation method to specify the set given below.

1. The days of the week
2. The months ending with “ber”
3. The last ten letters of the English alphabet

F. Use the rule method or the set builder notation to specify the set given below.

1. $H = \{ 2, 4, 6, 8, 10 \}$
2. $I = \{ 10, 20, 30, \dots \}$
3. $J = \{ \text{January, June, July} \}$

G. Fill in each blank with \in , \notin , \subset , \subseteq , $\not\subset$

1. $\{4\}$ ____ $\{1, 2, 4\}$
2. 12 ____ $\{\text{even numbers}\}$
3. $\{5, 6, 7\}$ ____ $\{6, 7, 5\}$

H. Classify each statement as TRUE or FALSE

If $A = \{1, 2, 3, 4, 5\}$, $B = \{2, 3, 4\}$ and $C = \{2, 4, 5\}$

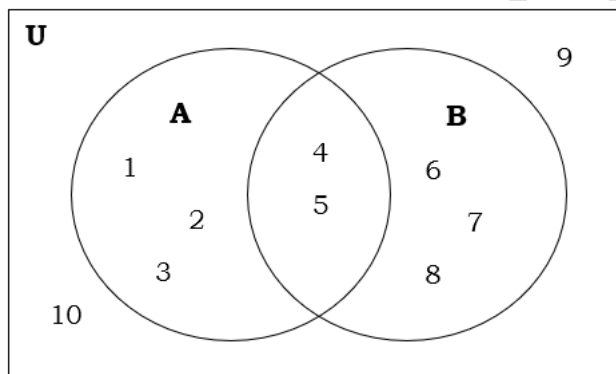
1. $A \subseteq B$
2. $B \subset C$
3. $C \not\subset B$

I. Listing the subsets

For the set $\{a, b, c, d\}$, list all subsets

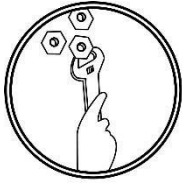
1. Containing four elements
2. Containing three elements
3. Containing two elements

J. Given the Venn diagram,



find the following:

- | | | |
|---------------|---------------|------------|
| 1. $A \cup B$ | 2. $A \cap B$ | 3. A' |
| 4. B' | 5. $A - B$ | 6. $B - A$ |

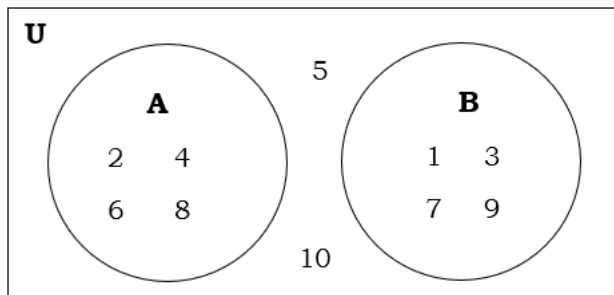


Deepen

Activity 1:

Answer the following questions using the figures below:

Figure 1



1. Give the elements of the following sets using figure 1.

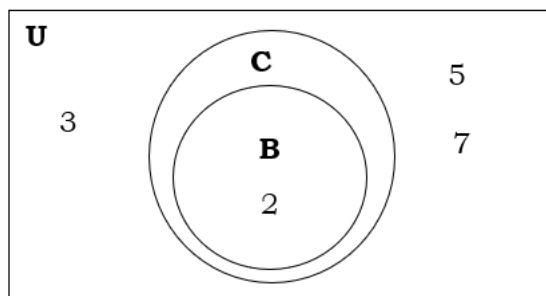
$U =$

$A =$

$B =$

2. What can you say about Set A and set B?

Figure 2

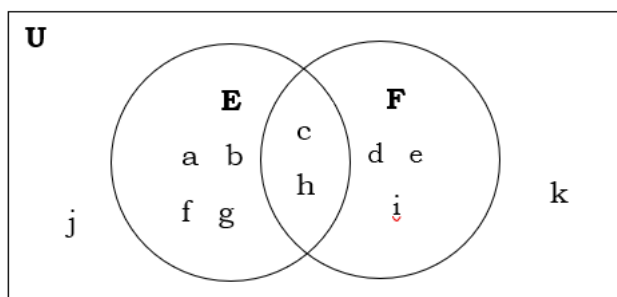


3. Using figure 2:

a. Yes or no: Is $B = C$? Why?

b. Yes or no: Is $B \subseteq C$? Why?

Figure 3



4. Give the elements of the following sets using figure 3.

U =

E =

F =

5. Are Set E and Set F joint sets or disjoint sets? Why?

Activity 2:

In a birthday party attended by 40 guests, a dance contest was held. The following participated in the dance contest:

18 danced the hip – hop dance

6 danced the hip – hop and the ballroom dance

20 danced the ballroom dance

4 danced the hip – hop and the folk dance

15 danced the folk dance

2 danced the three pieces

11 danced the ballroom and the folk dance

Questions:

1. How many danced the hip – hop dance only?

2. How many danced the ballroom dance only?

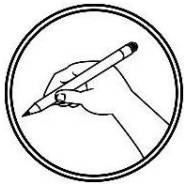
3. How many danced the folk dance only?

4. How many danced the hip – hop dance and folk dance but not ballroom dance?

5. How many danced the hip – hop dance and ballroom dance but not folk dance?

6. How many danced the ballroom dance and folk dance but not hip – hop dance?

7. How many did not dance any of the three pieces?



Gauge

Directions: Read carefully each statement below. Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following will make the statement, "Cow ____ the set of all farm animals." true?

- A. \in B. \subseteq C. \notin D. $\not\subseteq$

2. Which of the following is a finite set?

- A. The set of all whole numbers.
B. The set of all stars in the universe.
C. The set of soldiers in the Philippine army.
D. The set of counting numbers greater than 10.

3. How do you describe this set in words: $\{2, 3, 5, 7, 11, 13\}$

- A. Set of odd numbers less than 13.
B. Set of whole numbers less than 13.
C. Set of prime numbers less than 13.
D. Set of prime numbers from 2 to 13.

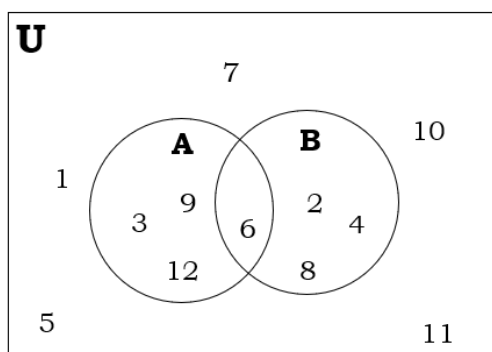
4. How do you write $\{\text{even whole numbers between 3 to 15}\}$ using the roster method?

- A. $\{5, 7, 9, 11, 13\}$ B. $\{4, 6, 8, 10, 12, 14\}$
C. $\{3, 5, 7, 9, 11, 13, 15\}$ D. $\{2, 4, 6, 8, 10, 12, 14, 16\}$

5. What symbol should be written in the blank space to make the statement $\{R, A, Y, M\}$ ____ $\{M, A, R, Y\}$ correct?

- A. \subset B. \in C. $\not\subset$ D. \subseteq

For items 6 – 10. Refer to the Venn diagram.



What is:

6. $A \cup B$?

A. $\{1,3,4,6,8,9,12\}$

B. $\{2,3,4,6,8,9,12\}$

C. $\{3,4,5, 6,8,9,12\}$

D. $\{4,5,6,7,8,9,12\}$

7. $A \cap B$?

A. $\{ 3 \}$

B. $\{ 4 \}$

C. $\{ 5 \}$

D. $\{ 6 \}$

8. $A - B$?

A. $\{ 2,4,8 \}$

B. $\{ 2,4,6,8 \}$

C. $\{ 3,9,12 \}$

D. $\{ 3,6,9,12 \}$

9. $B - A$?

A. $\{ 2,4,8 \}$

B. $\{ 2,4,6,8 \}$

C. $\{ 3,9,12 \}$

D. $\{ 3,6,9,12 \}$

10. $n(A)$?

A. 1

B. 2

C. 3

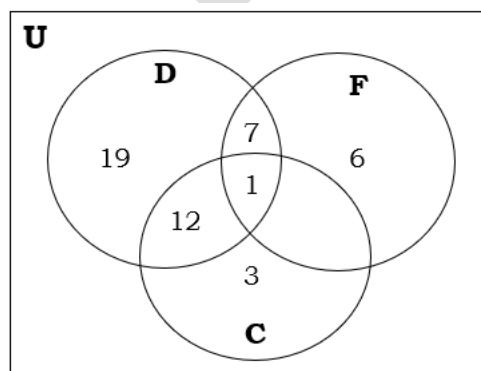
D. 4

Fifty people are asked about the pets they keep at home. The Venn diagram shows the results.

Let $C = \{ \text{people who have cats} \}$

$D = \{ \text{people who have dogs} \}$

$F = \{ \text{people who have fish} \}$



How many people have

11. dogs?

A. 19

B. 20

C. 31

D. 39

12. dogs and fish?

A. 8

B. 20

C. 42

D. 45

13. dogs or cats

A. 8

B. 20

C. 42

D. 45

14. all three?

A. 0

B. 1

C. 2

D. 3

15. neither one of the three?

A. 0

B. 1

C. 2

D. 3

Great job! You are done with this module.

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C. Online Resources

- <https://topperlearning.com>
- <https://courses.lumenlearning.com/>

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