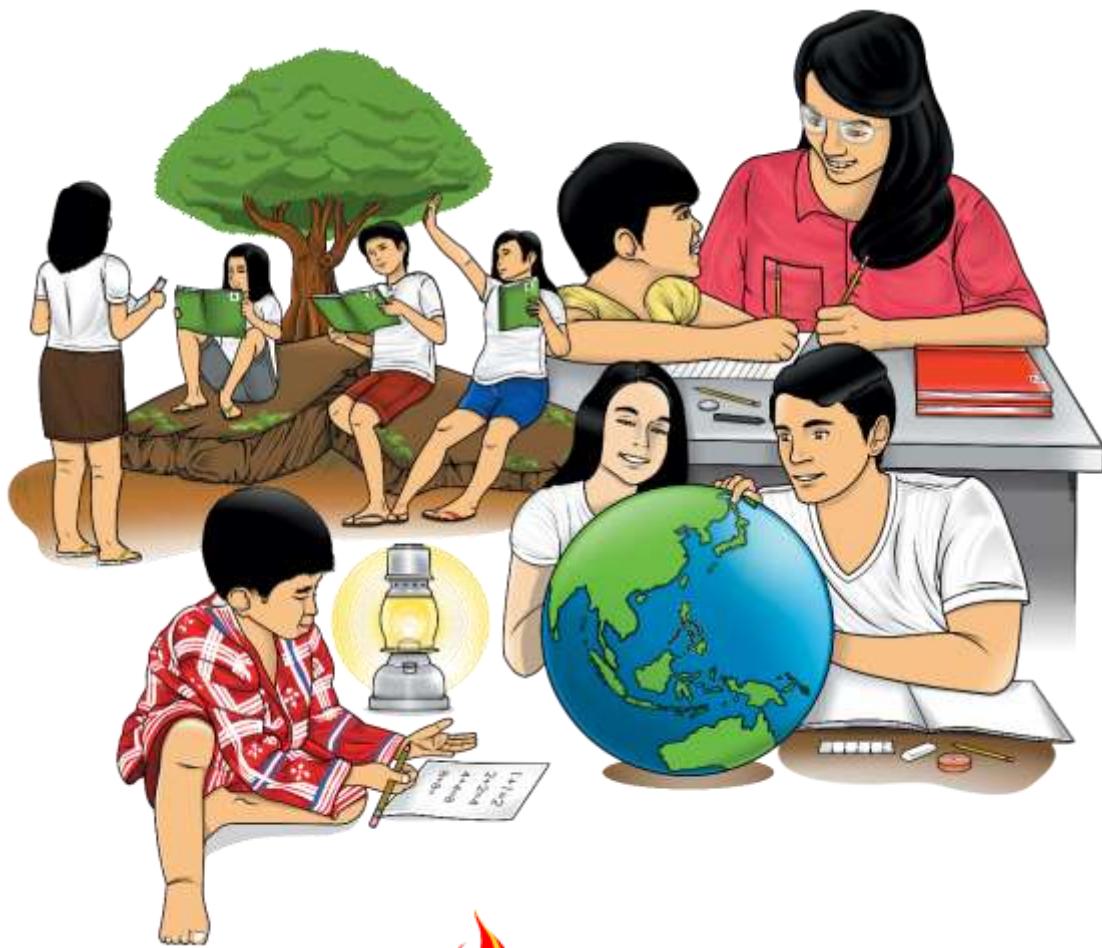


# Mathematics

## Quarter 1 – Module 2: Problems Involving Sets



**Mathematics – Grade 7**  
**Alternative Delivery Mode**  
**Quarter 1 – Module 2: Problems Involving Sets**  
**First Edition, 2020**

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## **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-test 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 Teachers are also provided to the 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. 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.



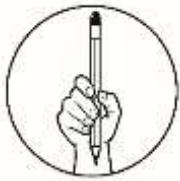
## ***What I Need to Know***

This module was designed and written with you in mind. It is here to help you master your skills in solving mathematical problems involving sets. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is all about Solving Problems Involving Sets.

After going through this module, you are expected to:

1. solve problems involving sets using Venn diagram;
2. apply set operations to solve a variety of word problems.



## ***What I Know***

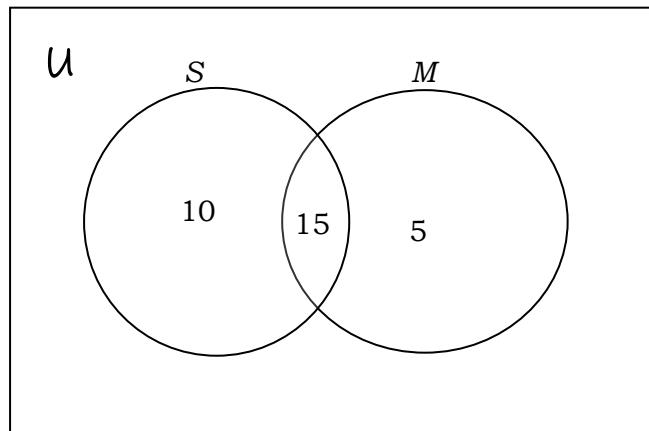
Read each question below. You may draw a Venn diagram to help you find the answer. Select your answer from the choices lettered A to D and write the letter of your choice on a separate sheet of paper.

For items 1 – 2.

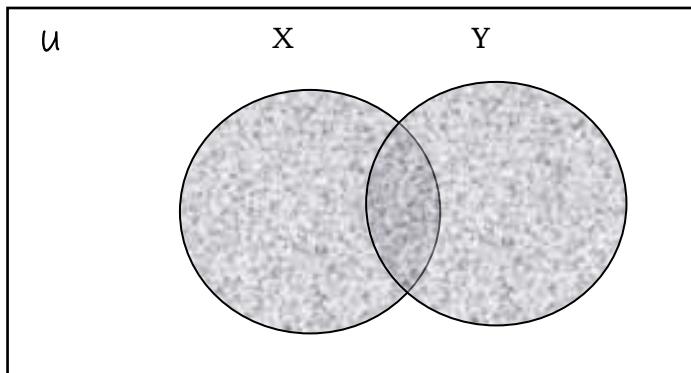
Let  $A = \{ 1, 2, 3, 4, 5, 6 \}$  ,  $B = \{ 2, 4, 5, 6 \}$

1. Find  $A \cup B$ .  
A.  $\{ 1, 2, 3, 4, 5, 6 \}$       B.  $\{ 2, 4, 5, 6 \}$       C.  $\{ 2, 4, 6 \}$       D.  $\{ 1, 3, 5 \}$
2. Find  $A \cap B$ .  
A.  $\{ 1, 2, 3, 4, 5, 6 \}$       B.  $\{ 2, 4, 5, 6 \}$       C.  $\{ 2, 4, 6 \}$       D.  $\{ 1, 3, 5 \}$

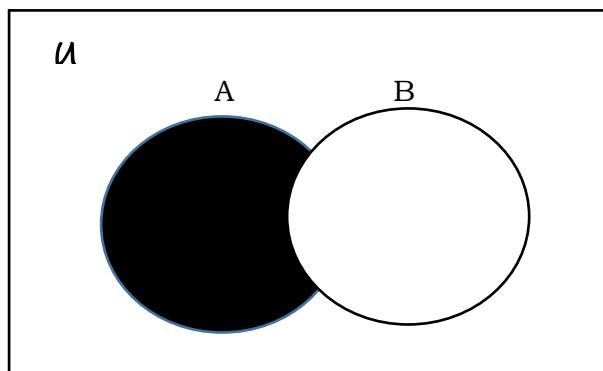
For items 3 - 4. Given the Venn Diagram below.



3. Find  $M \cup S$ .  
A. { 5, 10, 15 }      B. { 10, 15 }      C. { 5, 10 }      D. { 15 }
4. Find  $M \cap S$ .  
A. { 5, 10, 15 }      B. { 10, 15 }      C. { 5, 10 }      D. { 15 }
5. In the Venn diagram below, which of the following is represented by the shaded region?



- A.  $X \cup Y$
  - B.  $X \cap Y$
  - C.  $X'$
  - D. all of the above
6. Which of the following is represented by the Venn diagram below?



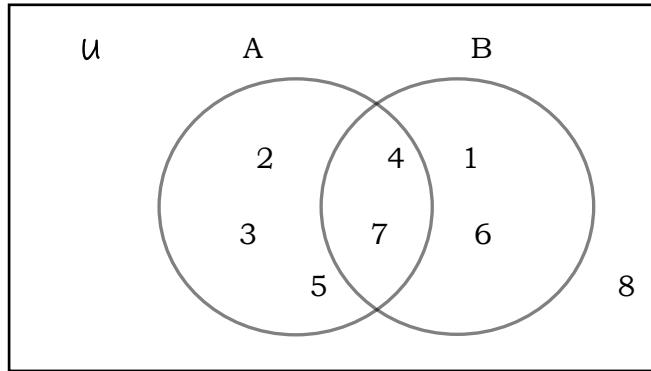
A.  $A - B$

B.  $B - A$

C.  $A \cup B$

D.  $A \cap B$

For items 7 – 10. Refer to the diagram below.



7. What is  $A \cap B$ ?

A. { 4,7 }

B. { 1, 6 }

C. { 2, 3, 5 }

D. { 1, 4, 6, 7, 8 }

8. What is  $A - B$ ?

A. { 4,7 }

B. { 1, 6 }

C. { 2, 3, 5 }

D. { 1, 4, 6, 7 }

9. What is  $B - A$ ?

A. { 4,7 }

B. { 1, 6 }

C. { 2, 3, 5 }

D. { 1, 4, 6, 7 }

10. What is  $A \cup B$ ?

A. { 1,2,3,4,5,6,8 }

B. { 1,2,3,4,5 ,6,7 }

C. { 2, 3,4, 5,7 }

D. { 1, 4, 6, 7,8 }

For items 11 – 15. Refer to the problem below.

A survey was conducted among 50 people on the ice cream flavor they liked. It was found out that 28 liked chocolate, 15 liked mango, and 20 liked strawberry. Furthermore, 8 liked chocolate and strawberry, and 7 liked chocolate and mango, 11 liked mango and strawberry and 4 liked all the 3 flavors.

11. How many people liked Chocolate only?

A. 28

B. 17

C. 8

D. 7

12. How many people liked mango only?

A. 15

B. 14

C. 7

D. 1

13. How many people liked strawberry only?

A. 20

B. 8

C. 5

D. 4

14. How many people liked all the three flavors?

A. 3

B. 4

C. 7

D. 9

15. How many people did not like the three flavors at all?

A. 3

B. 4

C. 7

D. 9

**Lesson  
1**

## **Problems Involving Sets**



### **What's In**

Try solving the following problem:

In a group of 120 students, 68 had ridden a bus, 78 had ridden the LRT, 33 had ridden a jeep, while 40 had ridden both the bus and the LRT , 20 had ridden the bus and the jeep,19 had ridden the LRT and the jeep and 15 had ridden the bus, the LRT and the jeep.

- a. How many had ridden the bus only?
- b. How many had ridden the LRT only?
- c. How many had ridden the jeep only?
- d. How many did not ride on any of the three modes of transportation?



### **Notes to the Learner**

Find the solution using any method.



## What's New

Venn diagram is a principal way of showing sets diagrammatically. This method consists primarily of entering the elements of a set into a circle or circles. It can be used to solve word problems involving union and intersection of sets.

In solving set operations using the Venn diagram, the following are the steps to be followed:

- Step 1. **Determine what is given and what are being asked.**
- Step 2. **Illustrate using the Venn diagram.**
- Step 3. **Determine what operations to be used.**
- Step 4. **Use the operations.**
- Step 5. **Answer the questions being asked.**

Here are some worked out examples:

### Example 1.

Let A and B be two finite sets such that  $n(A) = 20$ ,  $n(B) = 28$  and  $n(A \cup B) = 36$ . Find  $n(A \cap B)$ .

Solution:

- Step 1. **Determine what is given and what are being asked.**

**Given :**

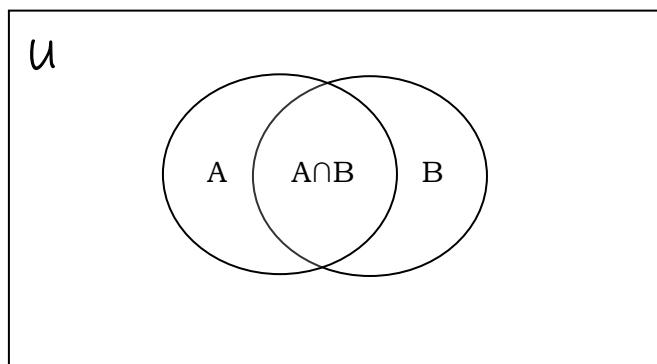
$$\begin{aligned}n(A) &= 20, \\n(B) &= 28 \\n(A \cup B) &= 36.\end{aligned}$$

**Asked:**

Find  $n(A \cap B)$ .

- Step 2. **Illustrate using the Venn diagram if possible.**

The Venn diagram is shown below



**Step 3. Determine what operations to be used.**

Using the formula  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ .  
then ,

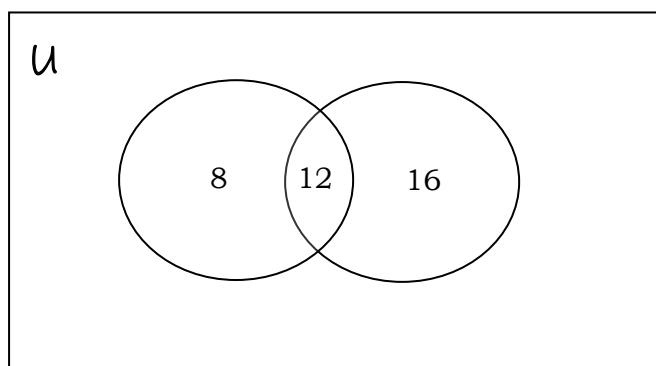
$$n(A \cap B) = n(A) + n(B) - n(A \cup B)$$

$$n(A \cap B) = 20 + 28 - 36$$

$$n(A \cap B) = 48 - 36$$

$$n(A \cap B) = 12$$

**Step 4. Use the operations.**



**Step 5. Answer the questions being asked.**

$$\text{Find } n(A \cap B) = 12$$

Example.

In a Junior High School, 200 students were randomly selected. 140 liked tea, 120 liked coffee and 80 liked both tea and coffee.

- How many students liked only tea?
- How many students liked only coffee?
- How many students liked neither tea or coffee?

Solution:

**Step 1. Determine what is given and what are being asked.**

**Given:**

200 Junior High School students who were randomly selected  
140 students who liked tea  
120 students who liked coffee  
80 students who liked both tea and coffee

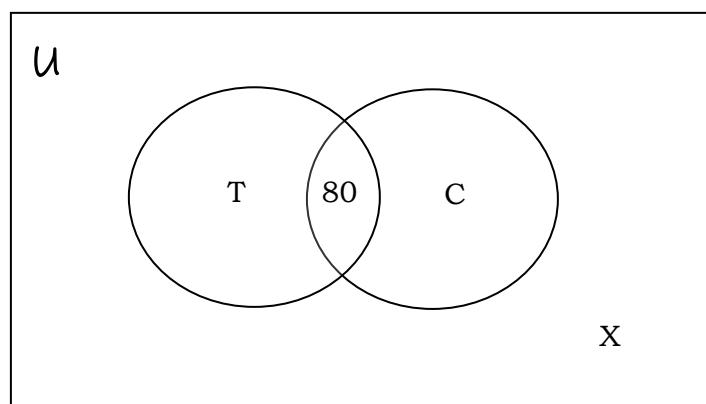
**Asked:**

- How many students liked only tea?
- How many students liked only coffee?
- How many students liked neither tea nor coffee?

**Step 2. Illustrate using the Venn diagram.**

Let  $T$  = set of students who like only tea  
 $C$  = set of students who liked only coffee  
 $X$  = set of students who liked neither tea nor coffee

The Venn diagram is shown below

**Step 3. Determine what operations to be used.**

(1) To obtain  $T$ ,

$$T = 140 - 80 \quad \text{students who liked tea minus students who liked both tea and coffee}$$

$$T = 60 \quad \text{set of students who liked only tea}$$

(2) To obtain  $C$ ,

$$C = 120 - 80 \quad \text{students who liked coffee minus students who liked both tea and coffee}$$

$$C = 40 \quad \text{set of students who liked coffee only}$$

(3) To obtain  $X$ ,

$$X = 200 - (T + C + 80) \quad \text{total number of students who were randomly selected minus the sums of } T, C \text{ and } 80$$

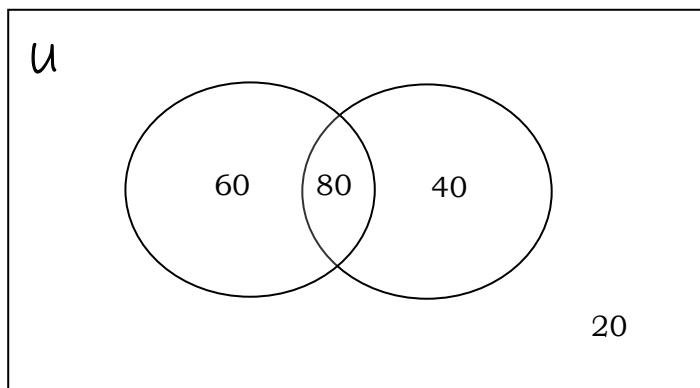
$$X = 200 - (60 + 40 + 80) \quad \text{by substitution}$$

$$X = 200 - 180 \quad \text{by simplifying}$$

$$X = 20 \quad \text{set of students who liked neither tea nor coffee}$$

**Step 4. Use the operations.**

The number of elements in each region is shown below:



**Step 5. Answer the questions being asked.**

- How many students liked only tea? 60 students
- How many students liked only coffee? 40 students
- How many students liked neither tea nor coffee? 20 students

Example 3.

A group of 25 high school students were asked whether they used either Facebook or Twitter or both. Fifteen (15) of these students used Facebook, and twelve (12) used Twitter.

- How many students used Facebook only?
- How many students used Twitter only?
- How many students used both Social networking sites?

Solution:

**Step 1. Determine what is given and what are being asked.**

**Given:**

- 25 high school students who were asked whether they use either Facebook or Twitter or both  
15 students who used Facebook  
12 students who used Twitter

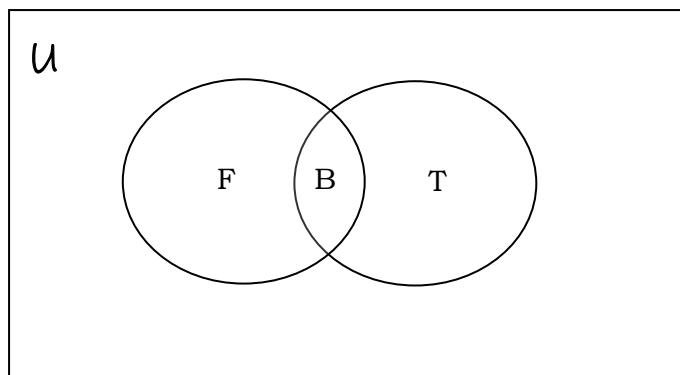
**Asked:**

- How many used Facebook only?
- How many used Twitter only?
- How many used both Social networking sites?

**Step 2. Illustrate using the Venn diagram.**

Let  $F$  = set of students who used Facebook only  
 $T$  = set of students who used Twitter only  
 $B$  = set of students who used both social networking sites

The Venn diagram is shown below



### Step 3. Determine what operations to be used.

(1) To obtain  $B$ ,

$$\begin{array}{ll}
 B = (F + T) - 25 & \text{sums of } F \text{ and } T \text{ minus 25 (total number of} \\
 & \text{high school students)} \\
 B = (15 + 12) - 25 & \text{by substitution} \\
 B = 27 - 25 & \text{by simplifying} \\
 B = 2 & \text{set of students who used both social} \\
 & \text{networking sites}
 \end{array}$$

(2) To obtain  $F$ ,

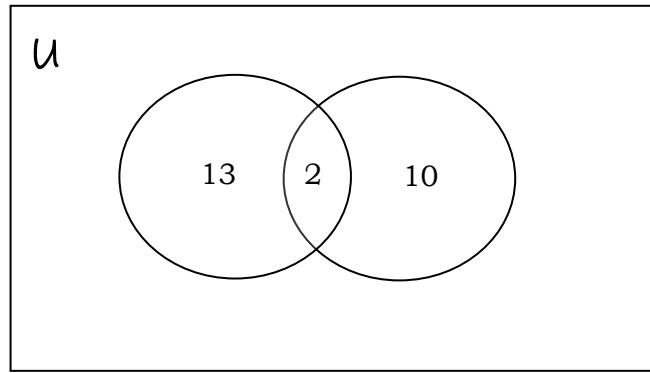
$$\begin{array}{ll}
 F = 15 - B & \text{students who used Facebook minus } B \\
 F = 15 - 2 & \text{by substitution} \\
 F = 13 & \text{set of students who used Facebook only}
 \end{array}$$

(3) To obtain  $T$ ,

$$\begin{array}{ll}
 T = 12 - B & \text{set of students who used Twitter only} \\
 & \text{minus } B \\
 T = 12 - 2 & \text{by substitution} \\
 T = 10 & \text{set of students who used Facebook only}
 \end{array}$$

### Step 4. Use the operations.

The number of elements in each region is shown below:



**Step 5. Answer the questions being asked.**

- How many used Facebook only? 13 students
- How many used Twitter only? 10 students
- How many used both Social networking sites? 2 students

**Example 2.**

A group of 50 students went for a tour in South Cotabato province. Out of 50 students, 24 joined the trip in Lake Sebu for a zipline experience, 18 went to the flower farm in Tupi, 20 went to Si – ok falls in Koronadal City, 12 joined the trip to Lake Sebu and Tupi, 15 went to Tupi and Si-ok falls and 11 made a trip to Lake Sebu and Si-ok falls and 10 visited the three tourists spots.

- How many of the students went to Lake Sebu only?
- How many of the students went to Tupi only?
- How many joined the Si-ok trip in Koronadal City only?
- How many did not go to any of the tourist spots?

**Solution:**

**Step 1. Determine what is given and what are being asked.**

**Given:**

50 students went for a tour  
 24 students who visited Lake Sebu  
 18 students who went to Tupi  
 20 students who went to Koronadal City  
 12 students who joined the trip to Lake Sebu and Tupi  
 15 students who went to Tupi and Koronadal City  
 11 students who went to Lake Sebu and Koronadal City  
 10 students who visited the three tourist spots

**Asked:**

- How many of the students went to Lake Sebu only?

- b. How many of the students went to Tupi only?
- c. How many joined the Si-ok trip in Koronadal City only?
- d. How many did not go to any of the tourist spots?

**Step 2. Illustrate using the Venn diagram.**

We will let,

LKT = number of students who visited the THREE tourist spots

L = number of students who visited Lake Sebu only

T = number of students who went to Tupi only

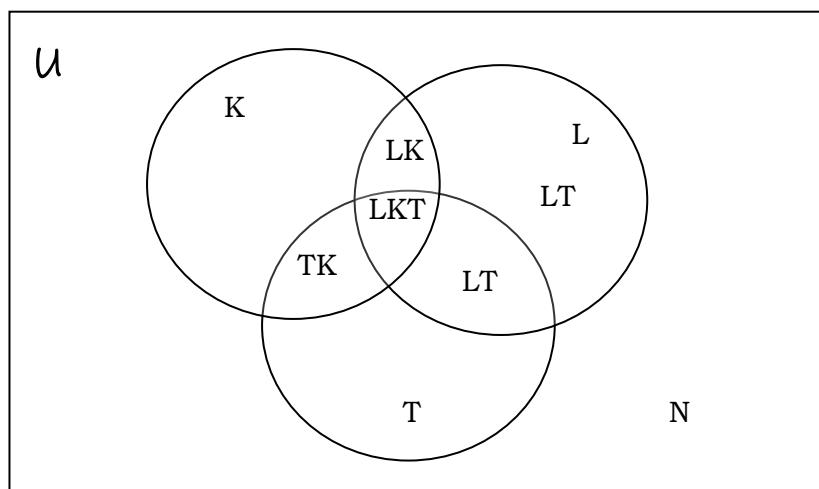
K = number of students who went to Koronadal City only

LT = number of students who joined the trip to Lake Sebu and Tupi only

TK = number of students who went to Tupi and Koronadal City only

LK = number of students who went to Lake Sebu and Koronadal City only

N = number of students who DID NOT see any of the THREE tourist spots



**Step 3: Determine what operations to be used.**

(1) To obtain LKT,

$$\text{LKT} = 10 \quad \text{students who visited the THREE tourist spots}$$

(2) To obtain TK,

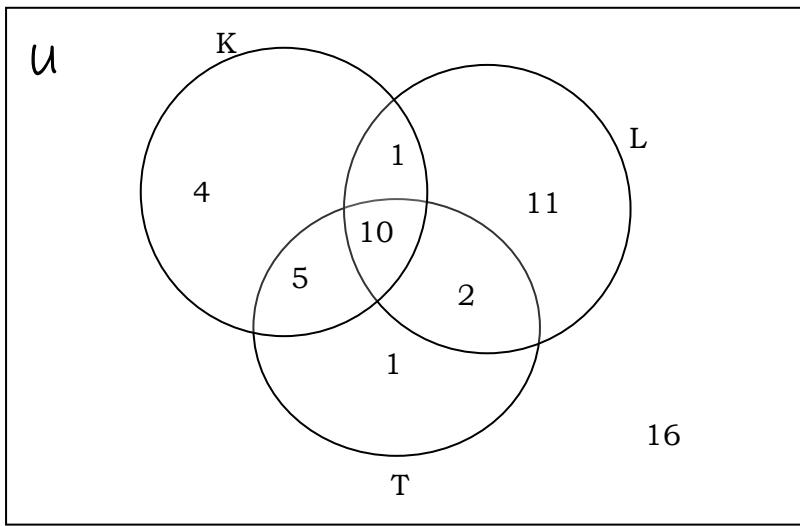
$$\begin{aligned} \text{TK} &= 15 - \text{LKT} && \text{students who went to Tupi and Koronadal City minus LKT} \\ &= 15 - 10 && \text{by substitution} \\ &= 5 && \text{students who went to Tupi and Koronadal City only} \end{aligned}$$

(3) To obtain LT ,

$$\begin{aligned} \text{LT} &= 12 - \text{LKT} && \text{students who went to Lake Sebu and Tupi minus LKT} \\ &= 12 - 10 && \text{by substitution} \end{aligned}$$

$LT = 2$	students who joined the trip to Lake Sebu and Tupi only
(4) To obtain LK, $LK = 11 - LKT$	students who went to Lake Sebu and Koronadal City minus LKT by substitution
$LK = 11 - 10$	students who went to Lake Sebu and Koronadal City only
$LK = 1$	
(5) To obtain L , $L = 24 - (LKT + LT + LK)$	students who joined the trip to Lake Sebu minus the sums of LKT, LT and LK by substitution
$L = 24 - (10 + 2 + 1)$	by simplifying
$L = 24 - 13$	
$L = 11$	students who visited Lake Sebu only
(6) To obtain K, $K = 20 - (LKT + LK + TK)$	students who went to Koronadal City minus the sums of LKT,LK and TK by substitution
$K = 20 - (10 + 1 + 5)$	
$K = 20 - 16$	by smplifying
$K = 4$	students who went to Koronadal City only
(7) To obtain T, $T = 18 - (LKT + TK + LT)$	students who went to Tupi minus the sums of LKT + TK + LT by substitution
$T = 18 - (10 + 5 + 2)$	by simplifying
$T = 18 - 17$	
$T = 1$	students who went Tupi only
(8) To obtain N, $N = 50 - (LKT + TK + LT + LK + L + K + T)$	total number of students went for a tour minus the sums of LKT, TK,LT,LK,L,K and T
$N = 50 - (10 + 5 + 2 + 1 + 11 + 4 + 1)$	by substitution
$N = 50 - 34$	by simplifying
$N = 16$	students who DID NOT visited any of the three spots

Step 4. **Use the operations.**



**Step 5. Answer the questions being asked.**

- How many of the students went to Lake Sebu only? 11 students
- How many of the students went to Tupi only? 1 student
- How many joined the Si-ok trip in Koronadal City only? 4 students
- How many did not go to any of the tourist spots? 16 students

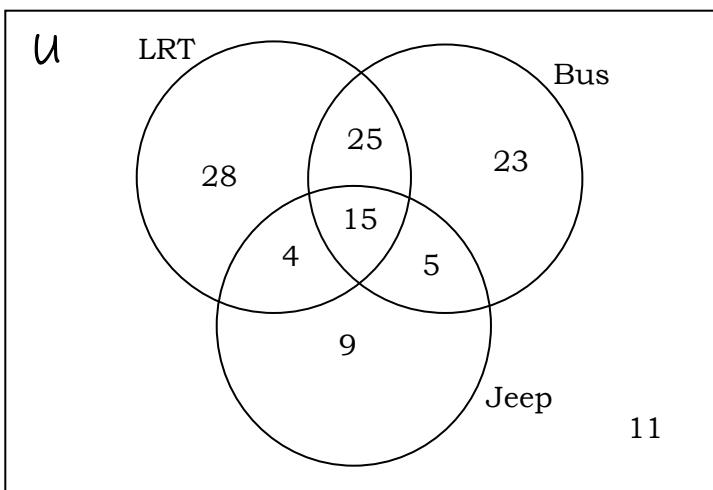


### **What is It**

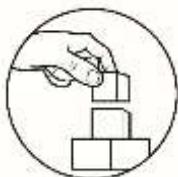
In a group of 120 students, 68 had ridden a bus, 78 had ridden the LRT, 33 had ridden a jeep, while 40 had ridden both the bus and the LRT, 20 had ridden the bus and the jeep, 19 had ridden the LRT and the jeep and 15 had ridden the bus, the LRT and the jeep.

- How many had ridden the bus only?
- How many had ridden the LRT only?
- How many had ridden the jeep only?
- How many did not ride on any of the three modes of transportation?

Solution:



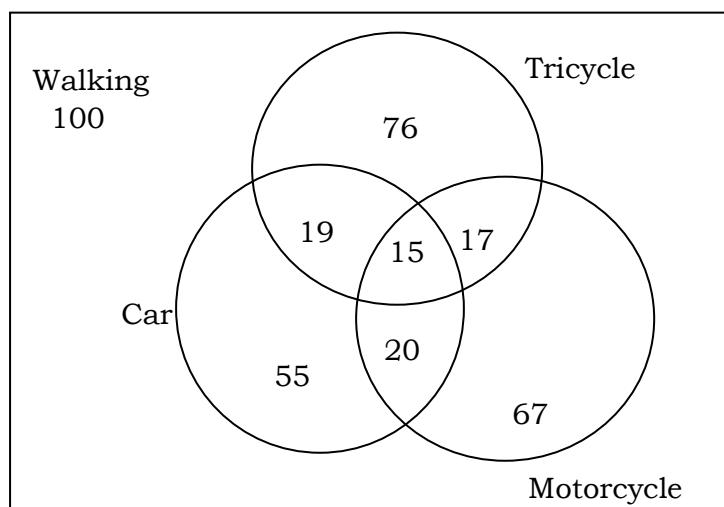
Can you explain the numbers?



### **What's More**

Do the following. Represent the sets and draw a Venn Diagram.

1. Among the 70 residents in Barangay General P. Santos, 53 liked eating in Restaurant A while 42 liked eating in Restaurant B. How many liked eating both in Restaurant A and Restaurant B? In Restaurant A only? In Restaurant B only?
2. The following diagram shows how all the Grade Seven students of Koronadal National Comprehensive High School go to school.



- a. How many students ride in a car, tricycle and the motorcycle in going to school?
- b. How many students ride both in a car and a tricycle?
- c. How many students ride both in a car and the motorcycle?
- d. How many students ride both in a tricycle and the motorcycle?
- e. How many students go to school in a car only? Tricycle only? in the motorcycle only? walking?
- f. How many Grade Seven students of Koronadal National Comprehensive High School are there in all?



## ***What I Have Learned***

In solving problems involving sets, application of the knowledge in sets and the use of Venn diagram and sets operations are necessary.

Here are the steps to follow in solving problems involving sets.

1. Determine what is given and what is being asked.
2. Illustrate using the Venn diagram.
3. Determine what operations to be used.
4. Use the operations.
5. Answer the questions being asked.

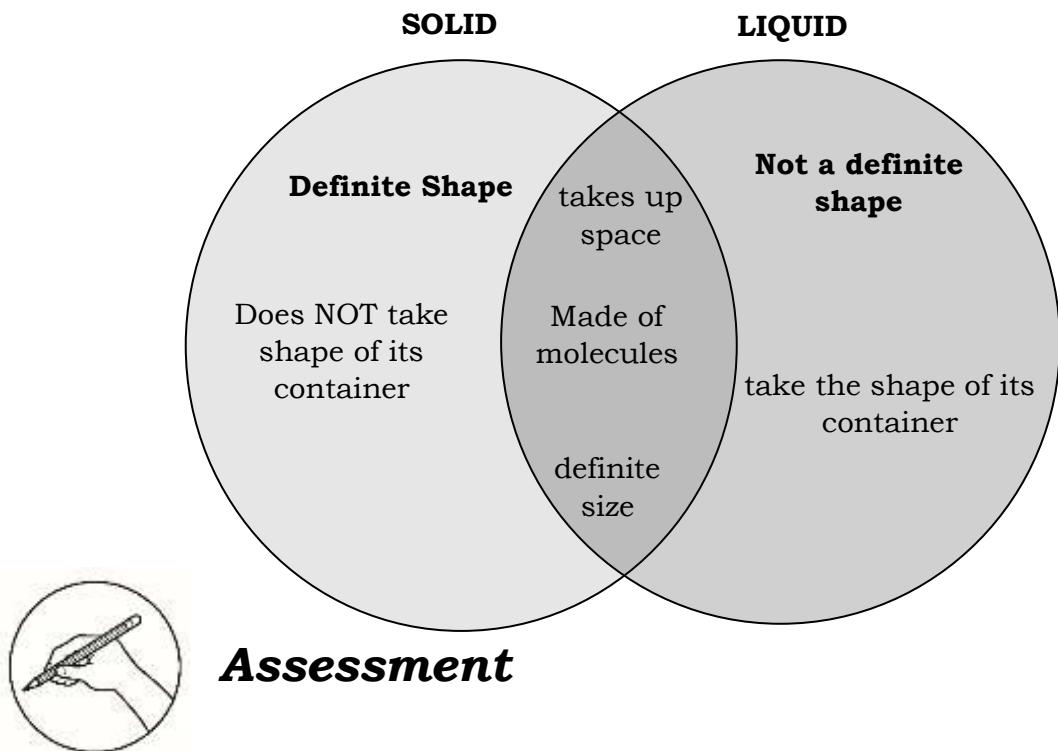


## ***What I Can Do***

Think of a scenario in real life situation where problems involving sets is shown.

Here is an example:

This is a diagram which shows the relationship between **solids** and **liquids**.



Solve the following problems using Venn diagram.

1. The 150 Grade 7 students participated in school's Math Olympics. 64 students registered in Math Trail, 78 students registered in Amazing Race and 28 students registered in both Math Trail and Amazing Race. How many students registered in Math Trail only and in Amazing Race only? Are there students who did not register in both events, how many?
2. The Hair Company offers two brands of shampoo: brand H and brand S. 100 people were surveyed and their brand preferences are as follows: 50 people liked brand H and 35 people liked brand S.  
What is the maximum number of people who liked both H and S?  
What is the minimum number of people who liked both H and S?  
What is the minimum number of people who do not like any of the brand?
3. In a group of students, 30 played chess, 19 played volleyball, 25 played basketball, 14 played both volleyball and chess, 8 played both basketball and volleyball, 15 played both basketball and chess and 5 played all three events. How many played chess only, basketball only and volleyball only? How many students are there in all?
4. A group of 300 incoming Grade 7 students were given questionnaires to find out who like Online classes as belonged to Group A, Offline classes as belonged to Group B and physical but no-contact policy as belonged to

Group C. It was found out that 138 students belonged to A, 150 students belonged to B, 95 students belonged to C, 58 students belonged to both A and B, 47 students belonged to both A and C, 42 students belonged to both B and C and 25 students belonged to the three options. How many students belonged to A only, to B only, to C only and how many students are still undecided?

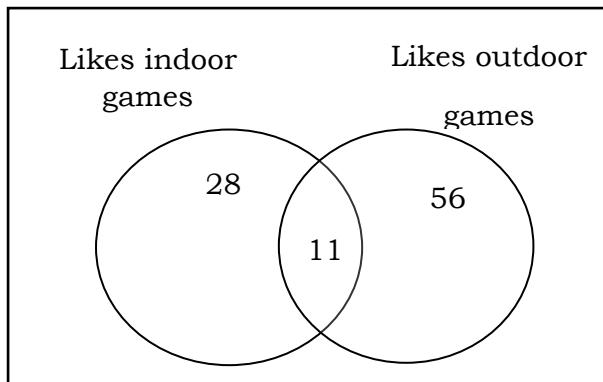
5. There are 35 students in art class and 57 students in dance class. Find  
The number of students
  - a. who are either in art class or in dance class.
  - b. when two classes meet at the same hour.
  - c. when two classes meet at different hours.



## ***Additional Activities***

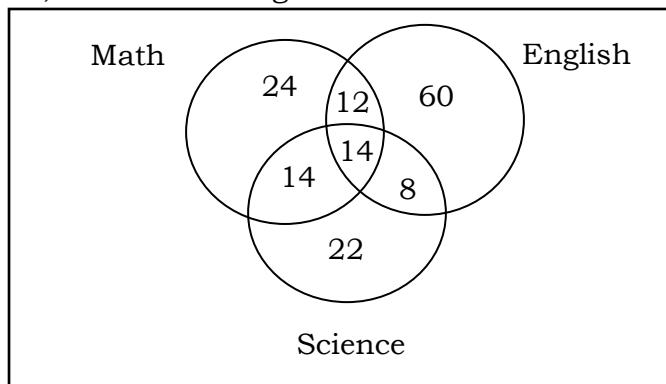
Answer the question based on the following Venn Diagram.

For items 1 – 4, Refer to the diagram below.



1. How many students like to play indoor games only?
2. How many students like to play outdoor games only and don't like to play indoor?
3. How many students don't like both indoor or outdoor games?
4. Do more students like to play indoor or outdoor games?

For items 5 - 6, refer to the diagram below.



5. Find how many had taken
  - a. Math only?
  - b. English only?
  - c. Science only?
  - d. all three subjects?
6. How many students had been considered in a survey?



## Answer Key

What I Know		What's More	
1. A	2. B	1. 25 liked eating in Both Restaurants registered in Math Trail only; 50 students registered in Amazoning Race only	28 liked eating in Restaurant A only ; 36 students did not register for an event ; 85 is the maximum number liked H&S;
3. A	4. D	1. 36 students registered in Math Trail only; 50 students registered in Amazoning Race only	2. a. 15 students ride in a car, tricycle and motorcycle ; None or 0 for the number who liked H&S;
5. A	6. A	3. 6 students played chess only; 7 students played basketball only; 2 students played both basketball and chess	3. a. 15 students ride in a car and in motorcycle ; 35 students ride both in car and in motorcycle ; 42 students in all.
7. A	8. C	4. 58 students who belonged to A only; 75 students who belonged to B only; 31 students belonged to C only; 39 students who are still undecided.	4. e. 55 students ride in car only ; 67 students ride in motorcycle only ; 76 students ride in tricycle only ; 100 students preferred walking
9. B	10. B	5. a. 22 students c. 92 students b. 70 students	f. there are 369 students
11. B	12. D		
13. C	14. B		
15. D			

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