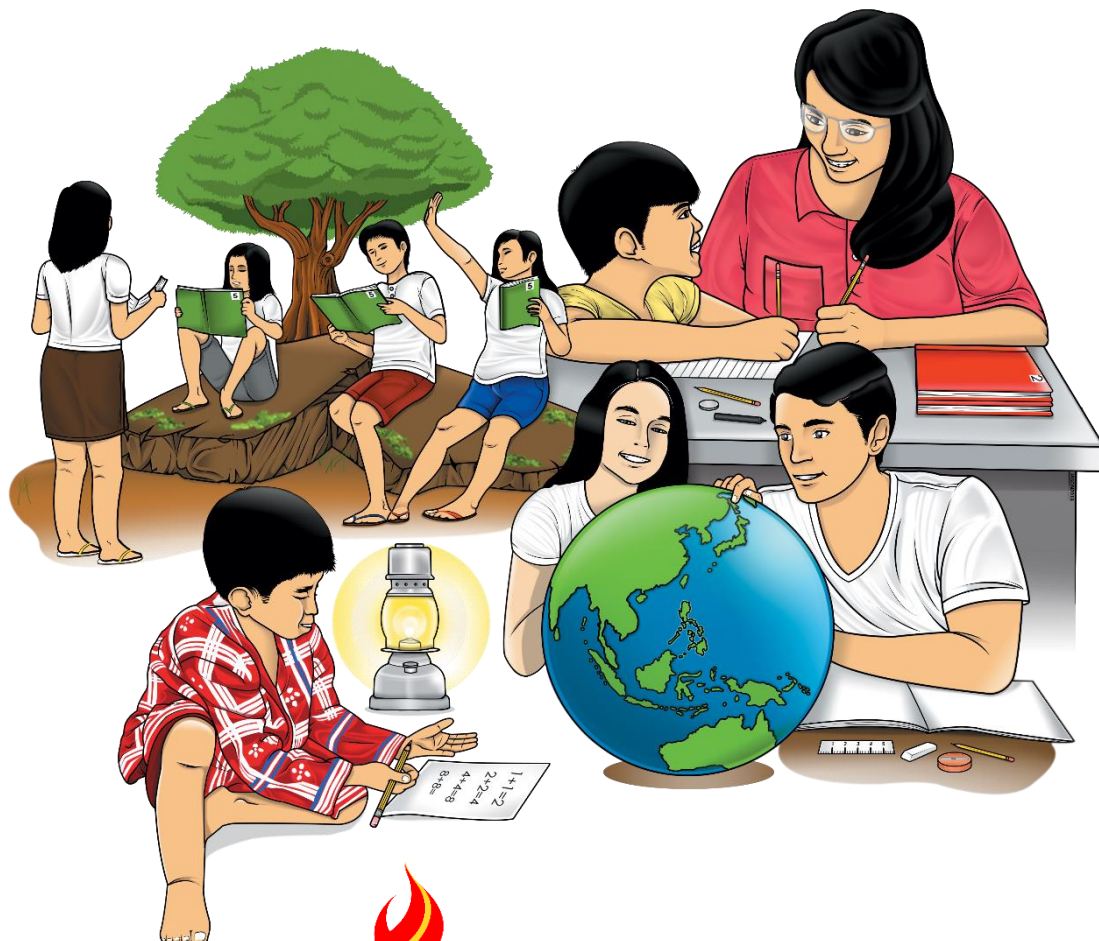


Mathematics

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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Mathematics

Quarter 1 – Module 2: Problems Involving Sets

Introductory Message

For the facilitator:

Welcome to the Mathematics 7 Alternative Delivery Mode (ADM) Module on Problems Involving Sets!

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:



Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Mathematics 7 Alternative Delivery Mode (ADM) Module on Problems Involving Sets!

The hand is one of the most symbolized part of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands! This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:



What I Need to Know

This will give you an idea of the skills or competencies you are expected to learn in the module.



What I Know

This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.



What's In

This is a brief drill or review to help you link the current lesson with the previous one.



What's New

In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.



What is It

This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.



What's More

This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



What I Have Learned

This includes questions or blank sentence/paragraph to be filled in to process what you learned from the lesson.



What I Can Do

This section provides an activity which will help you transfer your new knowledge or skill into real life situations or concerns.



Assessment

This is a task which aims to evaluate your level of mastery in achieving the learning competency.



Additional Activities

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.



Answer Key

This contains answers to all activities in the module.

At the end of this module you will also find:

References

This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!



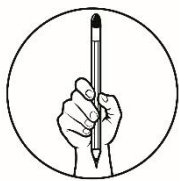
What I Need to Know

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

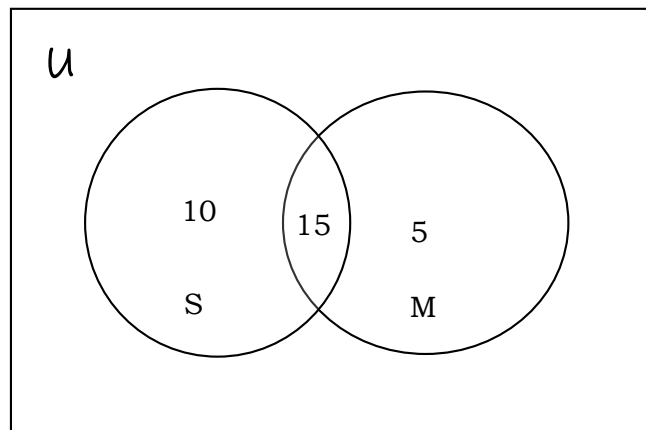
1. Find $A \cup B$.

- 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.



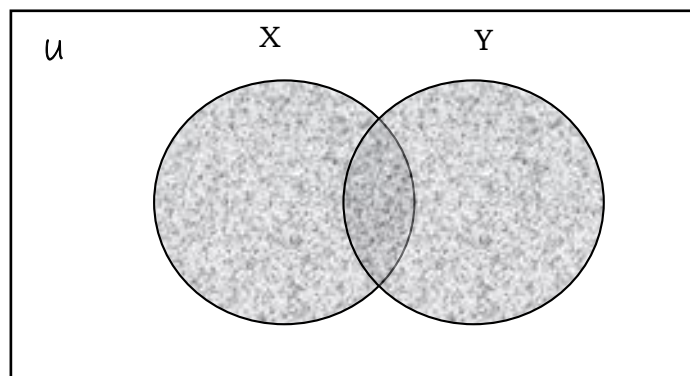
3. Find $M \cup S$.

- 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

For items 6 – 10. 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, and 4 liked all the 3 flavors.

6. How many people liked Chocolate only?
A. 28 B. 17 C. 8 D. 7
7. How many people liked mango only?
A. 15 B. 14 C. 7 D. 1
8. How many people liked strawberry only?
A. 20 B. 8 C. 5 D. 4
9. How many people liked all the three flavors?
A. 3 B. 4 C. 7 D. 9
10. 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.

- 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?



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 :

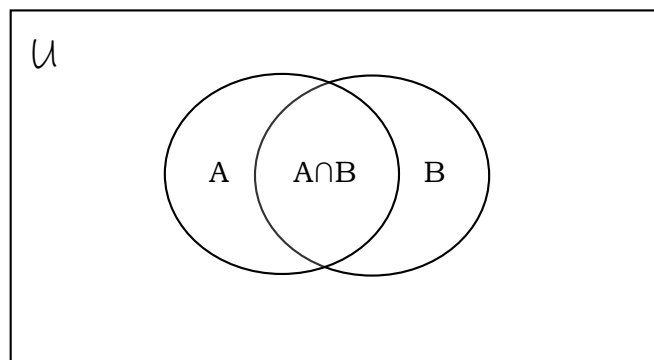
$$\begin{aligned}n(A) &= 20, \\n(B) &= 28 \\n(A \cup B) &= 36.\end{aligned}$$

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 ,

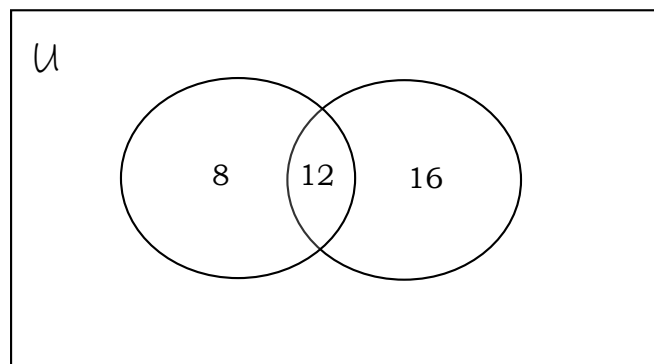
$$n(A \cap B) = n(A) + n(B) - n(A \cup B)$$

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

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

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

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

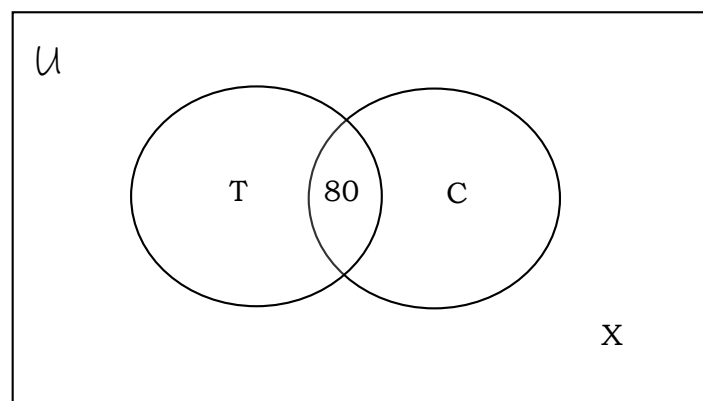
Asked:

- 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 ,

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

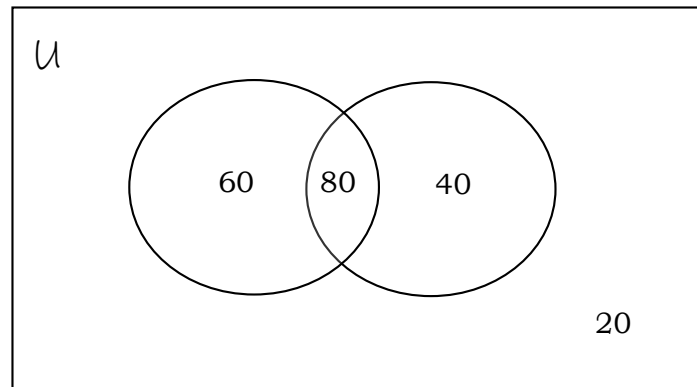
$$X = 200 - (60 + 40 + 80) \quad \text{by substitution}$$

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

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

Step 4. Use the operations.

The number of elements in each region is shown below:



Step 5. Answer the questions being asked.

- a. How many students liked only tea? 60 students
- b. How many students liked only coffee? 40 students
- e. 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.

- a. How many students used Facebook only?
- b. How many students used Twitter only?
- c. 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

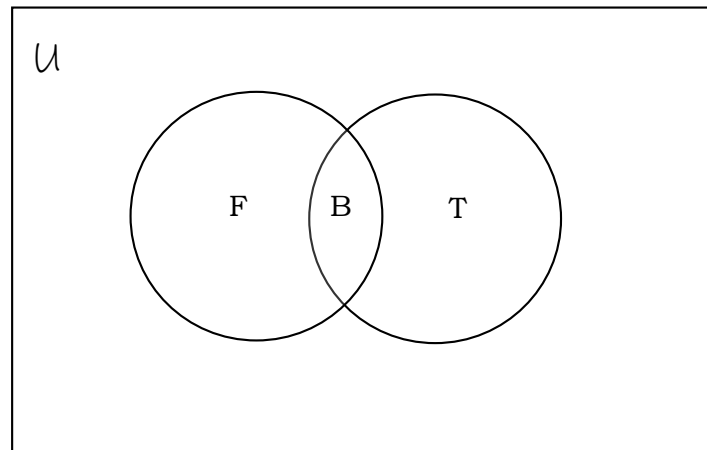
Asked:

- a. How many used Facebook only?
- b. How many used Twitter only?
- c. 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 ,

$$B = (F + T) - 25$$

sums of F and T minus 25 (total number of high school students)

$$B = (15 + 12) - 25$$

by substitution

$$B = 27 - 25$$

by simplifying

$$B = 2$$

set of students who used both social networking sites

(2) To obtain F ,

$$F = 15 - B$$

students who used Facebook minus B

$$F = 15 - 2$$

by substitution

$$F = 13$$

set of students who used Facebook only

(3) To obtain T ,

$$T = 12 - B$$

set of students who used Twitter only minus B

$$T = 12 - 2$$

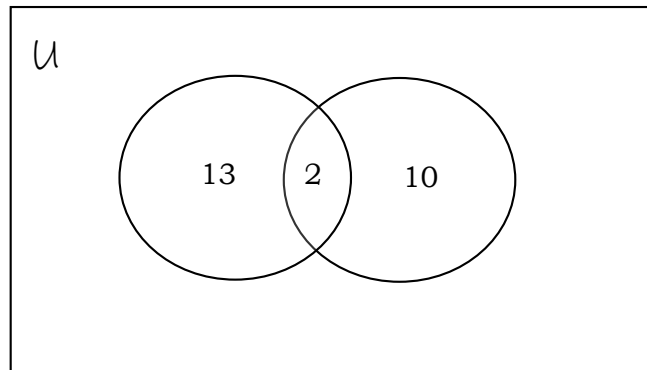
by substitution

$$T = 10$$

set of students who used Facebook only

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?
- 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?

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

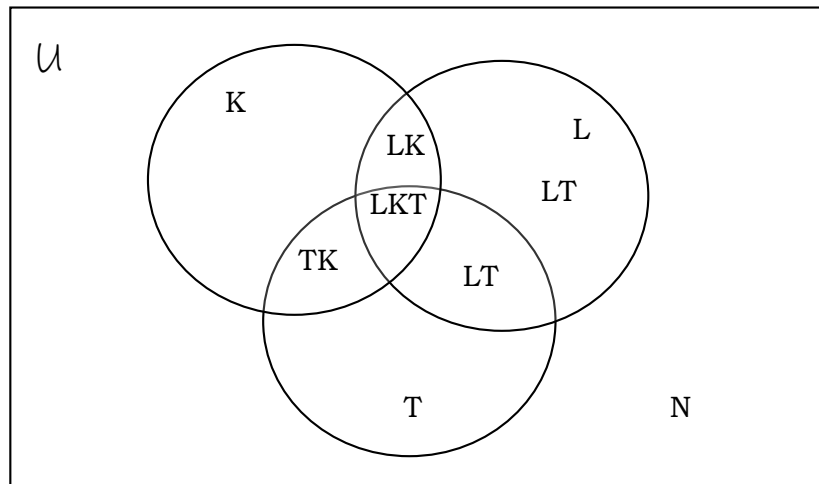
K = number of students who went to Koronadal City only

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,

$$LKT = 10$$

students who visited the THREE tourist spots

- (2) To obtain TK,

$$TK = 15 - LKT$$

students who went to Tupi and Koronadal City minus LKT

$$TK = 15 - 10$$

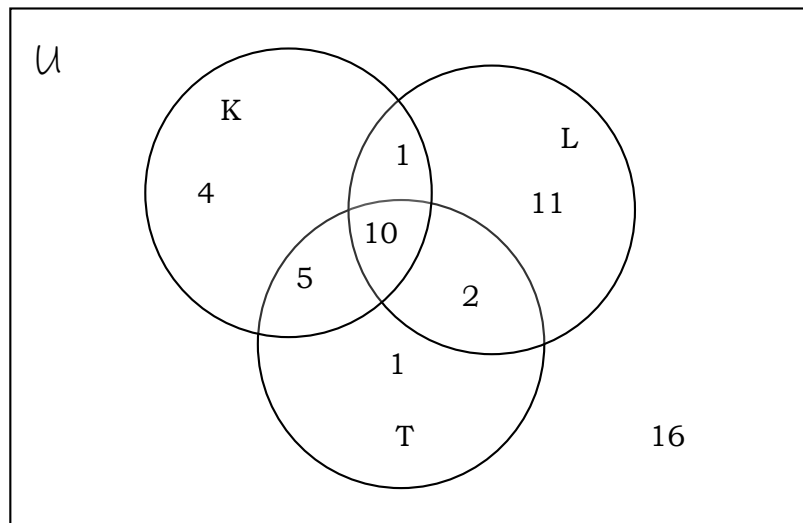
by substitution

$$TK = 5$$

students who went to Tupi and Koronadal City only

- (3) To obtain LT ,
 $LT = 12 - LKT$ students who went to Lake Sebu and Tupi minus LKT
 $LT = 12 - 10$ by substitution
 $LT = 2$ 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
 $LK = 11 - 10$ by substitution
 $LK = 1$ students who went to Lake Sebu and Koronadal City only
- (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)
 $L = 24 - (10 + 2 + 1)$ by substitution
 $L = 24 - 13$ by simplifying
 $L = 11$ 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
 $K = 20 - (10 + 1 + 5)$ by substitution
 $K = 20 - 16$ by simplifying
 $K = 4$ students who went to Koronadal City only
- (7) To obtain T,
 $T = 18 - (LKT + TK + LT)$ students who went to Tupi minus
 $T = 18 - (10 + 5 + 2)$ by substitution
 $T = 18 - 17$ by simplifying
 $T = 1$ 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

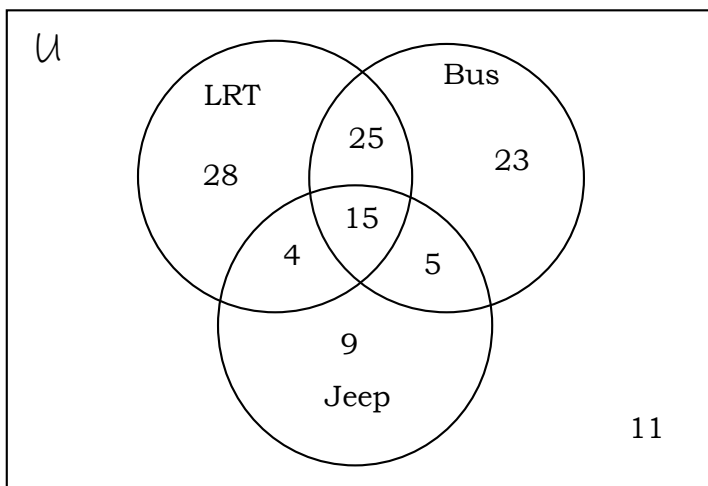


What is It

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?

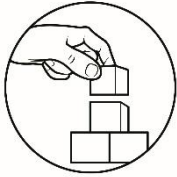
Solution:



Can you explain the numbers?

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

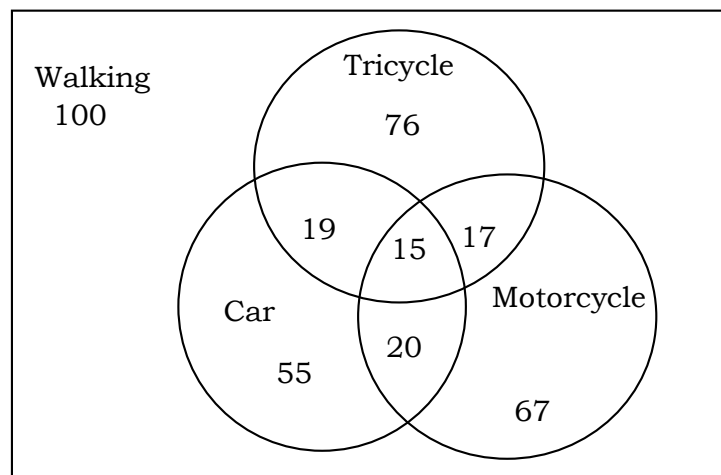
- Among the 70 residents in Barangay General P. Santos, 53 liked eating in Restaurant A while 42 liked eating in Restaurant B. How many liked



What's More

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.



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

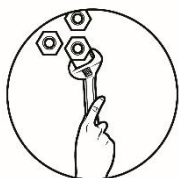


What I Have Learned

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.

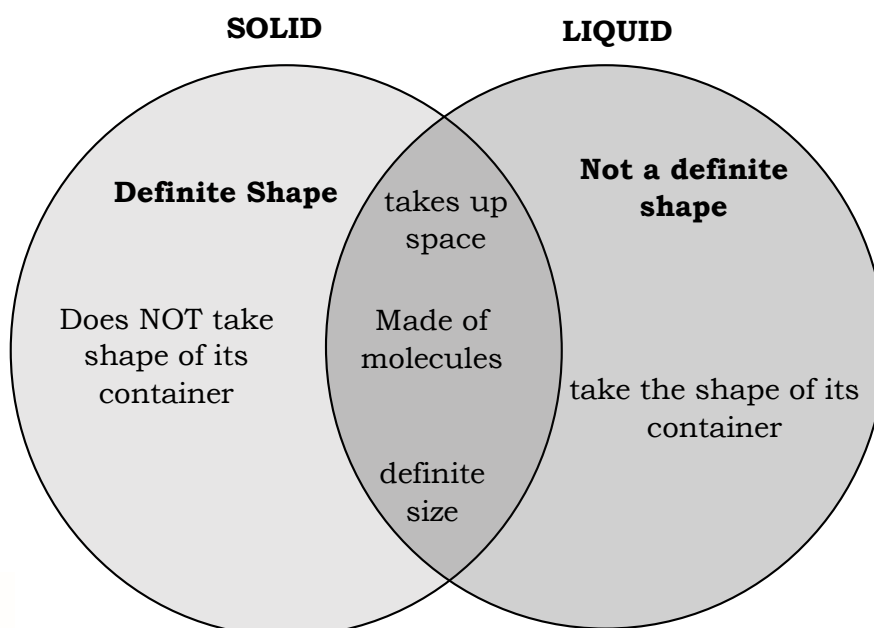


What I Can Do

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**.



Assessment

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 registered in both events, how many?

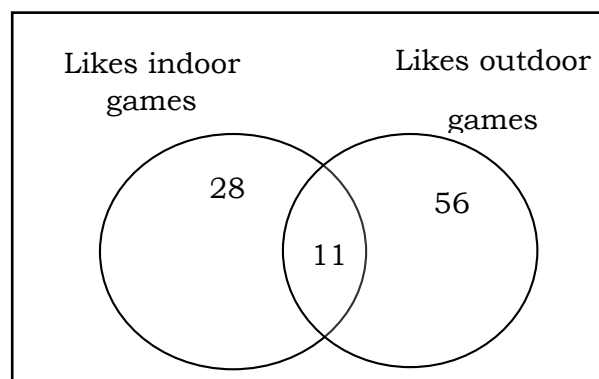
2. The Hair Company offers two brands of shampoo: brand H and brand S. 100 people were surveyed and their brand preferences are as follows: 50 people liked brand H and 35 people liked brand S.
What is the maximum number of people who liked both H and S?
What is the minimum number of people who liked 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 both 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

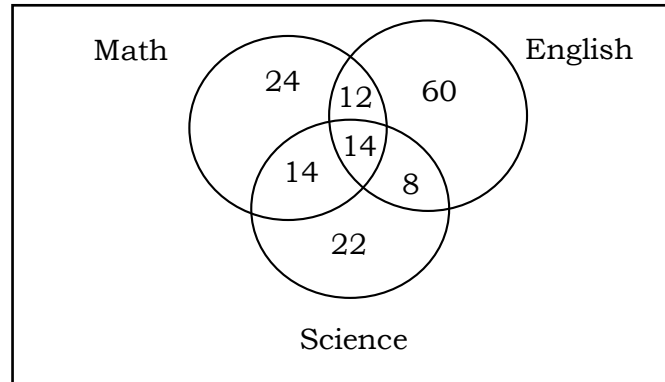
Answer the question based on the following Venn Diagram.

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

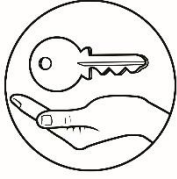


1. How many students like to play indoor games only?
2. How many students like to play outdoor games only and don't like to play indoor?
3. How many students don't like both indoor or outdoor games?
4. Do more students like to play indoor or outdoor games?

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 1. A 2. C 3. A 4. D 5. A 6. B 7. D 8. C 9. B 10. D	What's More 1. 25 liked eating in Both Restaurant A and Restaurant B 17 liked eating in Restaurant A only 28 liked eating in Restaurant B only 2. a. 15 students ride in a car, tricycle and motorcycle b. 34 students ride in both car and tricycle c. 35 students ride both in car and in motorcycle d. 32 students ride both in tricycle and in motorcycle e. 55 students ride in car only 67 students ride in motorcycle only 76 students ride in tricycle only 100 students preferred walking f. there are 269 students	Assessment 1. 36 students registered in Math Trail only; 44 students registered in Amazing Race only ; 42 students did not register for an event 85 is the maximum number of people who liked H & S; None or 0 for the minimum number; 15 is the minimum number of people who did not like H & S 3. 6 students played chess only; 7 students played basketball only; 2 students played volleyball only; There are 42 students in all. 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. 5. a. 12 students b. 92 students c. 80 students
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