SECONDARY
JHS

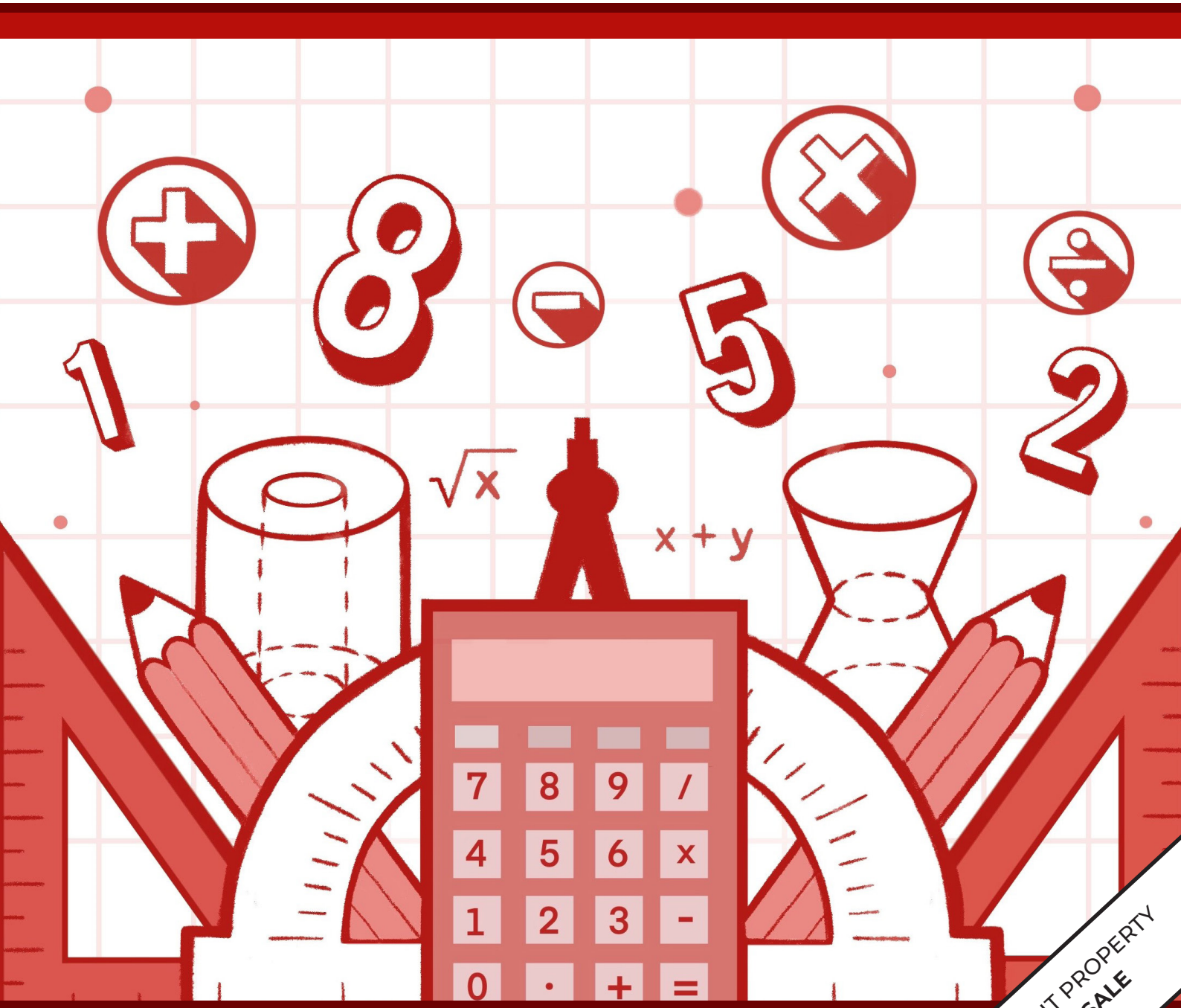
DepED DEPARTMENT OF EDUCATION

ALS Alternative Learning System LIFELONG LEARNING

LEARNING STRAND 3
MATHEMATICAL & PROBLEM-SOLVING SKILLS

MODULE 1: MEETING THE FAMILIES OF NUMBERS

ALS Accreditation and Equivalency Program: Junior High School



UNESCO United Nations Educational, Scientific and Cultural Organization

KOICA Korea International Cooperation Agency

LEARNING STRAND 3

MEETING THE FAMILIES OF NUMBERS

MATHEMATICAL AND PROBLEM-SOLVING SKILLS
MODULE 1

ALS Accreditation and Equivalency Program: Junior High School
Learning Strand 3: Mathematical and Problem-Solving Skills
Module 1: Meeting the Families of Numbers

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User's Guide

For the ALS Learner:

Welcome to this Module entitled Meeting the Families of Numbers under Learning Strand 3 Mathematical and Problem-Solving Skills of the ALS K to 12 Basic Education (BEC).

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 able to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:

 *Let's Get to Know*	This will give you an idea of the skills or competencies you are expected to learn in the module.
 *Pre-assessment*	This part includes an activity that aims to check what you already know about the lesson. If you get all the answers correct (100%), you may decide to skip this module.
 *Setting the Path*	This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.
 *Trying This Out*	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.
 *Understanding What You Did*	This includes questions that process what you learned from the lesson.
 *Sharpening Your Skills*	This section provides an activity that will help you transfer your new knowledge or skill in real-life situations or concerns.
 *Treading the Road to Mastery*	This is a task which aims to evaluate your level of mastery in achieving the given learning competency.
 *Don't Forget*	This part serves as a summary of the lessons in the module.
 *Explore More*	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.
 *Reach the Top*	This part will assess your level of mastery in achieving the learning competencies in each lesson in the module.
Answer Key	This contains answers to all activities in the module.
Glossary	This portion gives information about the meanings of the specialized words used 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 the Pre-assessment 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 ALS Teacher/Instructional Manager/Learning 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 ALS Teacher/Instructional Manager/Learning 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!

CONTENTS

CONTENTS

MODULE 1

LET'S GET TO KNOW

Tito Gino, the father of your friend, works in a junk shop. He is tasked to measure and group the items that are brought to the shop. He could use your help in writing the correct numerical values so he could finish his job quickly.

MODULE 1
PRE-ASSESSMENT

Instruction: Choose the letter of the correct answer by writing it on a separate sheet of paper.

1. Which of the following **do not belong** to the group of numbers?

   A. Two **B.** Three **C.** Four **D.** Six

2. Which of the following is a set of even integers?

   A. { 2, 4, 6, 8 } **B.** { 1, 2, 3, 4 } **C.** { 1, 3, 5, 7 } **D.** { 2, 4, 6, 7 }

3. Let ***A*** = { 5, 10, 15, 20, 25 }. Which is **not** an element of ***A***?

   A. 5 **B.** 10 **C.** 20 **D.** 30

4. Let B = { 6, 9, 12 } and C = { 6, 12, 18 }. What is $B \cup C$?

   A. { 6, 9, 12, 18 }
   B. { 3, 9, 12, 18 }
   C. { 6, 9, 15, 18 }
   D. { 6, 9, 12, 15 }

5. Let D be the set of odd integers from 1 to 15. How many elements does D have?

   A. 8 **B.** 7 **C.** 6 **D.** 5

6. Which of the following is a subset of the set consisting of multiples of 7?

   A. { 7, 14, 23 }
   B. { 7, 8, 9 }
   C. { 7, 10, 13 }
   D. { 7, 14, 21 }

7. True or False: The set of integers is a subset of the set of natural numbers.

   a. True **b.** False

8. Let $X = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$ and $Y = \{ 2, 4, 6, 8 \}$. What is $X \cap Y$?

a. $\emptyset$ **b.** $\{ 2, 4, 6, 8 \}$ **c.** $\{ 1, 3, 4, 5, 7 \}$ **d.** $\{ 0, 1, 3, 9 \}$

9. Let $X = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$ and $Z = \{ 1, 3, 4, 5, 7 \}$. What is $X \cap Z$?

a. $\emptyset$ **b.** $\{ 2, 4, 6, 8 \}$ **c.** $\{ 1, 3, 4, 5, 7 \}$ **d.** $\{ 0, 1, 3, 9 \}$

10. Let $X = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$ and $Z = \{ 10, 11 \}$. What is $X \cap Z$?

a. $\emptyset$ **b.** $\{ 2, 4, 6, 8 \}$ **c.** $\{ 1, 3, 4, 5, 7 \}$ **d.** $\{ 0, 1, 3, 9 \}$

11. In a number line, what are the integers on the left of 0?

a. Decimals
b. Positive integers
c. Fractions
d. Negative integers

12. If $\boldsymbol{A} = 2$, what is the integer 4 units to the right of $\boldsymbol{A}$?

a. 2 **b.** 4 **c.** 6 **d.** 8

13. Which of the following expression represents "x is greater than -3"?

a. $x > -3$ **b.** $x < -3$ **c.** $x \geq -3$ **d.** $x \leq -3$

14. Mang Pedro had ₱100.00. He gave ₱35.00 to his daughter. How much money is left?

a. ₱85.00 **b.** ₱75.00 **c.** ₱65.00 **d.** ₱55.00

15. John had 4 mangoes. He bought 3 more at the market. How many mangoes does he have in all?

a. 7 **b.** 8 **c.** 9 **d.** 10

LESSON 1

SETTING THE PATH

READY, SETS, GO

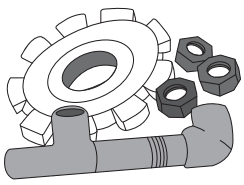
At the end of this lesson, you will be able to:

- define set and other related terms (LS3MP-NN-PSB-JHS-124);
- determine the union of two sets (LS3MP-NN-PSB-JHS-130); and
- express satisfaction in mastery of new ways of thinking through application of mathematics (LS3MP-NS-PSA-BL/LE/AE/JHS-3).

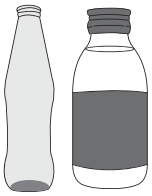
LESSON 1

TRYING THIS OUT

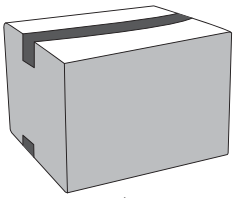
Instructions: Help Tito Gino arrange the items that can be found around the neighborhood. Write your answers in a separate sheet of paper.



scrap metal



bottle



carton

spring

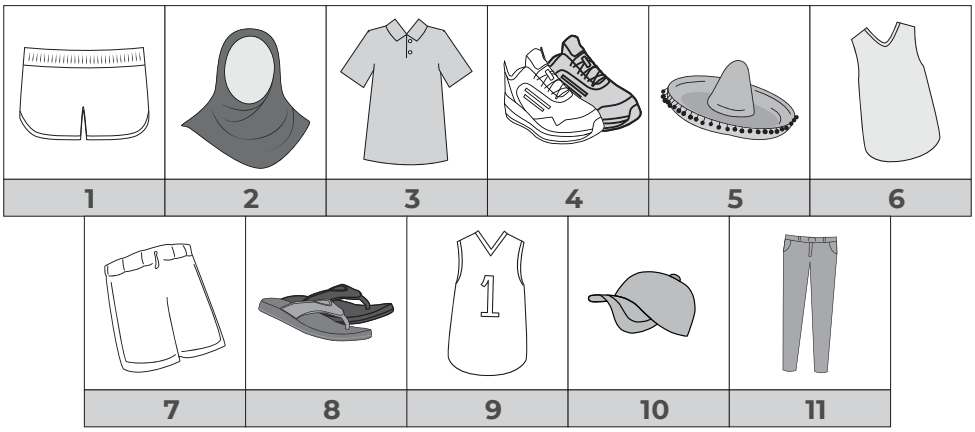
newspaper

tin can

I. Can you tell which group each item belongs to? On the table below, list the item that belongs under each classification.

PAPER-BASED	GLASS-BASED	ALLOY (STEEL MIX)	NON-BIODEGRADABLE (*HINDI NABUBULOK*)

II. Name the different items below.



III. Write the item/s one should wear with the corresponding body parts. Refer to the items identified above.

FEET	TORSO	LEGS	HEAD

IV. Write the items need to wear for a person's upper and lower body parts. Refer to the identified items above.

UPPER BODY (ABOVE THE WAIST)	LOWER BODY (BELOW THE WAIST)

LESSON 1

UNDERSTANDING WHAT YOU DID

Now, let us talk about what you just did. You should have been able to group the junk shop items in this manner:

- Paper-based items include newspaper and carton because they are made of paper.
- Glass-based items include *botelya* and bottles because they are made of glass.
- Alloy items include spring, tin can, and scrap metal because they are made of metallic materials.

How did you choose which garment belongs to each group? Remember that each item should share the same characteristics as the other items under the same group.

- Garments worn on the feet are shoes and slippers.
- Garments worn on the torso are shirt, sando, and jersey.
- Garments worn on the legs are shorts, skirt, and pants.
- Garments worn on the head are hijab, sombrero, and cap.

SETS

You can see different groupings around you like group of friends (*barkada*), a class of students, items in the grocery (wet and dry goods), fruits and vegetables in the market, and many others.

The same concept applies if we try to represent these items with numbers. Given below are some number groupings you might be familiar with.

WHOLE NUMBERS:	{ 1, 2, 3, 4, 5, 6 }
COUNTING NUMBERS:	{ 0, 1, 2, 3, 4, 5 }
INTEGERS:	{ −3, −2, −1, 0, 1, 2, 3 }
DECIMALS:	{ 0.32, 1.43, 2.5, 2.97, 3.8 }
FRACTIONS:	$\{\frac{1}{4}, \frac{2}{3}, \frac{3}{4}, \frac{7}{8}\}$

In mathematics, a collection of numbers is called a **set**, and it is usually enclosed in braces "{ }". Sets are named using capital letters, such as *Set A, Set B, Set C,* etc.

Each number inside a set is called an **element** or **member**. These elements should share the same characteristics based on the given condition, similar with what you did when sorting out the items in the junk shop and the clothing garments.

Let us go back to some of the examples we have above:

- The set of **Whole numbers** { 1, 2, 3, 4, 5, 6 } has **six elements** included.
- The set of **Decimals** { 0.32, 1.43, 2.5, 2.97, 3.8 } has **five elements** included, all of which are not exact whole number values and has a decimal point.
- The set of **Integers** { -3, -2, -1, 0, 1, 2, 3 } has **seven elements** included that are either positive or negative whole numbers and zero.

QUICK PRACTICE:
Let us go back to the rest of the examples above. Can you tell how many elements are included in those sets?

Counting Numbers _____ Fractions _____

When writing a set of numbers, arrange the elements in **ascending order**. Arranging numbers in ascending order means that the numbers are listed from the lowest value to the highest value.

Examples: { 2, 3, 4, 5, 6 }
{ −1, 0, 1, 2, 3, 4 }
{ −4, −2, 0, 2, 4, 6 }

Let us go back to the remaining items we have not yet discussed.

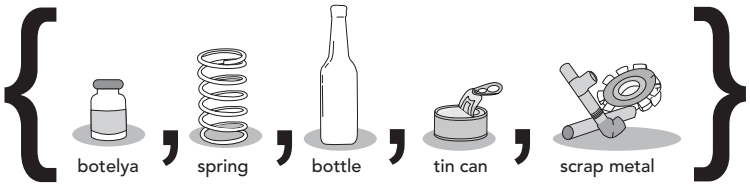
- For item (1.d.) **non-biodegradable** (*hindi nabubulok*), this group should include objects that do not decay such as: *botelya*, spring, bottles, tin can, and scrap metal.

- For item (4.a.) **upper body garments**, this group should include garments that are worn above the waist such as: hijab, sombrero, cap, shirt, sando, and jersey.

- For item (4.b.) **lower body garments**, this group should include garments that are worn below the waist such as: shorts, skirt, pants, shoes, and slippers.

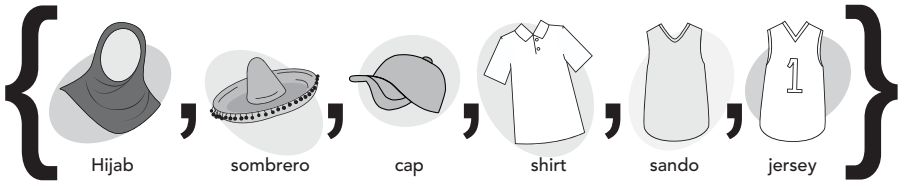
If you notice, these groups are composed of other groups that we have already identified before. For example, the non-biodegradable group in the junk shop is composed of objects made of glass and alloy materials.

NON-BIODEGRADABLE



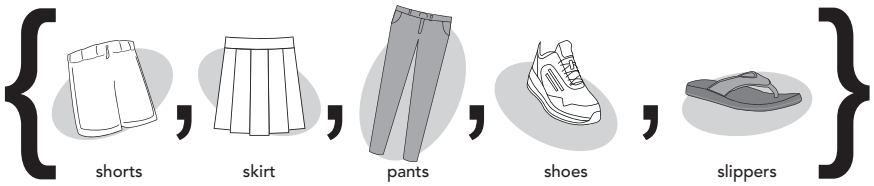
Similarly, the upper body garments group is made up of objects worn on the head and on the torso.

UPPER BODY GARMENTS



The lower body garments group is made up of objects worn on the legs and feet.

LOWER BODY GARMENTS



UNION OF SETS

Sets of numbers can also be combined together to form one bigger set. The set formed is called a **union of sets.** We use the symbol "∪" to show the union of two or more given sets.

1. $A = \{ 1, 3, 5, 8 \}$ $B = \{ -2, 0, 4, 9 \}$

- To determine $A \cup B$, we combine the elements of Set A and Set B in a single set: $(A \cup B) = \{ 1, 3, 5, 8, -2, 0, 4, 9 \}$.
- Arranging this set in ascending order, we obtain: $(A \cup B) = \{ -2, 0, 1, 3, 4, 5, 8, 9 \}$.
- $(A \cup B)$ is read as "A union B".

2. $A = \{ -3, 1, 9 \}$ $B = \{ 2, 5, 7, 10 \}$ $C = \{ 1, 13 \}$

- $(A \cup C) = \{ -3, 1, 9, 13 \}$
- $(A \cup C)$ is read as "A union C".
- Observe that the element "1" appears in both Set A and Set C.
- In $(A \cup C)$, we need to write the element "1" only once.

3. $A = \{ -3, 1, 9 \}$ $B = \{ 2, 5, 7, 10 \}$ $C = \{ 1, 13 \}$

- $(A \cup B \cup C) = \{ -3, 1, 2, 5, 7, 9, 10, 13 \}$
- $(A \cup B \cup C)$ is read as "A union B union C".

LESSON 1

SHARPENING YOUR SKILLS

I. **Instructions**: Group the numbers found in the table below into the given sets that they belong to. Write your answer on a separate sheet of paper.

-2	5	-15.8	$\frac{5}{6}$	$-\frac{13}{2}$	23
2.4	0	4	-9	8.01	$\frac{11}{8}$
$\frac{1}{4}$	-11	2.1	13	-5.7	$-\frac{2}{7}$

1. Integer: { }
2. Negative Decimal: { }
3. Odd Whole Number: { }
4. Positive Fraction: { }
5. Not Whole Number: { }

II. **Instructions**: Write down the numbers from 1 to 50, and identify which of these numbers belong to each group below.

1. Even numbers:
2. Multiples of 3:
3. Numbers greater than 35:
4. Odd numbers less than 20:
5. Multiples of 7 greater than 10:

III. Application:

If you are tasked to lead the collection of recycled materials in your neighborhood to be able to raise funds for the distribution of relief goods to the victims of calamity, what will you do?

Can you apply the learnings about sets in the given task? How?

In what way can you use the union of sets?

Write your answer on a separate sheet of paper.

LESSON 1

TREADING THE ROAD TO MASTERY

Instructions: Write down the indicated union of sets. Write your answer on a separate sheet of paper. Item 1 serves as an example.

$$\boldsymbol{A} = \{ -3, 1, 5, 9 \} \qquad \boldsymbol{B} = \{ -4, -2, 0, 2, 4 \}$$
$$\boldsymbol{C} = \{ -1, 3, 7 \}$$

1.

a. $(B \cup C)$ = **{ −4, −2, −1, 0, 2, 3, 4, 7 }**
b. $(C \cup A)$ = **{ −3, −1, 1, 3, 5, 7, 9 }**
c. $(B \cup A)$ = **{ −4, −3, −2, 0, 1, 2, 4, 5, 9 }**

$$\boldsymbol{D} = \{ -2.4, -1.7, 3.5, 8.09 \} \qquad \boldsymbol{E} = \{ -3.5, -2.57, -2.04, -0.69 \}$$
$$\boldsymbol{F} = \{ 1.42, 3.15 \}$$

2.

a. $(F \cup E)$
b. $(E \cup D)$
c. $(F \cup D)$

$$\boldsymbol{G} = \left\{ \frac{2}{7}, \frac{1}{2}, \frac{3}{5}, \frac{4}{3} \right\} \qquad \boldsymbol{H} = \{ 0.2, 0.45, 1.73, 2.8 \}$$
$$\boldsymbol{I} = \{ 0, 1, 2 \}$$

3.

a. $(G \cup H)$
b. $(H \cup I)$

LESSON 2

SETTING THE PATH

SETTING IT UP

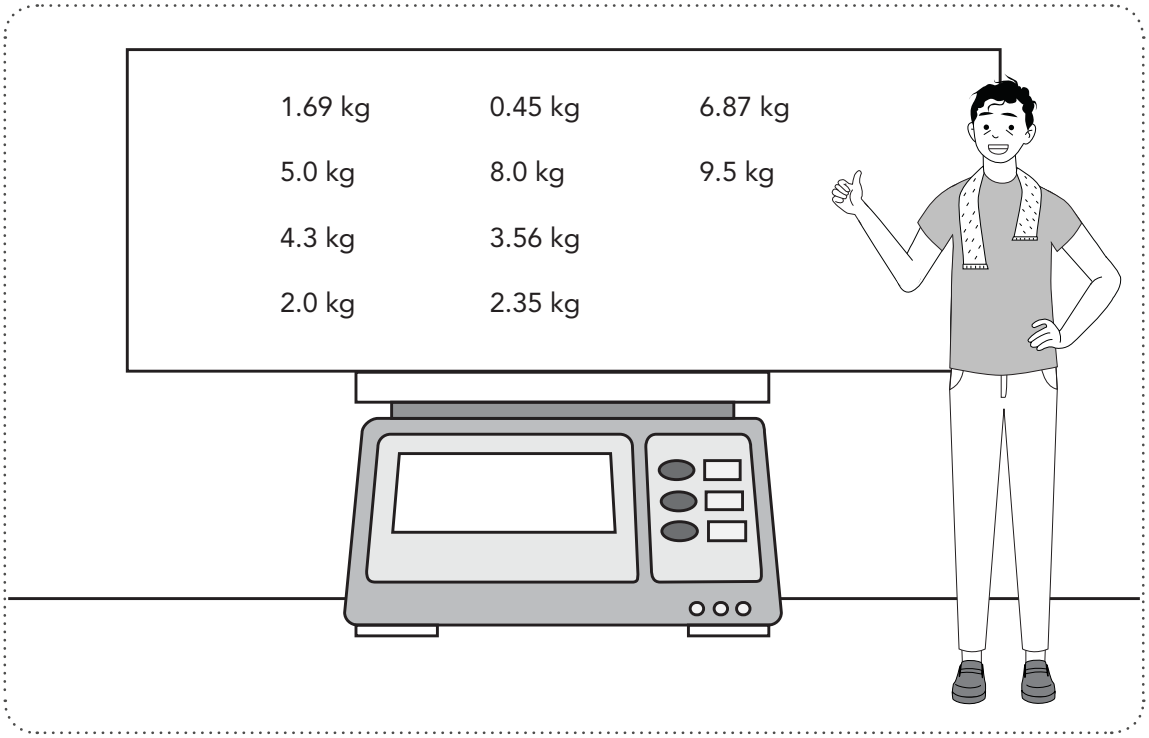
At the end of this lesson, you will be able to:

- discuss the different kinds of sets (LS3MP-NN-PSB-JHS-125);
- determine the intersection of two sets (LS3MP-NN-PSB-JHS-131); and
- express satisfaction in mastery of new ways of thinking through application of mathematics (LS3MP-NS-PSA-BL/LE/AE/JHS-3).

LESSON 2

TRYING THIS OUT

Instructions: Tito Gino is in-charge of recording the weight of the items sold to the junk shop. His boss asked him to group the weights according to the conditions stated in each set below. Help Tito Gino identify which weights belong to which set.



Set *A* = weight in whole number

Set *B* = weight with decimals

Set *C* = weight less than 1.0 kilogram

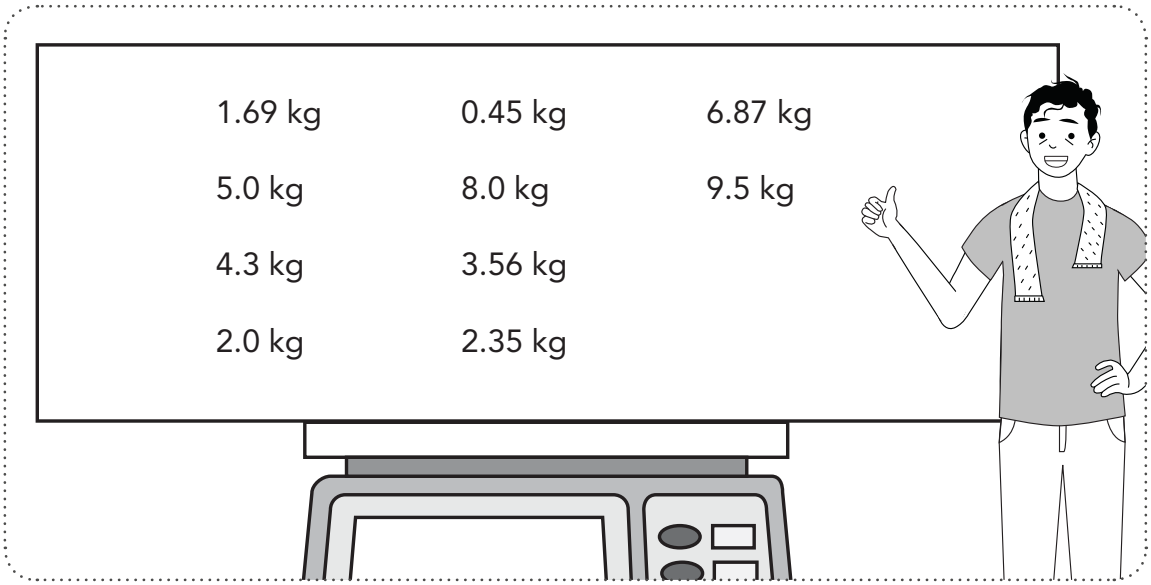
Set *D* = weight more than 10 kilograms

Set *E* = weight of not more than 5 kilograms

LESSON 2

UNDERSTANDING WHAT YOU DID

Look at the measurements of the items brought to the shop that Tito Gino recorded. If you grouped them the way they are grouped below, congratulations! You did a good job.



Set *A* = { 2, 5, 8 }
Set *B* = { 0.45, 2.35, 3.56, 4.3, 6.87, 9.5 }
Set *C* = { 0.45 }
Set *D* = { }
Set *E* = { 0.45, 2, 2.35, 3.56, 4.3 }

As you can observe, there are some sets that has only one element, some sets that share the same elements with other sets, and some sets that do not contain anything. Let us get to know what each of these sets are called.

DIFFERENT KINDS OF SETS

1. **SINGLETON SET** contains only one element.

   In Tito Gino's list, Set *C* is a singleton set. Set *C* = { 0.45 }

   Other singleton sets are Set *F* ={ 1 }, Set *G* ={ −2 }, and Set *H* = { 0 }.

2. **NULL OR EMPTY SET** does not contain any element. This kind of set is represented by the symbols "{ }" or "{∅}".

   In Tito Gino's list, Set *D* is a null or empty set because it does not have any element. In other words, no weight is more than 10 kilograms.

3. **FINITE SET** contains a limited amount of elements.

   In Tito Gino's list, sets A, B, C, and E are all finite sets with countable number of elements.

   Set *A* = { 2, 5, 8 }

   Set *B* = { 0.45, 1.69, 2.35, 3.56, 4.3, 6.87, 9.5 }

   Set *C* = { 0.45 }

   Set *E* ={ 0.45, 1.69, 2, 2.35, 3.56, 4.3 }

   The set { 2, 3, 7, 10 } has four elements.
   The set { −5, −3, −2, 4, 6, 11, 14, 19, 21 } has nine elements.

   These sets are finite because there is a specific number of items included.

Have you tried counting how many numbers are out there? Ten (10)? One hundred (100)? One thousand (1,000)? One million (1,000,000)?

Sadly, you will never be able to count all the numbers because numbers have **no limit**. Numbers are endless. This concept of numbers, having no limit or end, is called **infinity**.

4. **INFINITE SET** contains a number of elements that has no end or limit or not finite.

Examples: Set $J = \{ 2, 4, 6, 8, \ldots\}$
Set $K = \{ \ldots, -3, -2, -1 \}$
Set $L = \{ \ldots, 9, 12, 15, \ldots\}$

The three dots in succession is called an **ellipsis** which represents that the set has infinite number of elements.

For instance, if we are to list down all multiples of 5 that are greater than 15, it will be tedious and impossible, so we use ellipsis to show that the set is endless. Thus, we write a few elements of the set and put ellipsis, like the one shown below:
{ 20, 25, 30, 35, …}

Infinite sets are usually used with groups involving the words "greater or more than (>)" and "less than (<)."

Example 1. Let us look at Set D on page 16. Instead of writing 'weight more than 10 kilograms', you may symbolize this as $w > 10$, where w is the weight.

If we are asked to list all elements in Set D = w > 10 using all possible numbers we can imagine, we might never finish because the numbers more than 10 kilograms is infinite so we can use ellipsis to denote it does not end.

Set D = { 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9, 11, 11.1, 11.2, 11.3, 11.4, 11.5, … }

We do not write 10 because 10 is not more than 10, but we use it as a reference value, so the list starts with the number after it (here: 10.1).

Example 2. List the integers x less than 3.

$$x < 3 = \{ \ldots, -3, -2, -1, 0, 1, 2 \}$$

We do not write 3 because 3 is not less than 3, but we use it as a reference value, so the list stops with the integer before 3 (here: 2).

You might also meet the symbols "≥" (**greater than or equal**) and "≤" (**less than or equal**). The only difference is that we include the reference value in the list because of the word "equal". Check out the example below.

Example 3. List all whole numbers x more than or equal to 2.

$$x \geq 2: \{ 2, 3, 4, 5, \ldots \}$$

We write 2 because 2 is equal to 2, and we use it as a reference value, so the list starts with the whole number 2.

5. **SUBSET** is a set with ALL its elements contained in a bigger set. The symbol for subset is "⊆".

   In Tito Gino's list, there are several examples of a subset. Let us consider sets *B, C,* and *E*.

   Set *B* = { 0.45, 1.69, 2.35, 3.56, 4.3, 6.87, 9.5 }
   Set *C* = { 0.45 }
   Set *E* = { 0.45, 1.69, 2, 2.35, 3.56, 4.3 }

   As you can observe, all elements of set *C* is contained in set *B*. We say that set *C* is a subset of set *B*. We can write that as $C \subseteq B$. Similarly, set *C* is also a subset of set *E* written as $C \subseteq E$.

INTERSECTION OF SETS

Now, observe again the group of weights that Tito Gino recorded. More specifically, examine the sets that contain the same weights.

Set *A* = { 2, 5, 8 }
Set *B* = { 0.45, 1.69, 2.35, 3.56, 4.3, 6.87, 9.5 }
Set *C* = { 0.45 }
Set *D* = { }
Set *E* = { 0.45, 1.69, 2, 2.35, 3.56, 4.3 }

If Tito Gino's boss asked him to sort out their inventory by identifying groups of weights that contain the same elements, the list should look like this:

Set *A* and Set *E* both contain 2.
Set *B,* Set *C,* and Set *E* contain 0.45.
Set *B* and Set *E* both contain 0.45 , 1.69 , 2.35 , 3.56 , 4.3.

To determine the **intersection of sets**, we identify elements that are common to two or more different sets. We use the symbol "∩" to show intersection of these sets.

Using Tito Gino's list, we can write the intersection of sets as:

$(A \cap E) = \{ 2 \}$	$(A \cap E)$ read as "A intersection E"
$(B \cap C) = \{ 0.45 \}$	$(B \cap C)$ read as "B intersection C"
$(C \cap E) = \{ 0.45 \}$	$(C \cap E)$ read as "C intersection E"
$(B \cap E) = \{ 0.45, 1.69, 2.35, 3.56, 4.3 \}$	$(B \cap E)$ read as "B intersection E"

Look at the other examples of intersection of sets below:

$$M = \{ 1 , 2 , 3 , 4 , 5 \} \quad \text{and} \quad N = \{ 2 , 4 , 6 , 8 , 10 \}$$

To determine $M \cap N$, we find elements that are both in Set M and Set N. It appears that 2 and 4 are in both sets. Thus,

1. $(M \cap N) = \{ 2 , 4 \}$

$$P = \{ -3 , -1 , 2 , 4 \} \quad \text{and} \quad Q = \{ -4 , -3 , -2 , -1 , 0 , 1 , 2 , 3 , 4 , 5 \}$$

2. $(P \cap Q) = \{ -3 , -1 , 2 , 4 \}$

$$R = \{ 7 , 8 , 9 , 10 \} \quad \text{and} \quad T = \{ 12 , 13 , 14 , 15 \}$$

3. $(R \cap T) = \emptyset$

No elements are the same in set R and set T so the intersection is an empty set.

LESSON 2

SHARPENING YOUR SKILLS

I. **Instructions:** Identify the kind of set given in each item. Choose your answers from the names in the box. Justify your answer. Write your answer in a separate sheet of paper. Item 1 serves as an example.

Finite set	Infinite set	Singleton set	Null set	Subset

Infinite set **1.** $A = \{ \ldots , -13 , -12 , -11 , -10 , -9 \}$

Set A is an infinite set because it has no end or limit. The ellipsis in the beginning of the set shows that there are an infinite number of elements.

_____ **2.** $B = \emptyset$

Reason/s:

_____ **3.** $C = \{ 2 \}$

Reason/s:

_____ **4.** $D = \{ \ldots , 2 , 5 , 8 , 11 , \ldots \}$

Reason/s:

_____ **5.** $E = \{ -13 , -9 , -5 , -1 \}$

Reason/s:

_____ **6.** $F = \{ \ \}$

Reason/s:

II. Instructions: Identify the subsets of the main set in each item. Choose all letters that apply. Justify your answer. Write your answer in a separate sheet of paper.

1. $A = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 \}$

a. $\{ 0, 2, 4, 6, 8, 10 \}$
b. $\{ 1, 3, 7 \}$
c. $\{ -1, 0, 1, 2 \}$
d. $\{ 4, 5, 8, 9 \}$

Reason/s:

2. $B = \{ -21, -17, -13, -9, -5, -1, 3, 7 \}$

a. $\{ -21, -9, 3 \}$
b. $\{ -22, -21, -18, -17, -12, -13 \}$
c. $\{ -13, -5, -1, 7 \}$
d. $\{ -11, -10, -9, -8 \}$

Reason/s:

LESSON 2

TREADING THE ROAD TO MASTERY

Instructions: Identify the elements of the given intersection of sets. Write your answer in a separate sheet of paper.

1. $A = \{ 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 \}$ $B = \{ 0, 1, 2, 3, 5, 8 \}$
$C = \{ 0, 2, 4, 6 \}$ $D = \{ 1, 3, 5, 7 \}$

a. $A \cap B$
b. $A \cap C$
c. $A \cap D$
d. $B \cap C$
e. $B \cap D$
f. $C \cap D$

2. $P = \{ 2, 4, 6, 8, 10 \}$ $R = \{ -4, -3, -2, -1, 0, 1, 2, 3, 4, 5 \};$
$S = \{ -9, -8, -7, -6, -5 \};$ $T = \{ 5, 8, 11, 13 \}$

a. $T \cap P$
b. $R \cap T$
c. $S \cap T$
d. $P \cap S$
e. $R \cap P$
f. $S \cap R$

LESSON 3

SETTING THE PATH

FALLING IN LINE

At the end of this lesson, you will be able to:

- describe and draws a number line (LS3MP-NN-PSB-JHS-137);
- show the different sets of real numbers on a number line (LS3MP-NN-PSB-JHS-138); and
- describe the set of integers (LS3MP-NN-PSB-JHS-142).

LESSON 3

TRYING THIS OUT

It is inventory time for Tito Gino, and he asked for your help to better understand the different applications of numbers that can make his job easier. Right now, he needs to compute the money gained daily by determining the total weight of materials left in the junk shop after all the transactions in a day.

To get this information, do the activity below to show him how numbers work using movements.

Instructions:

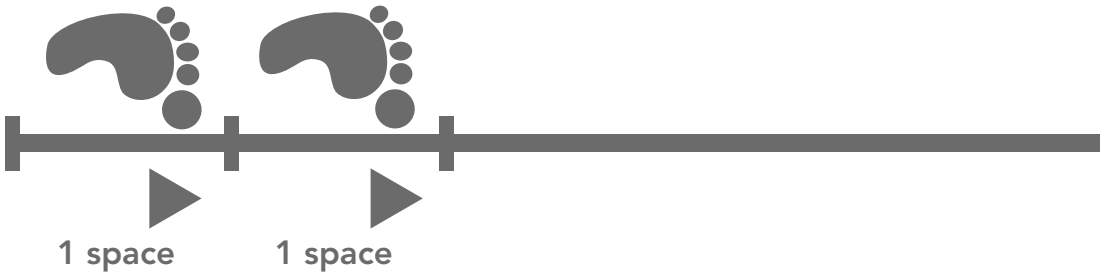
1. Create a straight line on the floor.

2. Mark the starting point as zero (0). Mark equal spaces on the line using your foot, then name each mark using numbers 1, 2, 3, and so on until you reach 15.

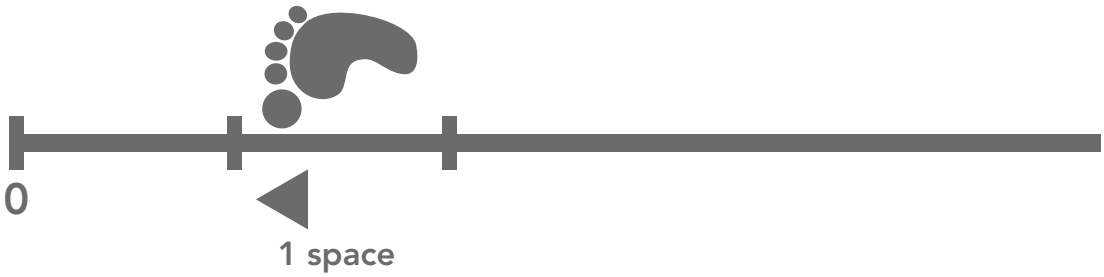
3. Using the list of transactions in the junk shop for the past week, compute the money gained daily in terms of the weight of materials left each day. Move forward for "sell" amounts, move backwards for "buy" amounts.

Examples:

1. SELL 2 kg → Move 2 spaces forward.



2. BUY 1 kg → Move 1 space backward.



Let us now apply the instructions in the activity based on the transactions for the last five days given in the table below.

DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
Sell 4 kg	Sell 8 kg	Sell 7 kg	Sell 9 kg	Sell 10 kg
Buy 2 kg	Buy 5 kg	Buy 5 kg	Sell 3 kg	Buy 5 kg
Buy 1 kg	Sell 3 kg	Buy 2 kg	Buy 10 kg	Buy 4 kg
Sell 5 kg	Buy 2 kg	Sell 8 kg	Sell 6 kg	Sell 3 kg
Sell 1 kg	Buy 4 kg	Buy 5 kg	Buy 7 kg	Sell 2 kg

LESSON 3

UNDERSTANDING WHAT YOU DID

Applying the movements on the line you made, this should be the results that you got:

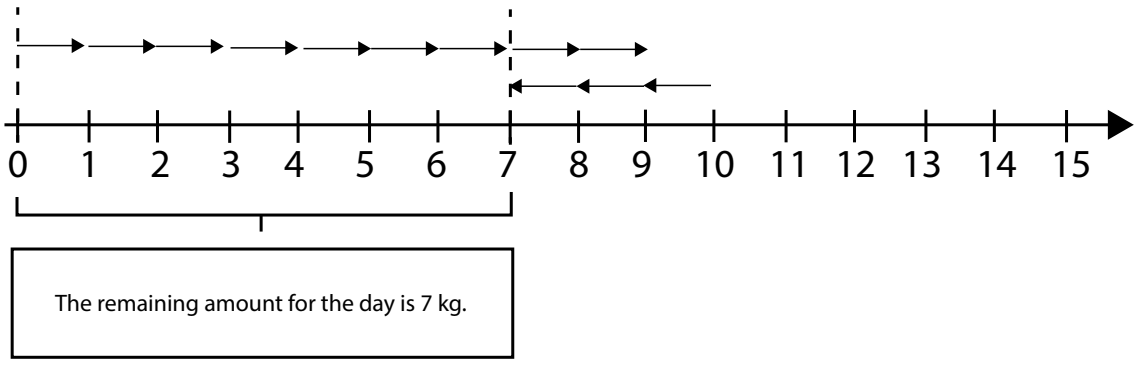
DAY 1	7 kg
DAY 2	0 kg
DAY 3	1 kg
DAY 4	3 kg
DAY 5	6 kg

The items that the shop sells, gain money, which is why the movement is forward.

The items that the shop buys, lose money, as payment to the sellers who brought them, which is why the movement is backward.

In this exercise, you have just used a number line to show the natural movement of numbers. The number line helps show the result of combining numbers in this kind of situations. The remaining weight on for Day 1 is shown below.

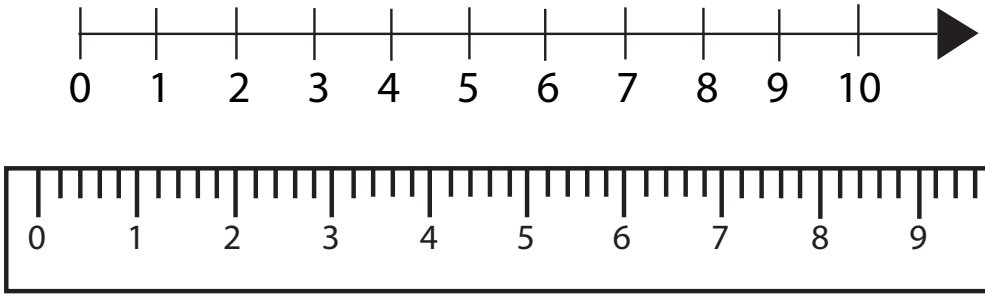
DAY 1



Let us get to know more about the number line.

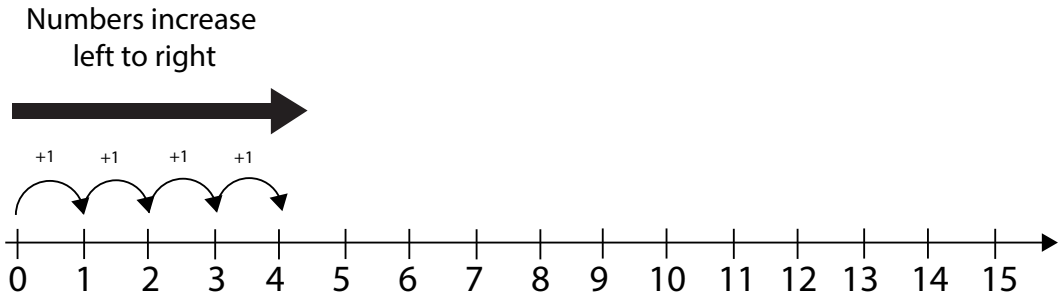
NUMBER LINE

The **number line** is a straight line that has numbers at equal distances. The number line uses zero as its starting point. It is similar to a ruler whose numbers have equal distances from each other.

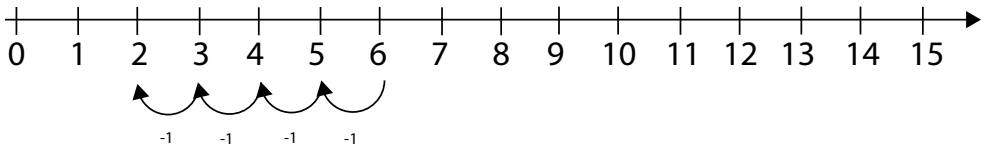


MOVEMENT IN THE NUMBER LINE

You may notice from the activity that you did at the beginning of the lesson that the numbers on the line gets bigger as you are moving to the right (forward).



Meanwhile, numbers on the line gets smaller when you are moving to the left (backward).



Numbers decrease
right to left

We can show different situations in real life as movement in the number line. For example, in the use of money, think of the movement to the right as receiving money where the amount you have increases. On the other hand, the movement to the left is your spending where the amount of your money decreases.

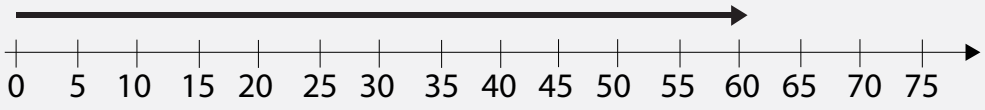
Example

If you have ₱20.00 as *baon* every day, compute how much will be left after three days if you spend on the following:

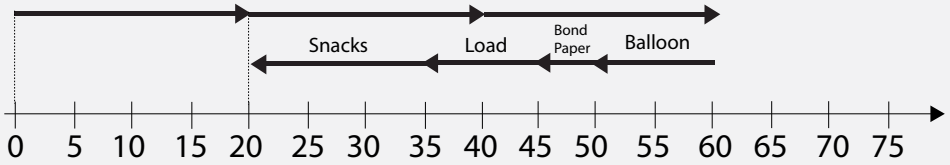
Ballpen = ₱10.00	Call & Text Load = ₱10.00
Bond Paper = ₱5.00	Snacks = ₱15.00

We can use any interval for our number line as long as it is consistent for all values. For this example, we use a number line with intervals of 5.

You have ₱20.00 each day for the three days, so your money increases, and you move to the right. This means you have ₱60.00 in total for three days. Look at the movement below.



The money you spend on things decreases the amount you have so we move to the left.

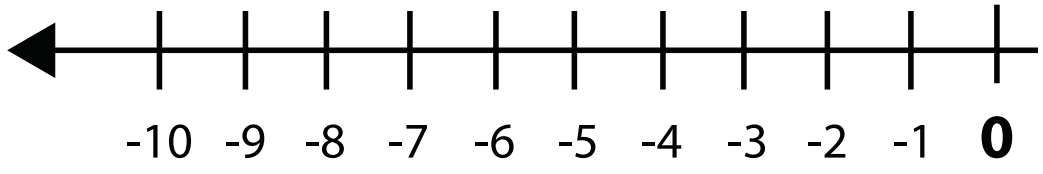


Using the number line, you can see that you still have ₱20.00

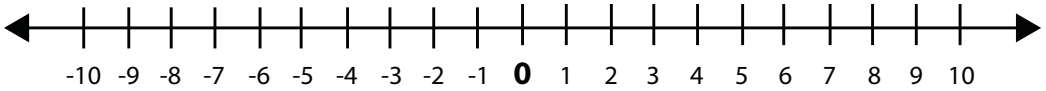
MOVING TO THE LEFT OF ZERO

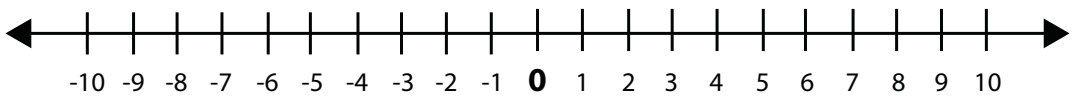
Can we move to the left of zero (0)? If we use money as reference, remember that moving to the left means we are losing money.

When we do not have any money (zero) but we need to pay bills and expenses, we might borrow money from your friends. Borrowing money or debt is an example of going to the left of zero. We will have a negative amount of money which is represented in the number line below.



Integers are made up of positive numbers, negative numbers, and zero. They constitute the usual number line used in mathematics.





This number line extends to infinity on both sides as symbolized by the arrow heads at both ends.

DIFFERENT INTERVALS ON THE NUMBER LINE

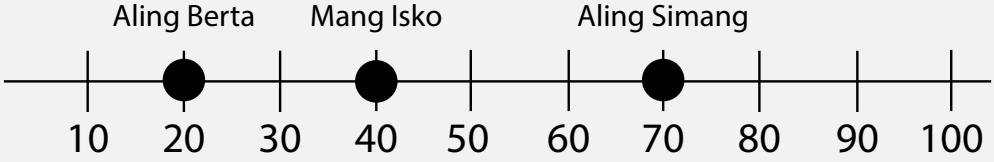
We can use any intervals on the number line to simplify representations particularly on bigger values as long as the intervals are of equal spaces.

Example 1.

Compare the number of fishes sold by three fish vendors in the market using the number line.

VENDOR	NUMBER OF FISHES SOLD
MANG ISKO	40
ALING SIMANG	70
ALING BERTA	20

Since the biggest number is 70 and it will take a lot of space to draw a number line up to 70, we can use a number line with intervals of 10.



The rightmost point in the number line is the biggest while the leftmost is the smallest.

Additionally, we can clearly see the differences between the number of fishes sold – who has the most and least number of fishes sold using the number line.

Aling Berta and Mang Isko are separated by 2 intervals of 10, meaning the difference between the fishes they sold is 20.

Aling Simang and Mang Isko are separated by 3 intervals of 10, meaning the difference between the fishes they sold is 30.

Aling Berta and Mang Isko are separated by 5 intervals of 10, meaning the difference between the fishes they sold is 50.

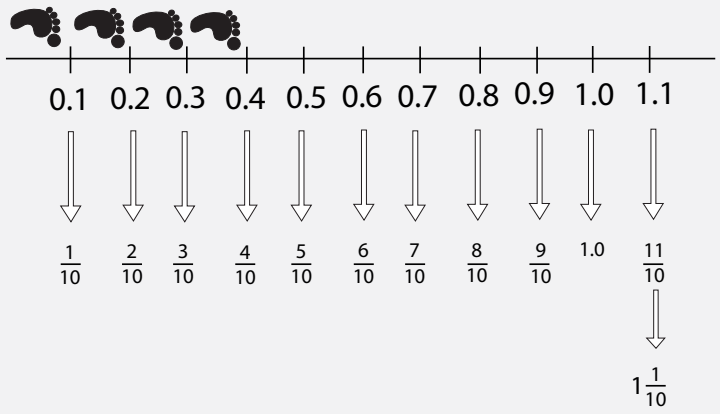
Example 2.

Represent the amount of centavo coins among three friends by shading their positions in the number line.

Eugene	₱ 0.30 or 30 centavos
Jeremiah	₱ 0.80 or 80 centavos
Jericho	₱ 0.50 or 50 centavos

We take note that decimals like 0.30, 0.50, and 0.80 are numbers that occur in between whole numbers.

We can imagine making smaller divisions or "baby steps" in between 0 and 1 to represent decimals better as shown below. In fact, both decimals and fractions may be represented this way.



Using this idea, the amount of centavo coins Eugene, Jeremiah, and Jericho has can be positioned in the number line as shown below.

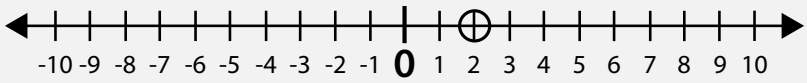
INFINITY ON THE NUMBER LINE

Suppose we want to show all numbers x greater than 2 in the number line. We need to show that all locations on the number line has the same characteristic (all are more than 2). To do so, we can *connect the points* representing the numbers.

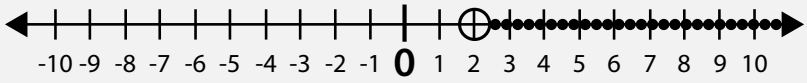
Example 1

Represent $x > 2$ in the number line.

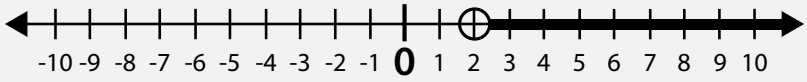
Recall that in demonstrating $x > 2$, we use 2 as the reference number that we do not include in the set. In the number line, we represent this using an open circle (unshaded).



You can see that all numbers greater than 2 is represented by points.



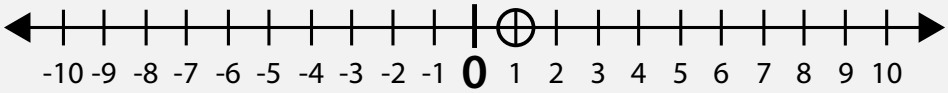
We can connect all these points to show that they have the same characteristic (all are greater than 2) by shading the area heavily.



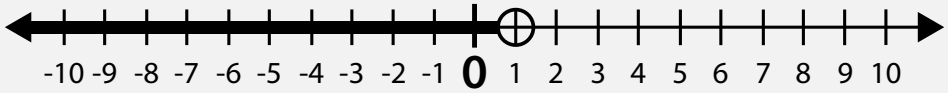
Example 2.

Represent $x < 1$ in the number line.

We use 1 as the reference value, and since it is not included in the set, we represent it with an open circle.



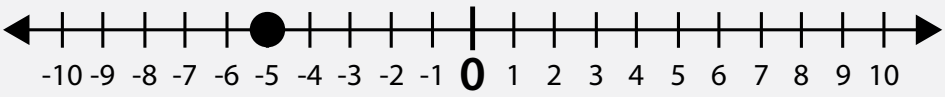
Then, shade the left side of 1 showing all numbers less than 1.



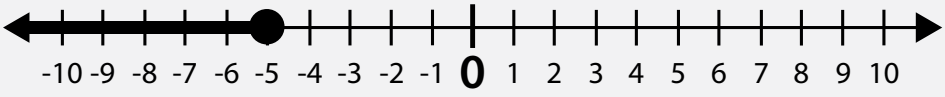
Example 3

Represent $x \leq -5$ in the number line.

Recall that in demonstrating $x \leq -5$, we use -5 as the reference number. The "equal to" means that -5 is included in the set. To show this, we use a shaded circle.



Then, shade the region to the left of the point showing all numbers less than -5.

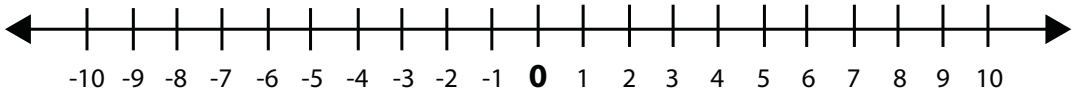


LESSON 3

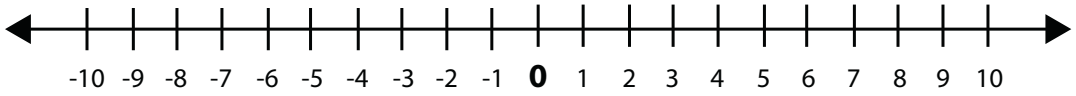
SHARPENING YOUR SKILLS

I. **Instructions:** Show where the given number is located by shading the corresponding point or points in the number line. Write your answer in a separate sheet of paper.

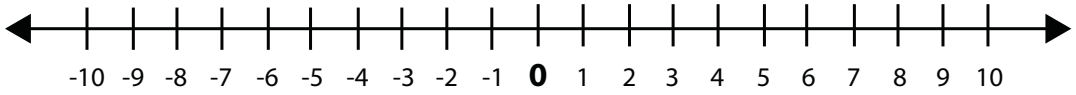
1. $x = 2$



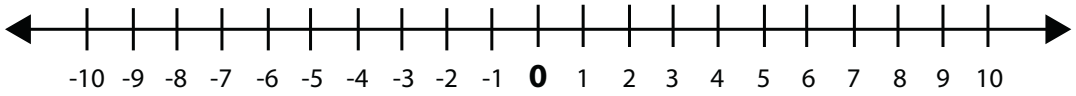
2. $x = \{-3, -1, 2, 5, 7\}$



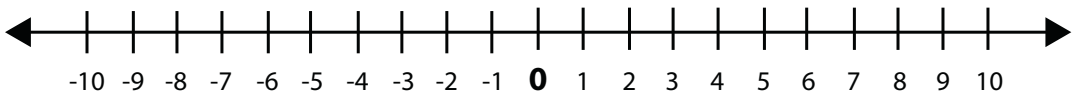
3. $x = \frac{5}{2}$



4. $x > -6$



5. $x \leq 4$



II. **Instructions:** Draw a number line with appropriate intervals. Then, show the location of all the points in the given list. Label the points with the correct name and describe the movement. Write your answer in a separate sheet of paper.

1. Number of kilograms of harvested corn:

AUGUST	x = 25 kg
SEPTEMBER	x = 55 kg
OCTOBER	x = 40 kg
NOVEMBER	x = 10 kg

Description:

2. Amount of alcohol used in an experiment:

TRIAL 1	0.5 g
TRIAL 2	0.7 g
TRIAL 3	0.2 g

Description:

3. Work completed by each worker in a day:

JOSH	$\frac{3}{10}$
JM	$\frac{4}{5}$
NANETTE	$\frac{1}{2}$
ERMIL	$\frac{7}{10}$
GINO	$\frac{2}{5}$

Description:

LESSON 3

TREADING THE ROAD TO MASTERY

Instructions: Use number line to solve the following word problems. Place your answers in a separate sheet of paper.

1. If gaining money is represented by *increasing value* and spending money is represented by *decreasing value*, show how to solve the given problem.

   Joel has a salary of ₱1,000.00. Solve for the amount of money Joel has left if he spent ₱200.00 for clothes, ₱300.00 for food, and ₱100.00 for transportation.

2. Tyang Amy buys-and-sells phones. Given her list of transaction for the week, compute how many phones are left with her.

BUY	10 phones
SELL	5 phones
BUY	6 phones
SELL	3 phones
SELL	7 phones
BUY	3 phones
SELL	2 phones

3. Compare the height (h) requirement of three sports teams of a university using a number line. Use shading.

FOOTBALL	$h > 5$ ft.
BASKETBALL	$h > 6$ ft.
VOLLEYBALL	$h > 5.5$ ft.

MODULE 1

DON'T FORGET

- **Sets** are groups of numbers, such as integers, whole numbers, decimals, fractions, etc, that have the same characteristics. Sets are named using capital letters such as Set *A*, Set *B*, etc. Members of a set are called **elements**.

- In writing sets of numbers, we enclose the elements, written in ascending order, inside braces "{ }".

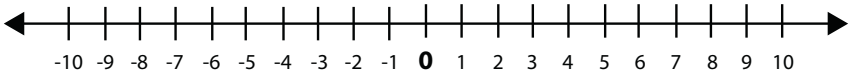
- There are different types of sets.

  a. A **singleton set** only contains one element.
  b. A **null or empty set** has no element — symbolized by "{ }" or "∅".
  c. A **finite set** has countable number of elements.
  d. An **infinite set** has a number of elements that does not have a limit or end.
  e. A **subset** is a set with all its elements found in another bigger set. Subset is symbolized by "⊆".

- A **union** of sets is combination of all the elements from each set. It is symbolized by "∪".

- An **intersection** of sets is composed of elements common to both sets. It is symbolized by "∩".

- A **number line** is a straight horizontal line extending on both directions containing numbers spaced equally from one another. It uses zero as a reference point.



- In the number line, numbers to the right of zero are positive, while numbers to the left of zero are negative.
- Different intervals can be used to represent a number line as long as the interval or spacing between numbers is the same to represent big numbers, decimals, or fractions.
- Moving to the right in the number line means an increase in value. In solving mathematical problems, this signifies addition.
- Moving to the left in the number line means a decrease in value. In solving mathematical problems, this signifies subtraction.

MODULE 1

EXPLORE MORE

For additional activities related to the topics in this module, these resources may be helpful:

“How Do You Graph a Set on a Number Line?”
through https://www.youtube.com/watch?v=FHOE4EvYCm8

"Intersection of Sets, Union of Sets and Venn Diagrams”
through https://www.youtube.com watch?v=xZELQc11ACY

MODULE 1
REACH THE TOP

I. **Instruction**: Choose the letter of the correct answer by writing them on a separate sheet of paper.

1. Which of the following is a positive fraction?

a. 2 **b.** $-\frac{1}{2}$ **c.** $\frac{3}{4}$ **d.** 0.4

2. Which of the following belongs to the set of numbers from 1 to 50 which are multiples of 5?

a. { 5, 10, 15 } **b.** { 1, 3, 5, 10 } **c.** { −10, −5, 0 } **d.** { 2, 4, 6, 7 }

3. If $A = \{ -1, 3, 7 \}$ and $B = \{ 0, 2, 4 \}$, find $A \cup B$.

a. { −1, 3, 0 } **b.** { −1, 3, 2, 4 } **c.** { −1, 3, 7, 0 } **d.** {−1, 0, 2, 3, 4, 7}

4. If $A=\{-1, 3, 7\}$ and $B=\{0, 2, 4\}$, find $A \cap B$.

a. ∅ **b.** { −1, 3, 4 } **c.** { −1, 0, 2 } **d.** { 0, 2, 7 }

5. If $C = \{ 0, \frac{1}{4}, \frac{1}{3}, \frac{1}{2} \}$ and $D = \{ -1, 0, 1 \}$, find $C \cap B$.

a. { 0 } **b.** { −1 } **c.** $\{\frac{1}{2}\}$ **d.** $\{\frac{1}{4}\}$

6. Which of the following is a singleton set?

a. { 7, 14, 23 } **b.** { −3, −2 } **c.** { −1, 0, 1 } **d.** { −3 }

7. Which of the following is a finite set?

a. { …, 8, 9, 10 } **b.** { −3, 0, 3 } **c.** { …, −1, 0, 1, … } **d.** { 2, 3, 4, … }

8. What type of set is $S = \{ -6, -3, 0, 3, 6 \}$?

a. singleton **b.** finite **c.** infinite **d.** null

9. Which of the following is a singleton subset of $S = \{ -6, -3, 0, 3, 6 \}$?

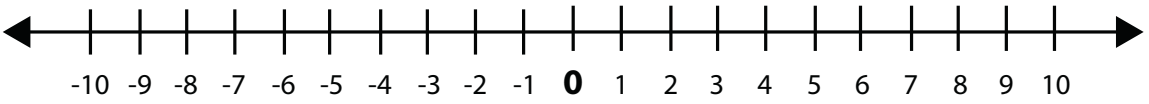
a. $\emptyset$ **b.** $\{ -6, 0 \}$ **c.** $\{ 3 \}$ **d.** $\{ 0, 3 \}$

10. Mark has a salary of ₱1,500.00. How much money will Mark have if he spent ₱100.00 for transportation, ₱250.00 for food, and ₱100 for clothes?

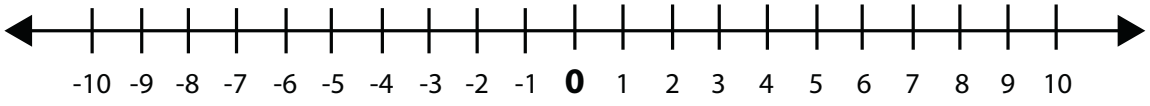
a. ₱1,050.00 **b.** ₱1,000.00 **c.** ₱900.00 **d.** ₱850.00

II. Instructions: Show where the given number is located by shading the corresponding point or points in the number line. Write your answer in a separate sheet of paper.

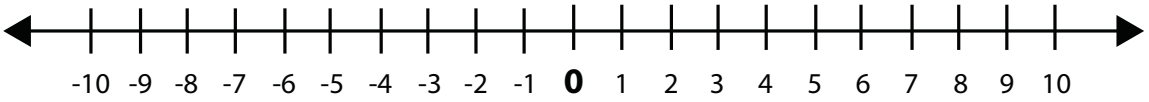
11. $x = -5$



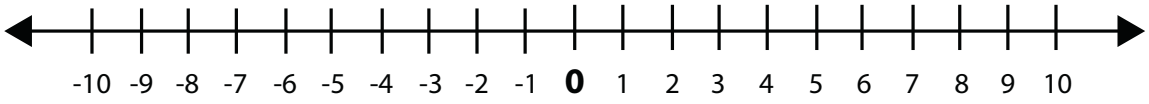
12. $x = 1$



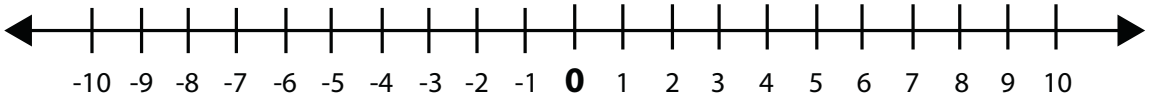
13. $x \geq 2$



14. $x < 3$



15. $x < 0$



ANSWER KEY

PRE-ASSESSMENT

PAGE 2

1. b
2. a
3. d
4. a
5. a
6. d
7. b
8. b
9. c
10. a
11. d
12. c
13. a
14. c
15. a

LESSON 1: READY, SETS, GO

SHARPENING YOUR SKILLS

PAGE 12

ACTIVITY I

1. $\{ -11, -9, -2, 0, 4, 5, 13, 23 \}$
2. $\{ -15.8, -5.7 \}$
3. $\{ 5, 13, 23 \}$
4. $\{ \frac{1}{3}, \frac{5}{6}, \frac{11}{8} \}$
5. $\{ -15.8, -11, -9, -\frac{13}{2}, -5.7, -2, -\frac{2}{7}, \frac{1}{3}, \frac{5}{6}, \frac{11}{8}, 2.1, 2.4, 8.01\}$

ACTIVITY II

1. $\{ 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50 \}$
2. $\{ 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48 \}$
3. $\{ 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50 \}$
4. $\{ 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 \}$
5. $\{ 14, 21, 28, 35, 42, 49 \}$

ACTIVITY III

The recycled materials collected would be made into re-usable products that can be sold such as bags, coin purse, pencil holders, etc. The idea of sets can

be used in this task in segregating and arranging the materials according to their usage. The idea of union of sets can be used in this task in putting together all the money collected from selling the products.

TREADING THE ROAD TO MASTERY

PAGE 14

ACTIVITY I

A. { −4, −2, −1, 0, 2, 3, 4, 7 }
B. { −3, −1, 1, 3, 5, 7, 9 }
C. { −4, −3, −2, 0, 1, 2, 4, 5, 9 }

ACTIVITY II

A. { −3.5, −2.57, −2.04, −0.69, 1.42, 3.15}
B. { −3.5, −2.57, −2.4, −2.04, −1.7, −0.69, 3.5, 8.09}
C. { −2.4, −1.7, 1.42, 3.15, 3.5, 8.09}

ACTIVITY III

A. { 0.2, $\frac{2}{7}$, 0.45, $\frac{1}{2}$, $\frac{3}{5}$, $\frac{4}{3}$, 1.73, 2.8}
B. { 0, 0.2, 0.45, 1, 1.73, 2, 2.8}

ANSWER KEY

LESSON II: SETTING IT UP

SHARPENING YOUR SKILLS

PAGE 23

ACTIVITY I

1. **Infinite set**
   It contains number of elements that has no limit/end.

2. **Null set**
   It does not contain any element.

3. **Singleton set**
   It contains only one element.

4. **Infinite set**
   It contains number of elements that has no limit/end.

5. **Finite set**
   It contains limited number of elements.

6. **Null set**
   It does not contain any element.

ACTIVITY II

1. **b.** { **1, 3, 7** } and **d.** { **4, 5, 8, 9** }
   Justification: The subsets of Set *A* are choices b and d because all their elements are contained in Set *A*. Choice a is not a subset because 10 is not in Set *A*. Choice c is not a subset because −1 is not in Set *A*.

2. **a.** { **−21, −9, 3** } and **c.** { **−13, −5, −1, 7** }
   Justification: The subsets of Set *B* are choices a and c because all their elements are contained in Set *B*. Choice b is not a subset because −21, −18 and −12 are not in Set *B*. Choice d is not a subset because −11, −10 and −8 are not in Set *B*.

ANSWER KEY

TREADING THE ROAD TO MASTERY

PAGE 25

ACTIVITY I

A. { 0, 1, 2, 3, 5, 8 }
B. { 0, 2, 4, 6 }
C. { 1, 3, 5, 7 }
D. { 0, 2 }
E. { 1, 3, 5 }
F. { } or Ø

ACTIVITY II

A. { 8 }
B. { 5 }
C. { } or Ø
D. { } or Ø
E. { 2, 4 }
F. { } or Ø

ANSWER KEY

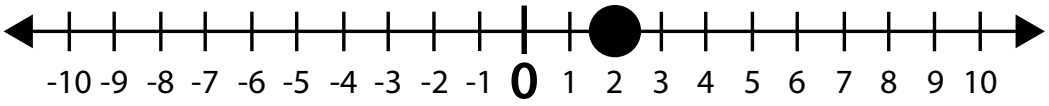
LESSON 3: FALLING IN LINE

SHARPENING YOUR SKILLS

PAGE 38

ACTIVITY I

1.



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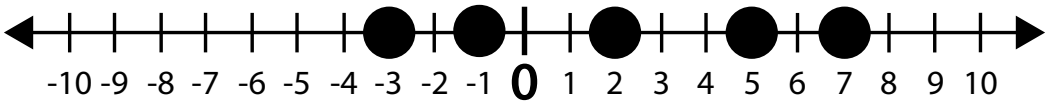

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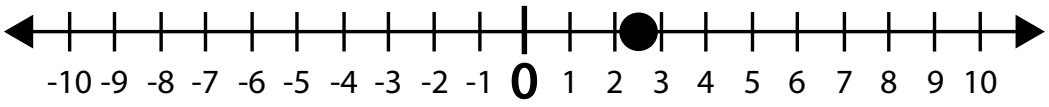

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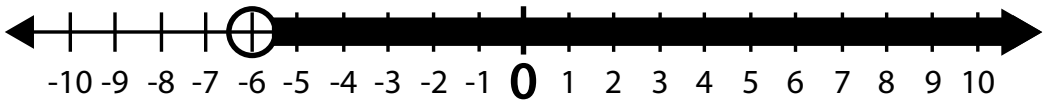

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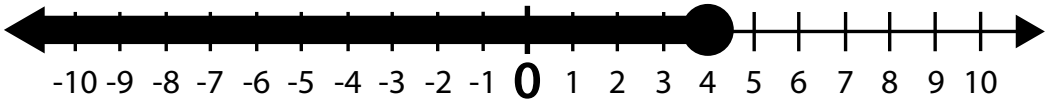
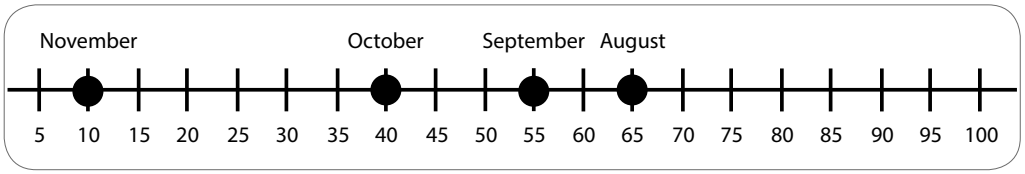


ANSWER KEY

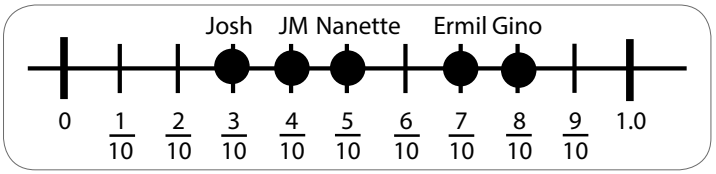
ACTIVITY II

1. **Description**: The movement of the numbers is to the left. This means that the amount of harvested corn from August to November is decreasing.



2. **Description**: The movement of numbers is to the right which means the amount of alcohol per trial is increasing.

3. **Description**: The movement of the work completed is increasing.

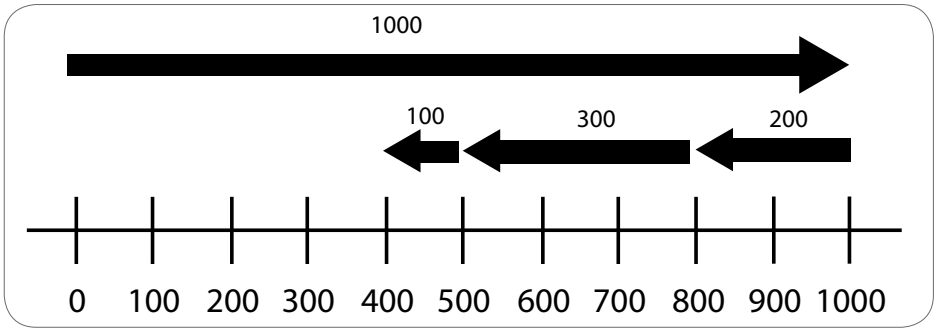


ANSWER KEY

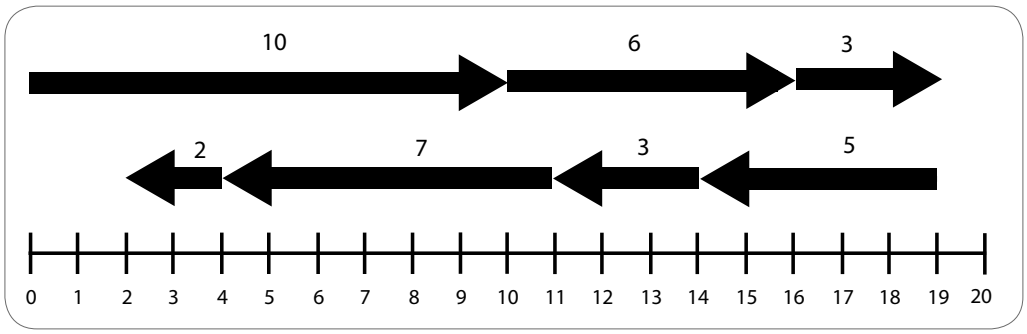
TREADING THE ROAD TO MASTERY

PAGE 40

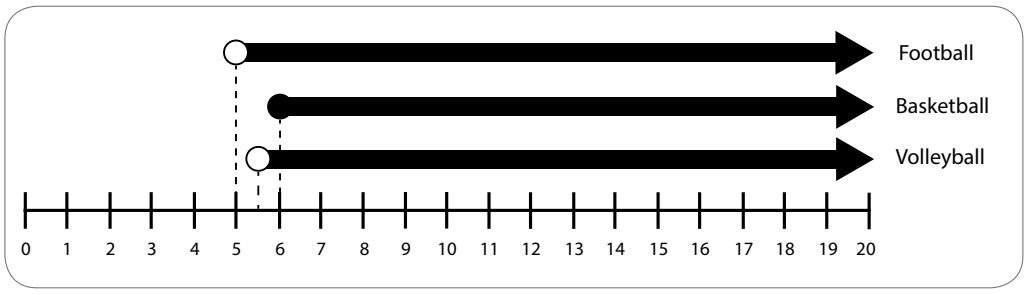
1. Joel has ₱400.00 left from his salary.



2. Tyang Amy has 2 phones left after all her transactions.



3. Basketball has the highest height requirement among the sports team given.



ANSWER KEY

REACH THE TOP

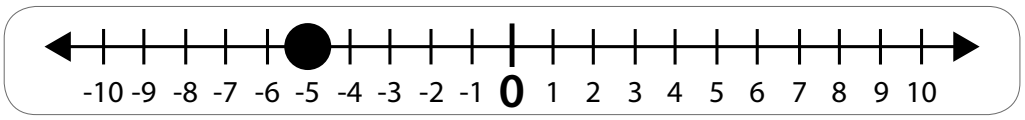
PAGE 44

ACTIVITY I

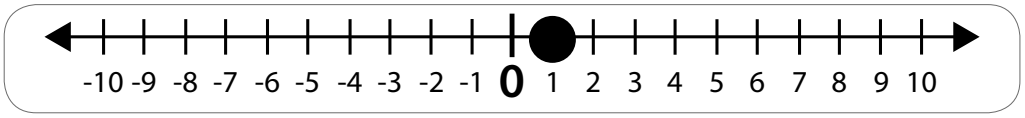
1. c
2. a
3. d
4. a
5. a
6. d
7. b
8. b
9. c
10. a

ACTIVITY II

11.



12.



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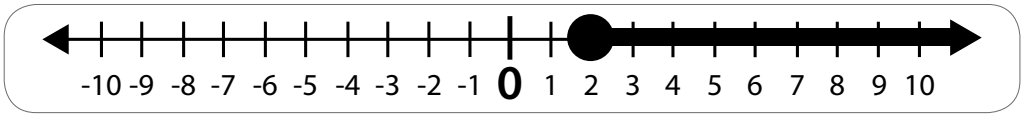

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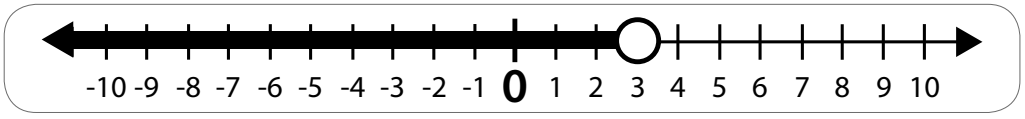
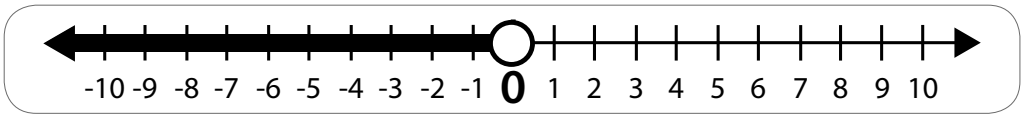


15.



GLOSSARY

Element (member)	each number in a set
Finite set	a set containing countable or limited number of elements
Infinite set	a set containing elements that does not have a limit or end
Intersection of sets	a set composed of elements common to two or more sets
Null set (empty set)	a set containing no element
Number line	a straight horizontal line extending on both directions containing numbers spaced equally from one another; uses zero as a reference point
Set	group of numbers, such as integers, whole numbers, decimals, fractions, etc., that have the same characteristics
Singleton set	a set containing only one element
Subset	a set whose elements are contained in a bigger set
Union of sets	a set of composed of all elements from two or more different sets

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