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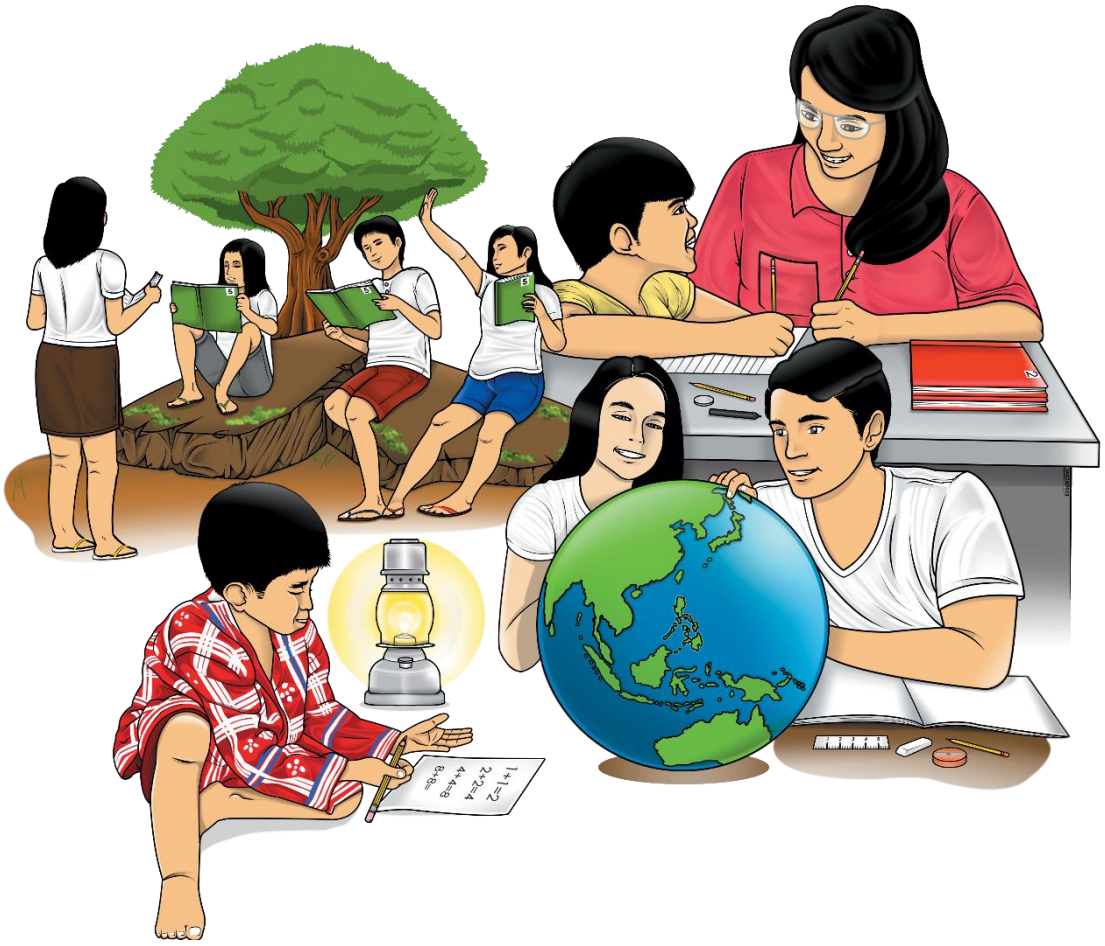
Mathematics

Quarter 1 – Module 9:
Subsets of Real Numbers



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Quarter 1 – Module 9: Subsets of Real Numbers
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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

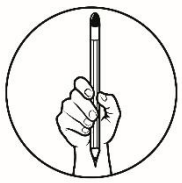
This module was designed and written with you in mind. It is here to help you master the Subsets of Real Number. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow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

The module is divided into two lessons, namely:

- Lesson 1 – Illustrates the Different Subsets of Real Numbers
- Lesson 2 – Arranges Real Numbers in Increasing or Decreasing Order and On a Number Line

After going through this module, you are expected to:

1. describe and illustrate the real number system;
2. classify the number by naming set or sets to which it or they belong/s using Venn diagram;
3. arrange the set of real numbers in increasing or decreasing order; and
4. plot the set of real numbers on a number line.



What I Know

Choose the letter of the correct answer. Write the chosen letter on a separate sheet of paper.

For questions 1-3, classify the subset of real numbers to which each number belongs.

1. 12
   A. Integer, Natural
   B. Rational, Integer, Whole, Natural
   C. Integer
   D. Irrational, Whole
2. $\sqrt{2}$
   A. Integer, Natural
   B. Rational, Integer, Whole, Natural
   C. Integer, Whole
   D. Irrational
3. $\frac{1}{3}$
   A. Rational
   B. Integer, Natural
   C. Irrational
   D. Whole, Natural
4. Which statement is NOT true?
   A. Every counting number is a whole number.
   B. Every integer is a rational number.
   C. Every decimal is an irrational number.
   D. Every natural number is a real number.
5. Which statement is true?
   A. The set of real numbers is a subset of rational numbers
   B. The set of decimal numbers are subset of irrational numbers.
   C. The set of whole numbers is subset of rational numbers.
   D. The set of irrational numbers are subset of rational numbers.
6. Which number is the smallest?
   A. 2.5
   B. 0.33…
   C. $\sqrt{9}$
   D. -3
7. Which number is the greatest?
   A. 2.5
   B. 0.33…
   C. $\sqrt{9}$
   D. -3
8. Which is in order from least to greatest?
   A. $\sqrt{25}$, 4.20, $\frac{1}{3}$, -0.66…, -7
   B. -7, -0.66…, $\frac{1}{3}$, 4.20, $\sqrt{25}$
   C. -0.66…, $\frac{1}{3}$, -7, 4.20, $\sqrt{25}$
   D. $\sqrt{25}$, -0.66, 4.20, -7, $\frac{1}{3}$

9. Which list shows the numbers in decreasing order?

A. $\sqrt{25}$, 4.20, $\frac{1}{3}$, -0.66..., -7

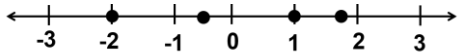
B. -7, -0.66..., $\frac{1}{3}$, 4.20, $\sqrt{25}$

C. -0.66..., $\frac{1}{3}$, -7, 4.20, $\sqrt{25}$

D. $\sqrt{25}$, -0.66, 4.20, -7, $\frac{1}{3}$

10. Which of the following best represents the arrangement of -2.25, -1, $\frac{1}{2}$, 1.75 on the number line?

A.



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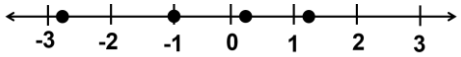

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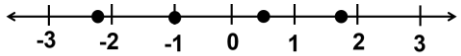

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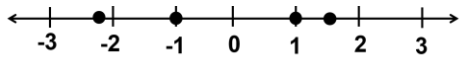


Lesson 1 Illustrates the Different Subsets of Real Numbers

In this lesson, we will classify real numbers into subsets and show how this idea relates with five types of numbers. Using Venn diagram and Number line, we will learn how to conceptualize the subsets of real numbers.

What's In

In this part of the lesson, your previous knowledge about Rational and Irrational numbers will be checked. Your learnings about these two concepts will equip you to the lesson, Subsets of Real Numbers.

Instruction: Given inside the box below is set of real numbers. On a separate sheet of paper, box (▭) all the irrational numbers and encircle (◯) all the rational numbers.

5	$\sqrt{3}$	2.333...	$2\frac{1}{2}$	π	$\frac{12}{17}$	-5.6	3.123123...	-40

Notes to the Teacher

When you ask someone to give a number, the person can easily give you an answer. We learn to count since childhood but do we know that numbers have classifications?

In lesson 1, try to stimulate the thoughts of the learners in understanding of the different names of sets of numbers. In What's more activity, learners should be equipped already on how to classify the number according to the names of sets of numbers. In What I can do activity, learners can apply now the concepts of Subsets of Real Numbers using Venn diagram while realizing the importance of Subsets of Real Numbers in real life situation.

What's New

Eleven different words are hidden in this puzzle. How many can you find? You may look up, down, across, backward, and diagonally. Good luck!

N	A	R	A	T	I	O	N	A	L	K	I
E	W	B	A	C	L	D	V	B	N	N	F
V	H	D	F	A	M	G	E	H	A	O	B
I	O	H	E	I	J	J	R	O	T	I	M
T	L	R	K	C	O	O	N	S	U	T	I
I	E	Z	L	M	I	N	A	E	R	C	C
S	N	Y	O	T	A	M	Q	L	A	A	E
O	T	L	R	S	P	O	A	U	L	R	R
P	I	J	T	E	R	E	M	L	E	F	A
T	I	N	T	E	G	E	R	S	A	L	I
A	N	F	Z	I	N	T	E	G	E	R	S
N	N	L	A	N	O	I	T	A	R	R	I

What is It

From the puzzle that you have answered earlier, recall the different terms you encountered including the set of real numbers and together let us determine the various subsets. Let us go back to the first time we encountered the numbers.

Subsets of Real Numbers

One of the subsets of Real numbers is the set of "***counting (or natural) numbers"***. This subset consists of all positive integers that we use to count starting with "1" and so on. The subset would look like this: {1, 2, 3, 4, 5...}

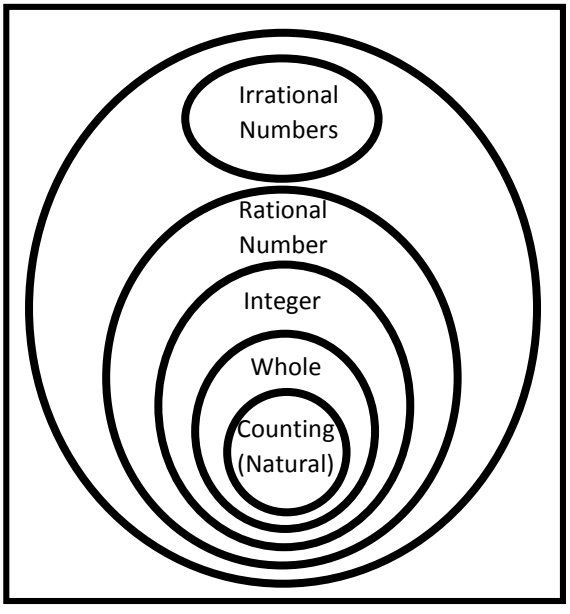
Another subset is the ***whole numbers***. This subset is exactly like the subset of counting numbers that includes zero "0." The subset would look like this: {0, 1, 2, 3, 4...}

A third subset is the ***integers.*** This subset includes whole number (not a fractional number) that can be positive, negative, or zero. The subset would look like this: {... -4, -3, -2, -1, 0, 1, 2, 3, 4...}

The next subset is the ***rational numbers.*** This subset includes all numbers that "come to an end" or numbers that repeat and have a pattern. Examples of rational numbers are 5.34, $\frac{6}{7}$, 0.131313..., 9.

Lastly, we have the set of ***irrational numbers.*** This subset includes numbers that cannot be expressed as a ratio of two integers. It has decimal that goes on forever without any repeating pattern. Examples of irrational numbers are $\sqrt{2}$, 4.626578..., e and π.

Figure 1. Subsets of Real Numbers



The Figure on the left is a Venn diagram that shows the relationship of various kinds of numbers in the real number system.

What's More

Activity 1.1

Classify the real numbers to which subset/s of real number belongs. Use a tick mark (✓) to answer.

Number	Whole Number	Integer	Rational	Irrational
-3				
0				
$\frac{4}{7}$				
$\sqrt{64}$				
13				
-0.125				
$\sqrt{2}$				
e				
.50				

Activity 1.2

Determine what set/sets of real numbers represent/represents the situation below. Write your answers on the blank provided after the given situation.

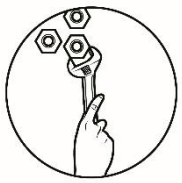
1. The number of COVID-19 victims in the Philippines. _____
2. The number of employees affected by the ABS-CBN shutdown. _____
3. The percentage of the population lived below the nation poverty line in the Philippines. _____
4. The ratio of teacher to students inside the classroom if face-to-face learning program will be implemented is 1: 20. _____
5. Maria went home empty-handed because her employer suddenly closed the business. _____

What I Have Learned

Fill in the missing word in the blank. Choose the correct answer from the box.

Counting	Integers	Irrational
Rational	Whole	

1. _____ is a subset of real numbers that can be positive, negative or zero.
2. Counting numbers and zero are called _____ numbers.
3. The set of _____ numbers are numbers that cannot be expressed as a fraction.
4. Natural numbers are also called _____ numbers.
5. The subset of _____ numbers includes Integers, Whole and Counting Numbers.



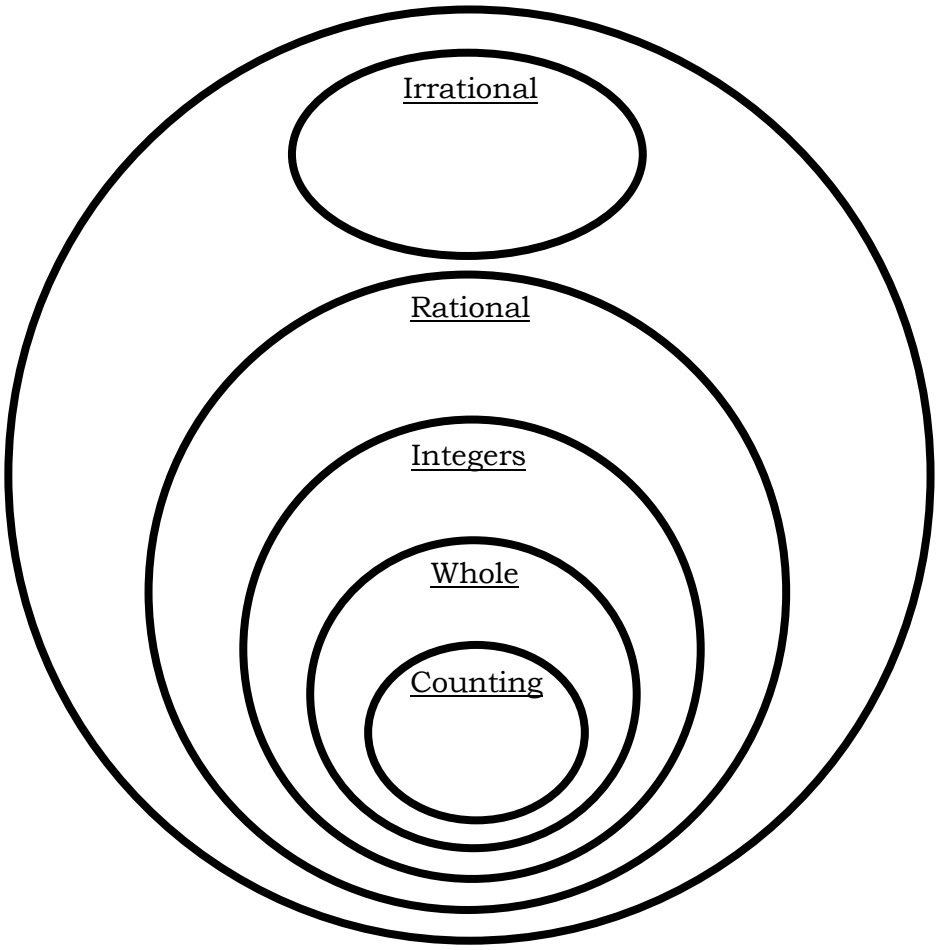
What I Can Do

Ana's mother prepared her ingredients in the kitchen. Below are the ingredients needed in her Leche Flan.

Leche flan recipe ingredients:

8 pcs egg yolks, large
2 pcs whole eggs, large
¼ cup water
¾ cup white sugar
300 mL condensed milk
370 mL evaporated milk

Classify the numbers given above by writing the numbers in the Venn diagram.



Lesson 2 Arranges Real Numbers in Increasing or Decreasing Order and On a Number Line

This lesson contains exciting activities in Arranging Real Numbers in Increasing or Decreasing Order and on a Number Line. Good luck dear!

What's In

This lesson is a continuation of the concepts on the Subsets of Real Numbers. Mastering the concepts in the previous lesson will enable you to perform the activities quickly.

Write **T** in the blank if the statement is true and write **F** if the statement is false.

_____ 1. All rational numbers are real numbers.
_____ 2. An irrational number is always a real number.
_____ 3. Every whole number is an integer.
_____ 4. Every decimal number is a rational number.
_____ 5. All real numbers are integers.
_____ 6. $\frac{1}{5}$ is an irrational number.
_____ 7. Zero is an integer.
_____ 8. All natural numbers are sometimes positive.
_____ 9. All repeating decimals are irrational numbers.
_____ 10. There are no natural numbers between -5 and 0.

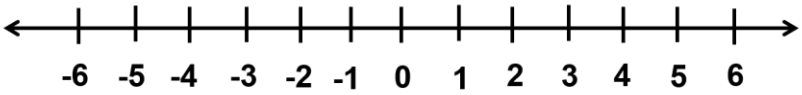
Notes to the Teacher

Generally, real numbers appear difficult among students. The second part of this module is a lesson on changing rational numbers from one form to another, particularly paying attention to changing rational numbers to decimal form. It is assumed students know how to compare numbers in decimal form. This lesson provides them with plenty of exercises to help them master how to arrange real numbers in increasing or decreasing order and on a number line.

What's New

Let's Compare

Ben travelled 4km from their school to the left (0 being the place of origin) and Chad did the same but travelled 2km longer than Ben. On the other hand, Kent travelled to the right starting from the same origin with the distance of 3km. Place those people on the number line to find their position from the place of origin.



What is It

If we want to order real numbers, first change each number to decimal. Then write the decimals in order from least to greatest or greatest to least, then write the decimals to their original form with their new order.

Examples:

1. Arrange 2.55..., $\sqrt{9}$, $\frac{15}{4}$, $-\frac{11}{5}$ in ascending order and plot the numbers on a number line.

Solution:

Change the following numbers to decimals:

2.55... ≈ **2.56** (Round off to the nearest hundredths)

$\sqrt{9}$ = **3** (The square root of 9 is 3)

$\frac{15}{4}$ = **3.75** (15 ÷ 4 = 3.75)

$-\frac{11}{5}$ = **-2.2** (-11 ÷ 5 = -2.2)

Let us now arrange 2.56, 3, 3.75 and -2.2 from least to greatest.
That is, -2.2, 2.56, 3, 3.75.

Change the decimal forms to their original form. $-\frac{11}{5}$, 2.55..., $\sqrt{9}$, $\frac{15}{4}$

Therefore, the order from least to greatest is $\mathbf{-\frac{11}{5}}$**, 2.55..., $\sqrt{9}$,** $\mathbf{\frac{15}{4}}$.

We are now ready to plot the points on the number line.

2. Which of the following is the largest: $\sqrt{4}$, $-\frac{5}{2}$, $\frac{3}{4}$, -0.30?

Solution:

Change the following numbers to decimal form:

$\sqrt{4}$ = **2** (2^2= 4)

$-\frac{5}{2}$ = **-2.5** (-5 ÷ 2 = -2.5)

$\frac{3}{4}$ = **0.75** (3 ÷ 4 = 0.75)

-0.30 (Copy the fourth number since it is already in decimal form.)

Let us now arrange 2, -2.5, 0.75 and -0.30 from greatest to least.
That is: 2, 0.75, -0.30, -2.5.

Change the decimal forms to their original form: $\sqrt{4}$, $\frac{3}{4}$, -0.30, $-\frac{5}{2}$

Since, $\sqrt{4}$ > $\frac{3}{4}$ > -0.30 > $\frac{5}{2}$, $\sqrt{4}$ has the largest value.

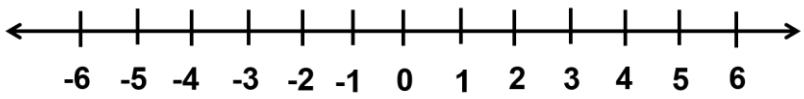
What's More

A. Compare the following real numbers. Write >, < or = in the blanks.

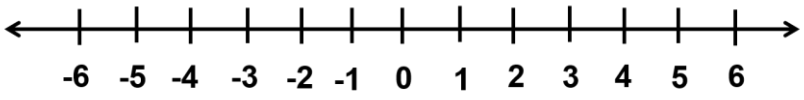
1. $\frac{7}{3}$ _____ $\frac{9}{2}$
2. -1.54 _____ $-\frac{5}{2}$
3. 11 _____ $\sqrt{100}$
4. 0.33... _____ $\frac{3}{9}$
5. $-\frac{11}{5}$ _____ 2.2

B. Arrange the following real numbers in descending order and plot them on the number line.

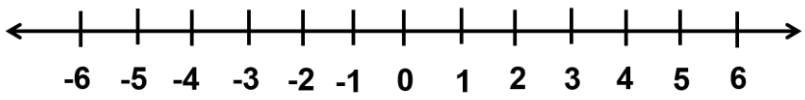
1. -3.45, 0.98, $\sqrt{16}$, $-\frac{5}{2}$



2. 4.26, $-\sqrt{9}$, 0.15, -1.11

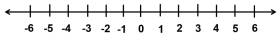


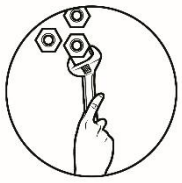
3. $-\frac{2}{5}$, $\frac{2}{\sqrt{4}}$, 5.72, -1.23



What I Have Learned

Fill in the blank to make a true statement.

1. The figure  is called a _____ line.
2. When ordering set of real numbers from _____to _____, follow the order on the number line from left to right.
3. When ordering set of real numbers from _____to _____, follow the order on the number line from right to left.
4. To arrange real numbers in ascending or descending order, change first each number to _____ form. Then write the decimals in order from least to greatest or greatest to least, then write the decimals in their original form with their new order.



What I Can Do

Here is another activity that lets you apply in a real-world context what you learned about arranging real numbers in increasing or decreasing order by solving the following problems.

1. Five students (Allan, Ben, Carlo, Daisy, Emman) of grade 7 ran the following distances in kilometers in 2 hours:

$$\frac{5}{2}\text{ , }3\text{, }\frac{11}{5}\text{, }2.8\text{ and }\frac{13}{4}$$

a. Which student ran the farthest distance? _____

b. Arrange the distance covered by five students from least to greatest.
From least to greatest, the distances are _____, _____, _____, _____, _____.

2. Four people have found the perimeter of a new resort using different methods. Their results are given in the table. Arrange their calculations from greatest to least.

Resort Perimeter (Km)			
Kyle	Jane	Belle	Ashley
$\sqrt{16}$	3.80	$\frac{15}{4}$	3.50

From greatest to least, the calculations are _____, _____, _____, _____.

Great work! You did a good job in applying what you have learned.

Assessment

For questions 1-5. Name the subset(s) of numbers to which each number belongs.

1. $\sqrt{7}$
2. -16.28
3. $\sqrt{81}$
4. -9
5. $\frac{6}{17}$

For questions 6-10. Determine whether the statement is TRUE or FALSE.

6. All whole numbers are integers.
7. Some fractions are irrational numbers.
8. Every rational number is a decimal.
9. Zero is a counting number.
10. Set A = {0, 1, 2, 3, 4, …} is the set of whole numbers.

For questions 11-15. Multiple Choice: Choose the letter of the correct answer.

11. Which number is the smallest?

    A. $\frac{25}{6}$ C. $\sqrt{25}$

    B. -5 D. 4.16...

12. Which number is the greatest?

    A. $\frac{25}{6}$ C. $\sqrt{25}$

    B. -5 D. 4.16...

13. Which is in order from least to greatest?

    A. $\sqrt{4}$, 2.33..., 0, -2, $\frac{7}{4}$ C. -2, 0, $\frac{7}{4}$, $\sqrt{4}$, 2.33...

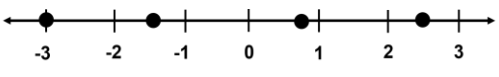
    B. 2.33..., $\sqrt{4}$, $\frac{7}{4}$, 0,-2, $\frac{7}{4}$ D. $\sqrt{4}$, 0, $\frac{7}{4}$, 2.33...,-2

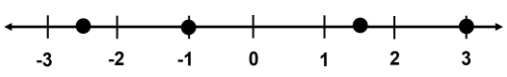
14. Which list shows the numbers in decreasing order?

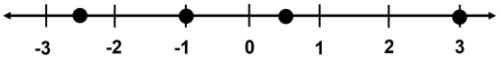
    A. 2.33..., $\sqrt{4}$, $\frac{7}{4}$, 0, -2 C. -2, 0, $\frac{7}{4}$, $\sqrt{4}$, 2.33...

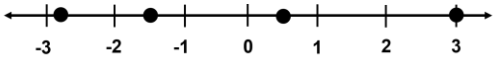
    B. $\sqrt{4}$, 2.33...,0, -2, $\frac{7}{4}$ D. $\sqrt{4}$, 0, $\frac{7}{4}$, 2.33..., -2

15. Which of the following best represents the arrangement of -2.5, $\sqrt{9}$, -1, $\frac{1}{2}$ on the number line?

    A. 

    C. 

    B. 

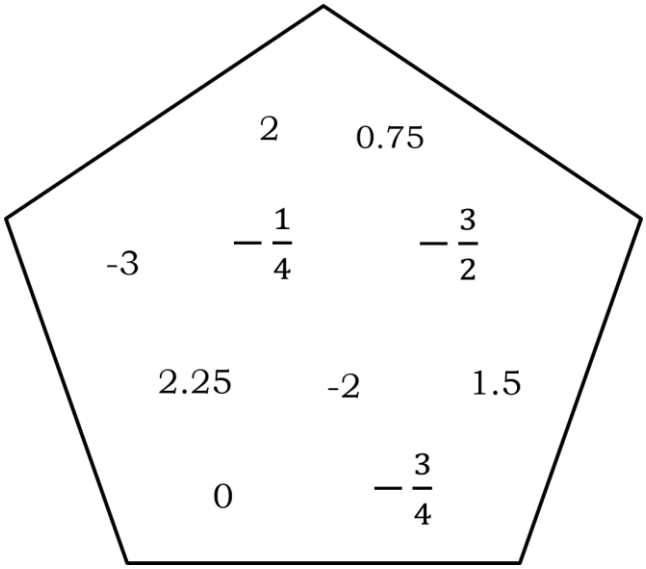
    D. 

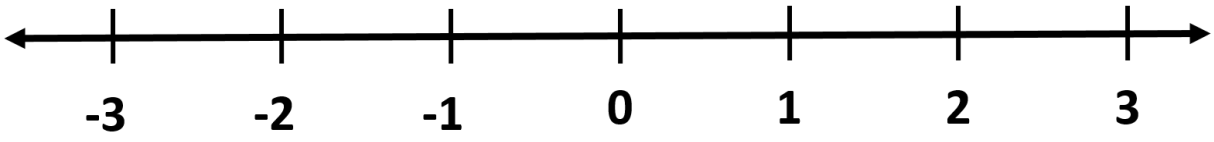
Additional Activities

A. Classify the different sets of numbers below.

1. -3, -2, -1, 0, 1, 2, 3...
2. $\sqrt{5}$, π
3. 0
4. 0, 1, 2, 3...
5. 1, 2, 3...

B. Arrange the following numbers in increasing order and plot these on the number line.





Answer Key

What I Know

1. B
2. D
3. A
4. C
5. C
6. D
7. C
8. B
9. A
10. C

Lesson 1
What's In

Lesson 1
What's New

N	A	R	A	T	I	O	N	A	L	K	I
E	W	B	A	C	L	D	V	B	N	N	F
V	H	D	E	A	M	G	E	H	A	O	B
I	O	H	E	I	J	J	R	O	T	I	M
T	L	R	K	C	O	O	N	S	U	T	I
I	E	Z	L	M	I	N	A	E	R	C	C
S	N	Y	O	T	A	M	Q	L	A	A	E
O	T	L	R	S	P	O	A	U	L	R	R
P	I	J	T	E	R	E	M	L	E	F	A
T	I	N	T	E	G	E	R	S	A	L	I
A	N	F	Z	I	N	T	E	G	E	R	S
N	N	L	A	N	O	I	T	A	R	R	I

Lesson 1
What's More
Activity 1.1

Number	Whole Number	Integer	Rational	Irrational
-3		√	√	
0	√	√	√	
$\frac{4}{7}$			√	
√64	√	√	√	
13	√	√	√	
-0.125			√	
√2				√
e				√
.50			√	

Activity 1.2

1. Rational, Whole, Integer, Counting
2. Rational
3. Rational, Whole, Integer, Counting
4. Rational, Whole, Integer, Counting
5. Rational

Lesson 1
What I Have
Learned

1. Integers
2. Whole
3. Irrational
4. Counting
5. Rational

Assessment

1. Irrational
2. Rational
3. Rational, Whole, Integer, Counting
4. Rational, Integer
5. Rational
6. True
7. True
8. False
9. False
10. True
11. B
12. C
13. C
14. A
15. C

Lesson 1
What Can I Do

Additional Activities

A.

1. Rational Numbers, Integers, Whole Numbers
2. Irrational Numbers
3. Rational Numbers, Integers, Whole Numbers
4. Rational Numbers, Integers, Whole Numbers
5. Rational Numbers, Integers, Whole Numbers, Natural Numbers

B.

Lesson 2
What's In

1. T
2. T
3. T
4. F
5. F
6. F
7. T
8. F
9. F
10. T

Lesson 2
What's New

Lesson 2
What I have Learned

1. number
2. least, greatest
3. greatest, least
4. decimal

Lesson 2
What I can do

1. Emman

2. $\frac{11}{4}, \frac{5}{21}, 2.8, 3, \frac{13}{4}$

3. $3.5, \frac{15}{4}, 3.8, \sqrt{16}$

Lesson 2
What's More
A.

1. <
2. >
3. >
4. =
5. <

Lesson 2
What's More
B.

1. $-3.45, -\frac{5}{2}, 0.98, \sqrt{16}$

2. $-\sqrt{9}, -1.11, 0.15, 4.26$

3. $-1.23, -\frac{2}{5}, \frac{2}{\sqrt{4}}, 5.72$

References

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