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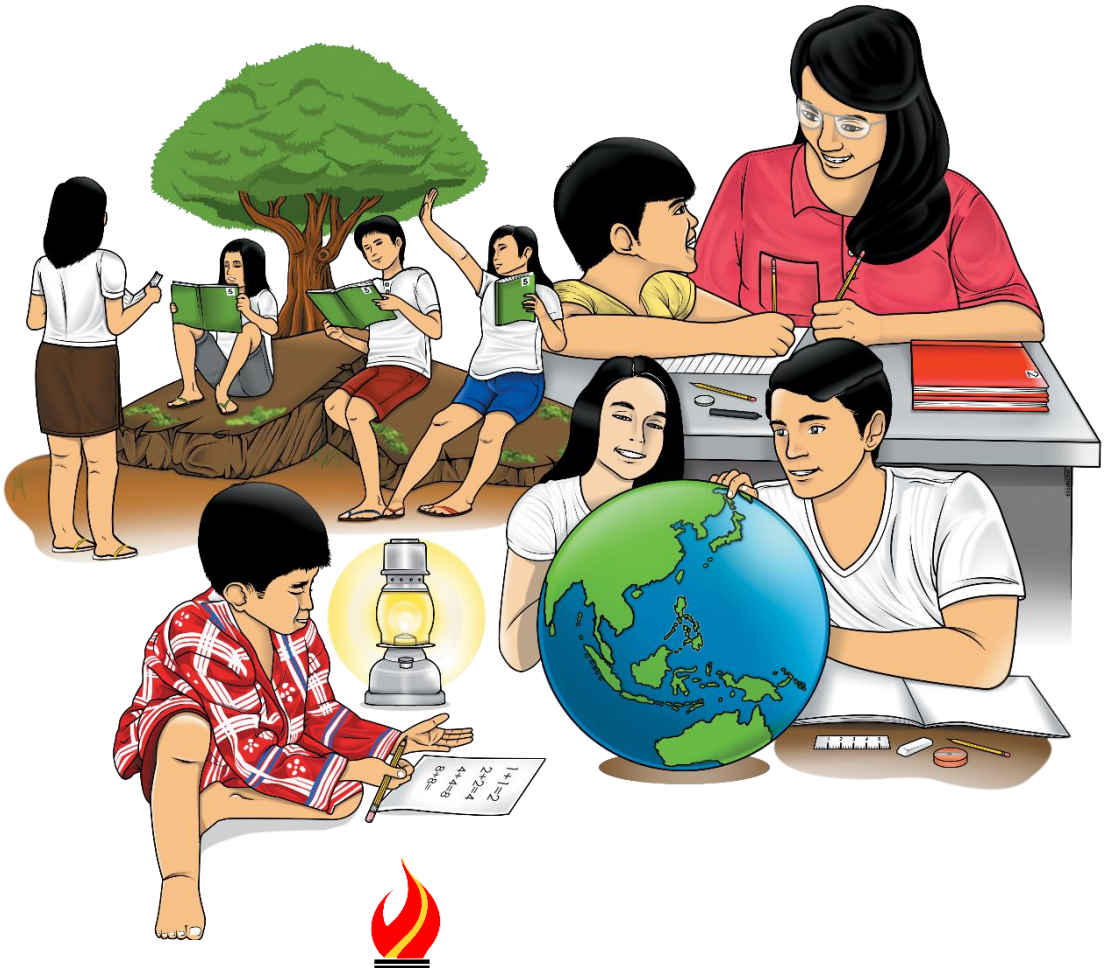
DEPARTMENT OF EDUCATION

Mathematics

Quarter 3 – Module 1:
Basic Concepts and Terms in Geometry



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Mathematics

Quarter 3 – Module 1:
Basic Concepts and Terms in Geometry

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

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

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

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

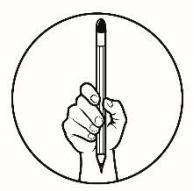
Thank you.

What I Need to Know

This module was designed and written with you in mind. It is here to help you master Basic Concepts and Terms in Geometry. 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.

After going through this module, you are expected to:

- represent point, line and plane using concrete and pictorial models (M7GE-IIIa-1); and
- illustrate subsets of a line (M7GE-IIIa-2).



What I Know

Multiple choice. Read each item carefully. Choose the letter of the best answer and write it on a separate sheet of paper.

1. Which of the following does not represent a plane?
   A. board
   B. edge of a notebook
   C. surface of the table
   D. screen of an iPad

2. In every line, there are at least how many distinct points?
   A. 5
   B. 4
   C. 3
   D. 2

3. Which of the following represents a line?
   A. dot
   B. table cover
   C. envelop
   D. yarn

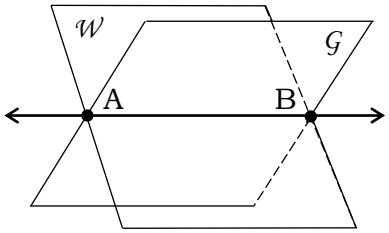
4. Which of the following represents a point?
   A. tip of a pin
   B. pen
   C. peso bill
   D. edge of the ruler

5. In every plane, there are at least how many noncollinear points?
   A. 5
   B. 4
   C. 3
   D. 2

6. What is the intersection of a plane and a line perpendicular to the plane?
   A. line
   B. plane
   C. point
   D. space

7. Which of the following best describes a line?
   A. Usually represented by a dot
   B. A flat surface
   C. Can be extended in both directions
   D. Has width and thickness

For numbers 8-11, refer to the illustration on the right.



8. What is the intersection of planes $\mathcal{W}$ and $\mathcal{G}$?
   A. space
   B. point
   C. plane
   D. line

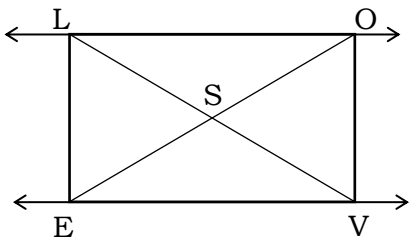
9. Which of the following is a ray in the given figure?
   A. ray AB
   B. ray AG
   C. ray AW
   D. ray WG

10. If A and B are collinear, are they also coplanar?
   A. yes
   B. no
   C. maybe
   D. cannot be determined

11. What is the correct symbol for the intersection of the two planes?
   A. $\overleftarrow{AB}$
   B. $\overline{AB}$
   C. $\overrightarrow{AB}$
   D. $\overleftrightarrow{AB}$

12. What is the undefined term in geometry that has no dimension?
   A. line
   B. plane
   C. point
   D. space

For numbers 13-15, refer to the illustration on the right.



13. What is the intersection of $\overline{LV}$ and $\overline{OE}$?
   A. line
   B. plane
   C. point
   D. space

14. What is the common point of $\overline{LV}$ and $\overline{OE}$?
   A. L
   B. O
   C. V
   D. S

15. How do you call lines LO and VE?
   A. concurrent lines
   B. intersecting lines
   C. parallel lines
   D. skew lines

Lesson 1 Basic Concepts and Terms in Geometry

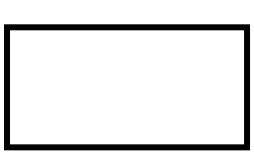
Looking back at our first drawing as a child, we often remember points, lines and even planes in the form of familiar shapes. These concepts and terms are part of geometry.

Geometry is a branch of mathematics that studies the sizes, shapes, position, angles, dimensions of things and the knowledge dealing with spatial relationship. This is from the Ancient Greek words: "*geo*" which means "*earth*" and "*-metrein*" which means *"to measure*". The basic knowledge and concepts will help us appreciate better the beauty of nature and the things around us.

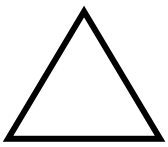
This time, let us dig deeper on these basic concepts and terms in geometry. Let's go!

What's In

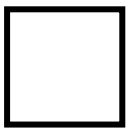
Let us recall on the common shapes we have at preschool. Identify them first before answering the questions that follow.



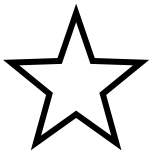
Shape 1



Shape 2



Shape 3



Shape 4

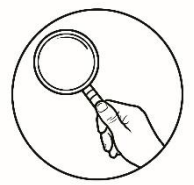
Questions:

1. What do these shapes have in common?
2. How many corners does shape 1 have?
3. How many corners does shape 2 have?
4. How many corners does shape 3 have?
5. How many corners does shape 4 have?
6. In each shape, what connects one corner to the other?
7. How do we call the intersection of one side to the other?

What's New

Now, let us familiarize some words related to the lesson through this anagram. This is an activity in which words are formed by rearranging the letters of words or by arranging letters taken at random. Your task is to rearrange the highlighted letters to form the word described.

Anagram	Description	Word Formed
1. **NILE**	It has no width and no thickness but can be extended infinitely in opposite directions.	
2. **TOPIN**	It has no dimension and usually represented by a dot.	
3. **NAPLE**	It is a flat surface that extends infinitely in all directions	
4. **GETSEMN**	It is formed when two distinct points are connected with a line.	
5. **ARY**	It has only one endpoint and an arrowhead which extends infinitely in one direction	



What is It

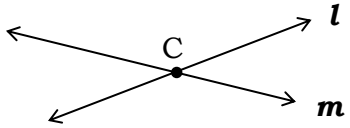
In any mathematical system, definitions are important. Elements and objects must be defined precisely. However, there are some terms or objects that are the primitive building blocks of the system and hence cannot be defined independently of other objects. In geometry, these are **point, line**, **plane**, and **space**. There are also relationships like **between** that are not formally defined but are merely described or illustrated.

A. UNDEFINED TERMS

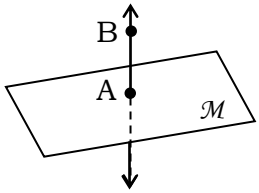
In Euclidean Geometry, the geometric terms point, line, and plane are all undefined terms and are purely mental concepts or ideas. However, we can use concrete objects around us to represent these ideas. Thus, these undefined terms can only be described.

Term	Figure	Description	Notation
point	• A	▪ A point suggests an exact location in space. ▪ It has no dimension. ▪ We use a capital letter to name a point.	point A
line	J D ***m***	▪ A line is a set of points arranged in a row. ▪ It is extended endlessly in both directions. ▪ It is a one-dimensional figure. ▪ Two points determine a line. That is, two distinct points are contained by exactly one line. ▪ We use a lowercase letter or any two points on the line to name the line.	line ***m*** or $\overleftrightarrow{JD}$
plane	Z Y X $\mathcal{A}$	▪ A plane is a set of points in an endless flat surface. ▪ The following determine a plane: (a) three non-collinear points; (b) two intersecting lines; (c) two parallel lines; or (d) a line and a point not on the line. ▪ We use an uppercase letter, script letter, such as $\mathcal{A}$, or three points on the plane to name the plane.	plane $\mathcal{A}$, plane XYZ or $\square$XYZ

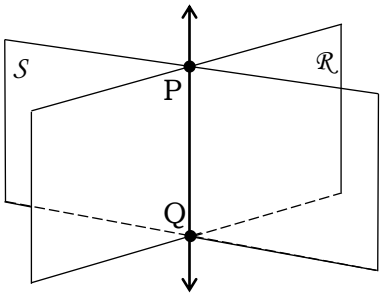
Consider the following illustrations:



Lines l and m intersect at point C.



Line AB and plane $\mathcal{M}$ intersect at point A.



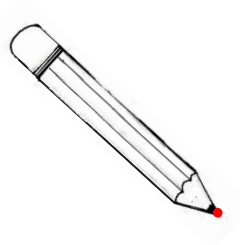
Planes $\mathcal{S}$ and $\mathcal{R}$ have $\overleftrightarrow{PQ}$ in common. They intersect at $\overleftrightarrow{PQ}$.

Since we have already described the undefined terms, we need the following postulates to serve as guiding rules or assumptions from which other statements on the undefined terms may be derived.

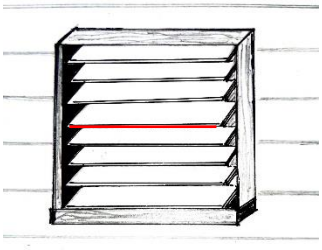
Postulates

- Two points are contained in exactly one line.
- Every line contains at least two distinct points.
- If two points are on a plane, then the line containing these points is also on the plane.
- Every plane contains at least three noncollinear points.
- (Plane Postulate) Any three points lie in at least one plane and any three noncollinear points lie in exactly one plane.
- If two distinct planes intersect, then their intersection is a line.

There are some objects around us that could represent a point, line or a plane.



tip of a pencil

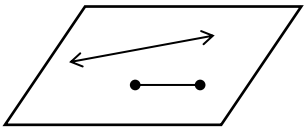
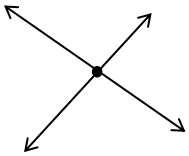
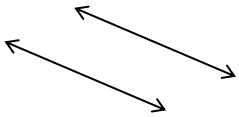
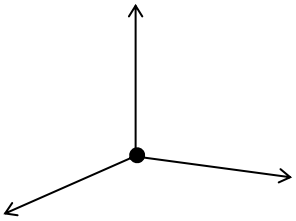
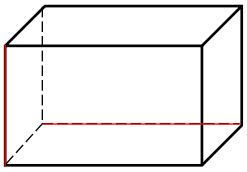


louvers of a window

cover of a book

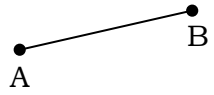
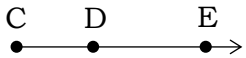
Objects that could represent a **POINT**	Objects that could represent a **LINE**	Objects that could represent a **PLANE**
1. Tip of a needle 2. The intersection of the front wall, the side wall and the ceiling	1. Laser 2. Pen 3. Intersection of the front wall and the side wall	1. blackboard 2. wall 3. a sheet of intermediate paper

B. OTHER BASIC GEOMETRIC TERMS ON POINTS AND LINES

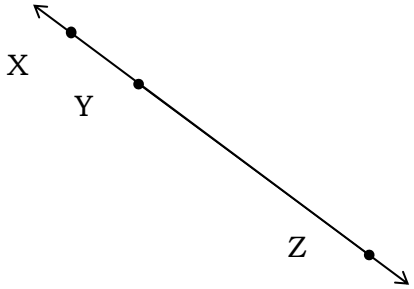
Term	Illustration	Description
collinear points		▪ These are points on the same line.
coplanar points/ lines		▪ These are points/ lines on the same plane.
interesting lines		▪ Two or more lines are intersecting if they have a common point.
parallel lines		▪ These are coplanar lines that do not meet.
concurrent lines		▪ Three or more lines are concurrent if they all intersect at only one point.
skew lines		▪ These are lines that do not lie on the same plane.

C. SUBSETS OF LINES

The following are some of the subsets of a line:

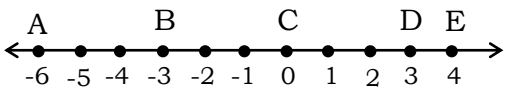
Term	Figure	Description	Notation
line segment		▪ It is a part of a line that has two endpoints.	line segment AB or BA or in symbols, $\overline{AB}$ or $\overline{BA}$
ray		▪ It is a subset of a line but has one endpoint, and extends in one direction. ▪ We name ray by its endpoint and one of its points. Naming a ray will always start on the endpoint.	ray CD or ray CE or in symbols, $\overrightarrow{CD}$ or $\overrightarrow{CE}$

Consider the following illustrations:



A line segment XY, as a subset of line XZ, consists of points X and Y and all the points between them.

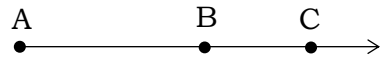
If the line to which a line segment belongs is given a scale so that it turns into the real line, then the **length of the segment can be determined by getting the distance between end points**.



Given the points on the number line on the left, the length of the following segments may be derived.

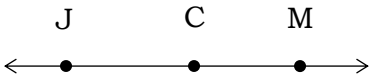
1. $\overline{AB} = |(-6) - (-3)| = 3$ units
2. $\overline{CD} = |0 - (3)| = 3$ units
3. $\overline{BD} = |(-3) - (3)| = 6$ units
4. $\overline{BC} = |(-3) - (0)| = 3$ units
5. $AC = |(-6) - (0)| = 6$ units

Segments are **congruent** ~~if they~~ have ~~the~~ same ~~length~~. So, ~~AB~~ and CD, BC and CD, and AC and BD are pairs of **congruent segments**.



The points A, B, C are on ray AC. However, referring to another ray BC, the point A is not on ray BC.

The points of $\overrightarrow{AB}$ are all the points on segment $\overline{AB}$ such that B is between A and C.



If $\overrightarrow{JM}$ is extended in the direction of point J, a line is formed. Point C is the common endpoint of the two rays.

$\overrightarrow{CJ}$ and $\overrightarrow{CM}$ are **opposite rays**.

What's More

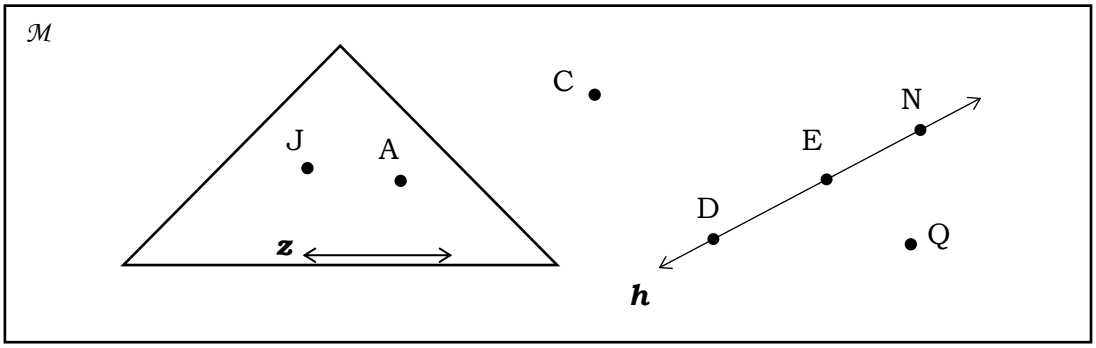
Let us check your understanding about the basic concepts and terms in geometry by answering the following activities.

A. Real-life objects represent a point, line, or a plane. Place each object in its corresponding column in the table below.

hair strand	tip of a ballpen	electric wire
corner of a table	surface of the table	edge of a paper
screen of a smartphone	plywood	thread
intersection of a side wall and the ceiling		

Objects that could represent a **POINT**	Objects that could represent a **LINE**	Objects that could represent a **PLANE**

B. Use the given figure to identify what is being asked.



1. What are the points in the interior region of the triangle?

   _____

2. Give other name(s) for line *h*.

   _____

3. Name three (3) line segments on line *h*.

   _____

4. Name four (4) rays on line *h*.

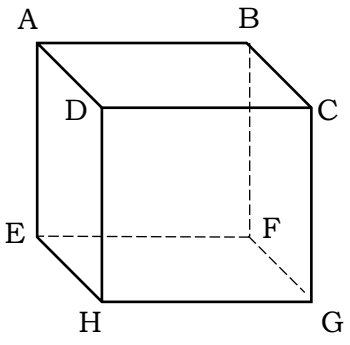
   _____

5. If E is the midpoint of DN, name a pair of congruent segments.

   _____

C. The points A, B, C, D, E, F, G, and H are the corners of a box shown below. Answer the questions that follow.

1. How many lines can be formed by these points? (Hint: There are more than 20.)
2. What are the lines that contain point A? (Hint: There are more than three lines.)
3. Identify the different planes which can be formed by these points. (Hint: There are more than six.)
4. What are the planes that contain line DC?
5. What are the planes that intersect at line BF?



What I Have Learned

Let's recap! Identify the geometric term described in each sentence. Choose the terms from the list below.

point	line	plane
opposite rays	ray	line segment
concurrent lines	intersecting lines	parallel lines
skew lines	collinear	coplanar

_____ 1. It is a subset of a line with one endpoint and an arrowhead.

_____ 2. These are lines that are not coplanar.

_____ 3. It has no dimension.

_____ 4. Two or more coplanar lines that meet at a common point.

_____ 5. It is a flat surface.

_____ 6. Three or more lines that intersect at only one point.

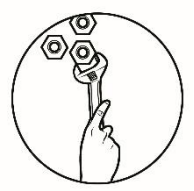
_____ 7. These are lines that will never meet.

_____ 8.It is a set of points extended infinitely in both directions.

_____ 9. It is a subset of a line with two endpoints.

_____ 10. Points or lines that lie on the same plane.

Good job! Now you're up for the next challenge of this lesson.



What I Can Do

This section involves real-life application of the basic concepts and terms in geometry that we have studied. Do what is asked.

Direction: Roam around your house and look for objects which represent a point, a line or a plane. For each column, list at least 3 objects not mentioned earlier in the discussion and draw the object.

Objects that could represent a **POINT**	Objects that could represent a **LINE**	Objects that could represent a **PLANE**
1. _____	1. _____	1. _____
2. _____	2. _____	2. _____
3. _____	3. _____	3. _____

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

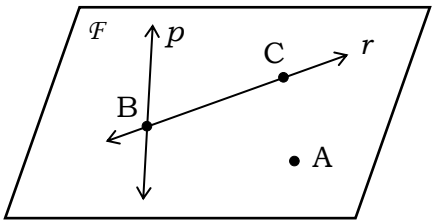
Assessment

Multiple choice. Read each item carefully. Choose the letter of the best answer and write it on a separate sheet of paper.

1. Which of the following does not represent a point?
   A. dot
   B. edge of a notebook
   C. intersection of two lines
   D. tip of a pen

2. What is the geometric term represented by a nylon string?
   A. point
   B. line
   C. plane
   D. ray

For numbers 3-6, refer to the illustration on the right.



3. Which of the following is the name of the plane?
   A. plane A
   B. plane B
   C. plane C
   D. plane $\mathcal{F}$

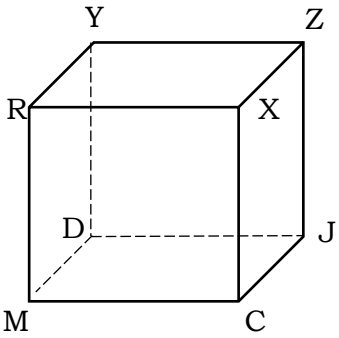
4. Which of the following is not a point?
   A. A
   B. B
   C. C
   D. F

5. What is the best geometric term for line *p* and line *r*?
   A. skew lines
   B. parallel lines
   C. intersecting lines
   D. concurrent lines

6. In the given figure, what is A?
   A. line
   B. point
   C. ray
   D. segment

7. What are points that lie on the same line?
   A. coplanar
   B. collinear
   C. common point
   D. point of intersection

For numbers 8-10, refer to the illustration on the right.



8. What is the intersection of plane ZYRX and plane CXRM?
   A. line segment ZY
   B. line segment YD
   C. line segment RX
   D. line segment CM

9. Which of the following lines does not contain M?
   A. line RX
   B. line RM
   C. line DM
   D. line CM

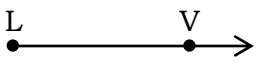
10. What is the intersection of planes ZXCJ, ZYRX, and CMRX?
   A. line ZX
   B. line RX
   C. point R
   D. point X

11. What is the intersection of two distinct planes?
   A. point
   B. line
   C. plane
   D. ray

12. What does a rope represent?
   A. line
   B. point
   C. plane
   D. ray

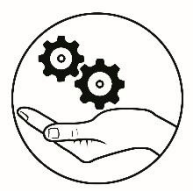
13. The top of a table represents what geometric term?
   A. point
   B. plane
   C. line segment
   D. line

14. How do we name the illustration of a ray on the right?



   A. $\overline{LV}$
   B. $\overleftarrow{LV}$
   C. $\overrightarrow{LV}$
   D. $\overrightarrow{VL}$

15. What are segments with equal length?
   A. collinear segments
   B. congruent segments
   C. coplanar segments
   D. opposite segments



Additional Activities

Let us try your reasoning power. Answer the following questions and state your reasons.

1. Consider the stars in the night sky. Do they represent points?

2. Consider the moon in its fullest form. Would you consider a full moon as a representation of a point?

3. A point has no dimension. A line has a dimension. How come that a line composed of dimensionless points has a dimension?

4. A pencil is an object that represents a line. Does a pencil extend infinitely in both directions? Does a pencil really represent a line?

Answer Key

What I Know

1. B
2. D
3. D
4. A
5. C
6. C
7. C
8. D
9. A
10. A
11. D
12. C
13. C
14. D
15. C

What's In

Shape 1: Rectangle
Shape 2: Triangle
Shape 3: Square
Shape 4: Star

Answer to Questions:

1. Closed figure/ corners/ plane
2. 4
3. 3
4. 4
5. 10
6. Line/ side
7. Point/ dot

What's New

1. Line
2. Point
3. Plane
4. Segment
5. Ray

What's More

A. Representation of:
1. Point
   - Corner of the table
   - Tip of a ballpen
2. Line
   - Hair strand
   - Intersection of side wall and ceiling
   - Electric wire
   - Edge of a paper
   - thread
3. Plane
   - Screen of a smartphone
   - Surface of the table

What's More

(Continuation)

B.
1. point J and point A
2. lines DN, DE, EN
3. lines DE, EN, DN
4. rays ED, EN, ND, DN
5. segments DE and EN

C.
1. 28
2. lines AB, AD, AE, AC, AG, AF
3. planes ABCD, EFGH, ADHE, BCGF, CDHG, ABFE, ABGH, CDEF, ADGF, BCHE
4. planes ABCD, EFCD, CDHG
5. planes ABFE, BFGC, BFHD

What I Have Learned

1. ray
2. skew lines
3. point
4. intersecting lines
5. plane
6. concurrent lines
7. parallel lines
8. line
9. line segment
10. coplanar

What I Can Do

Learners' answers may vary depending on available objects at home and choice.

Assessment

1. B
2. B
3. D
4. D
5. C
6. B
7. B
8. C
9. A
10. D
11. B
12. A
13. B
14. C
15. B

Additional Activities

Learners' answers may vary.

References

1. Bernabe, Julieta G., et al, Geometry Textbook for Third Year. SD Publications, Inc. 2009

2. Department of Education-Bureau of Learning Resources (DepEd-BLR) (2016) *Grade 7 Mathematics Learner's Module*. Lexicon Press Inc., Philippines

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