7

Mathematics

Quarter 3: Week 1 – Module 1

Basic Concepts and Terms in Geometry

AIRs - LM

Mathematics Grade 7

Quarter 3: Week 1 - Module 1: **Basic Concepts and Terms in Geometry**

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Target

This lesson focuses on plane figures. Included in the discussion are the basic terms used in geometry such as points, lines and planes. The focus of this section is the different ways of describing and representing the basic objects used in the study of geometry.

Learning Competencies

- represents point, line, and plane using concrete and pictorial models **(M7GE-IIIa-1)**
- illustrates subsets of a line **(M7GE-IIIa-2)**
- classifies the different kinds of angles **(M7GE-IIIa-3)**

Before going on, check how much you know about this topic.

PRE – ASSESSMENT

***Directions*:** Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following is defined as an exact location in space?

   A. line segment B. midpoint C. plane D. point

2. Which is a part of a line that is bounded by two endpoints?

   A. cut-line B. line piece C. line portion D. line segment

3. Which object is an example of a straightedge used to draw straight lines?

   A. ball B. box C. needle D. ruler

4. It is a straight path that goes on without end in two directions. What is it?

   A. line B. plane C. ray D. triangle

5. Which of the following is a point that divides a line segment into two equal parts?

   A. endpoint B. interior C. midpoint D. vertex

6. What do you call a flat surface that extends forever in all directions?

   A. angle B. area C. plane D. surface area

7. What lines are equidistant from each other and never intersect?

A. bisector B. parallel C. perpendicular D. ray

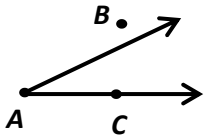
8. What is it called when there is an arrow on each side of the line?

A. line B. line segment C. point D. ray

9. What part of a line that has a fixed starting point but no endpoint?

A. line B. line segment C. point D. ray

10. On the figure shown below, what is AB?



A. line B. line segment

C. point D. ray

11. Which of the following divides a line segment into two equal parts?

A. endpoint B. interior C. midpoint D. vertex

12. Which object best represents a point?

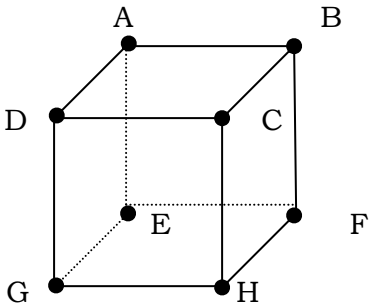
A. ball B. eraser C. table D. tip of a pen

13. What is the best definition of a line segment?

A. It is a part of a line that has no endpoint
B. It is a part of a line that has one endpoint
C. It is a part of a line that has two endpoints
D. It is a part of a line that has three endpoints

14. How many plane/s can be found in a cube given below?

A. 4
B. 5
C. 6
D. 8



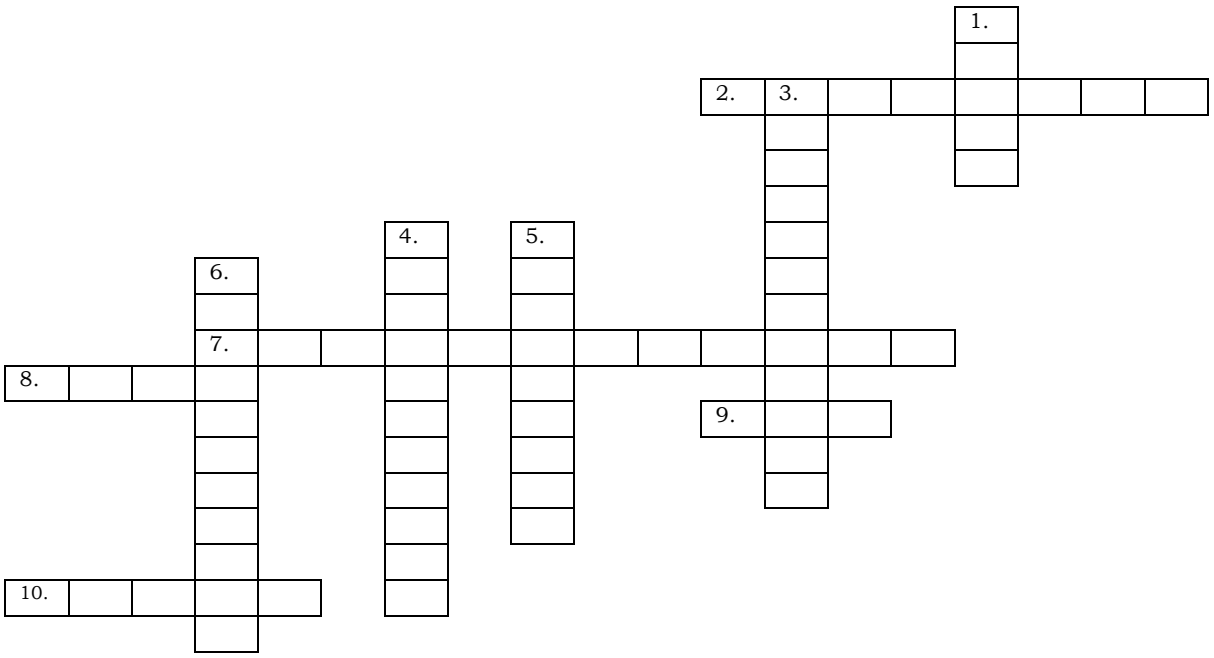
15. In the figure given in item 14, lines DC, BC, and CH intersected in what point?

A. point B B. point C C. point D D. point H

Jumpstart

CROSS-WORD PUZZLE

Directions: Complete the cross-word puzzle by answering the questions below.



Cross

2. points that lie on the same plane

7. points that do not lie on the same line

8. an object with no thickness that extends two directions

9. part of a line consisting of one endpoint and extending in one direction

10. an exact location in space with an indefinite shape and size

Down

1. a flat surface that continues in all directions infinitely

3. rays that share a common endpoint

4. points that do not lie on the same plane

5. points that lie on the same line

6. part of a line consisting of two endpoints and all the points in between

Discover

Lesson 1	**Basic Concepts and Terms in Geometry**

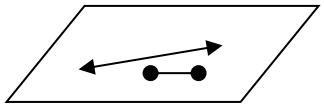
A. Introduction to the Undefined Terms:

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.

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	R V ***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 lower case letter or any two points on the line to name the line.	line ***m*** or $\overleftrightarrow{RV}$
Plane	• P • Q • R	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 a lowercase letter or three points on the plane to name the plane.	plane PQR or □PQR

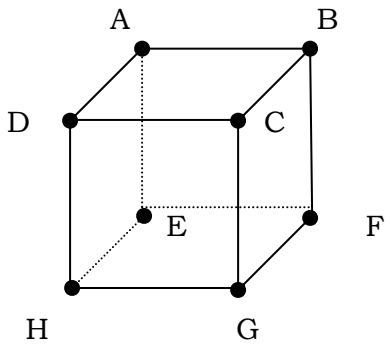
B. Other Basic Geometric Terms on Points and Lines

Relationships are defined and described in the illustrative examples that follow.

Geometric Terms	**Illustration**
Collinear points are points on the same line.	
Coplanar points/lines are points/lines on the same plane.	

The following illustration will help you develop the definitions of the other relationships.

Given: The points A, B, C, D, E, F, G, H are corners of a box as shown:



- **Intersecting Lines**
  Lines DH and DC intersect at point D. They are intersecting lines.
  Lines CG and GF intersect at point G. They are also intersecting lines.

- **Parallel Lines**
  Lines AB and DC are **parallel**.
  Lines DH and CG are **parallel**.

- **Concurrent Lines**
  Lines AD, AB, and AE are concurrent at point A.
  Lines GH, GF, and GC are concurrent at point G.

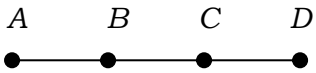
- **Skew Lines**
  Lines DH and EF are two lines which are neither intersecting nor parallel. These two lines do not lie on a plane and are called ***skew lines***. Lines AE and GF are also skew lines. The lines DH, CG, HE and GF are ***skew to*** AB.

Remember:

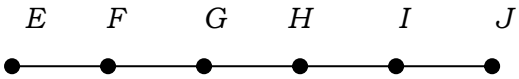
- Two lines are **intersecting** if they have a common point.
- Three or more lines are **concurrent** if they all intersect at only one point.
- **Parallel lines** are coplanar lines that do not meet.
- **Skew lines** are lines that do not lie on the same plane.

C. Subsets of Lines

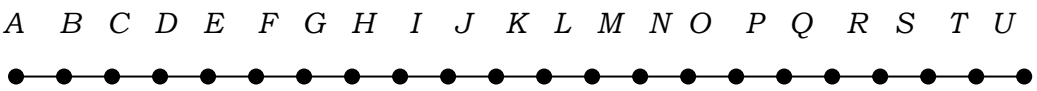
The **line segment** and the **ray** are some of the subsets of a line. A segment has two endpoints while a ray has only one endpoint and is extended endlessly in one direction. The worksheets below will help you formulate the definitions of segments and rays.



$\overline{AD}$ is a line segment. The points *A*, *B*, *C*, and *D* are on line segment *AD*. In notation, we write $\overline{AD}$ or simply *AD*. We can also name it as $\overline{DA}$ or *DA*.



FH is a segment. The points *F*, *G*, and *H* are on line segment *FH*. The points *E*, *I*, and *J* are not on line segment *FH*. In notation, we write $\overline{FH}$. We can also name it as $\overline{HF}$ or *HF*.

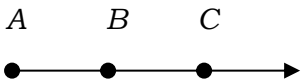


The points *E*, *F*, *G*, and *J* are on line segment *EQ* or segment *QE*.

The points *C*, *D*, *T*, and *U* are not on line segment *EQ*.

A ***line segment*** is part of a line that has two endpoints. We define a line segment $\overline{AB}$ as a subset of line $\overleftrightarrow{AB}$ consisting of the points *A* and *B* 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 its endpoints.

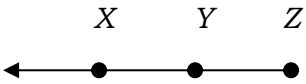
Definition of a Ray



This is ray *AB*. We can also name it as ray *AC*.

In symbol, we write $\overrightarrow{AC}$.

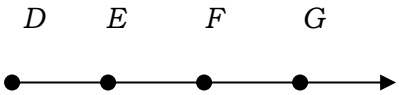
The points *A*, *B*, *C* are on ray *AC*.



This is ray *ZY*. We can also name it as ray *ZX*.

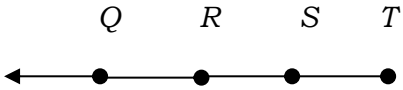
In symbol, we write$\overrightarrow{ZX}$. We do NOT write it as$\overleftarrow{XZ}$.

The points *X*, *Y*, *Z* are on ray *ZY*.



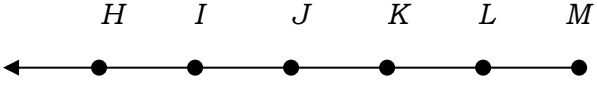
This is ray *DE*. We can also name it as ray *DF* or ray *DG*.

The points *D, E, F, G* are on ray *DE*.

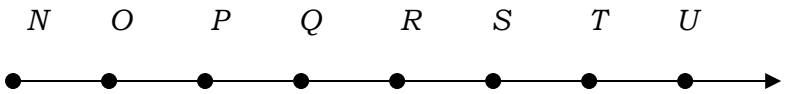


This is ray *TS*. We can also name it as ray *TR* or ray *TQ*.

The points *Q, R, S, T* are on ray *TS*.



This is ray *ML*.

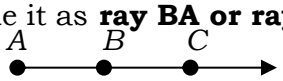


The points *Q, R, S, T, U* are on ray *QR*.

The points *N, O, P* are not on ray *QR*.

A **ray** is also a part of a line but has only one endpoint, and extends endlessly in one direction. We name a ray by its endpoint and one of its points. We always start on the endpoint. The figure is ray *AB* or we can also name it as ray *AC*.

It is not correct to name it as **ray BA or ray CA.** In notation, we write $\overrightarrow{AB}$ or $\overrightarrow{AC}$.

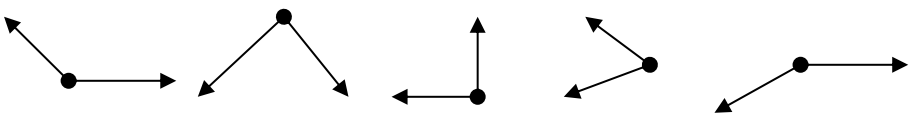


Lesson 2

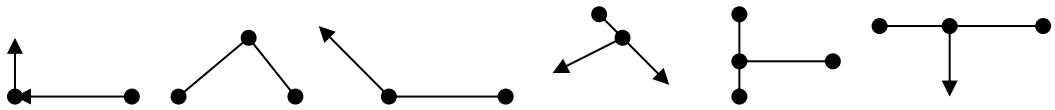
Classification of the Different Kinds of Angles

An **angle** is a union of two non-collinear rays with common endpoint. The two non-collinear rays are the ***sides*** of the angle while the common endpoint is the ***vertex***.

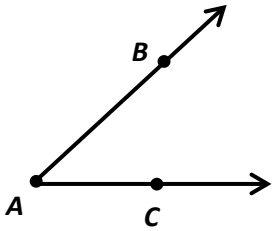
The following are angles:



The following are **NOT** angles:

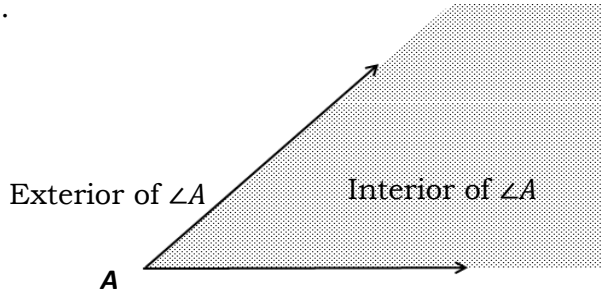


If no confusion will arise, an angle can be designated by its vertex. If more precision is required three letters are used to identify an angle. The middle letter is the vertex, while the other two letters are points one from each side (other than the vertex) of the angle. For example:



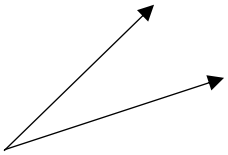
The angle on the left can be named angle A or angle BAC, or angle CAB. The mathematical notation is $\angle A$, or $\angle BAC$,

An angle divides the plane containing it into two regions: the interior and the exterior of the angle.

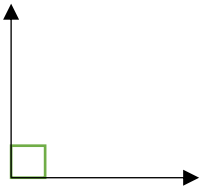


The three different types of angles are acute, right and obtuse angles. An ***acute angle*** measures more than 0° but less than 90°; a ***right angle*** measures exactly 90° while an ***obtuse angle*** measures more than 90° but less than 180°. If two lines or segments intersect so that they form a right angle, then they are ***perpendicular***. In fact, two perpendicular lines meet to form four right angles.

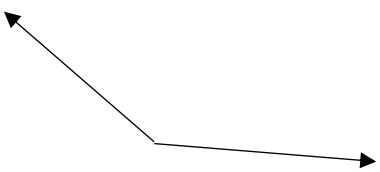
Illustrative Examples



Acute angle



Right angle



Obtuse angle

Note that we define angle as a union of two non-collinear rays with a common endpoint. In trigonometry, an angle is sometimes defined as the rotation of a ray about its endpoint. Here, there is a distinction between the initial position of the ray and its terminal position. This leads to the designation of the initial side and the terminal side. The measure of an angle is the amount of rotation. If the direction of the rotation is considered, negative angles might arise. This also generates additional types of angles: the zero, straight, reflex and perigon angles. A zero angle measures exactly 0°; a straight angle measures exactly 180°; a reflex angle measures more than 180^{o} but less than 360° and a perigon angle measures exactly 360°.

On Angle Pairs:

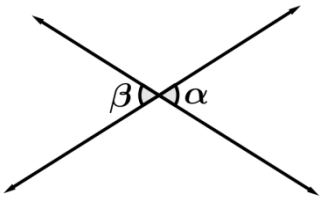
Two angles are **adjacent** if they are coplanar, have common vertex and a common side but have no common interior points.

Two angles are **complementary** if the sum of their measures is 90^{0}.

Two angles are **supplementary** if the sum of their measures is 180^{0}.

Two angles form a **linear pair** if they are both adjacent and supplementary.

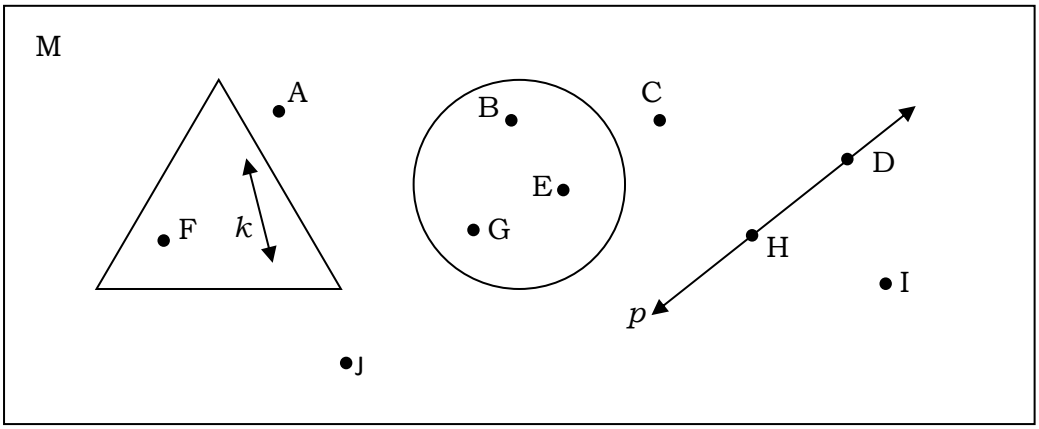
Vertical angles are the opposite angles formed when two lines intersect. Vertical angles are congruent.



In the figure, $\angle\alpha$ and $\angle\beta$ are vertical angles.

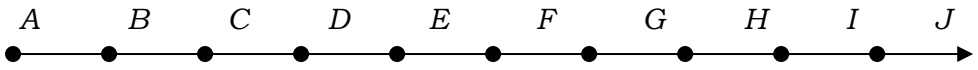
Explore

ACTIVITY 1. Use the figure below, identify what is being asked.

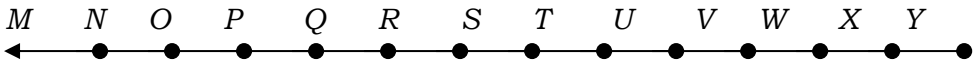


1. Name the point(s) in the interior region of the triangle.
2. Name the line(s) in the interior region of the triangle.
3. Name the plane formed by line ***p*** and point I.
4. Name the points inside the circular region.
5. Name the points outside the region bounded by the triangle and circle.

ACTIVITY 2. Answer the following questions using the given figures



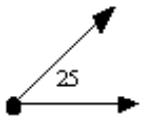
1. What are the points on ray *DE*? _____
2. What are the points not on ray *EG*? _____

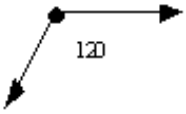


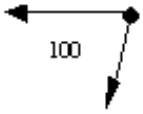
3. What are the points on ray *QT*? _____
4. What are the points on ray *PO*? _____
5. What are the points on ray *XU* _____

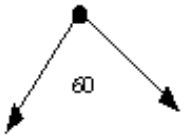
ACTIVITY 3. Classify Me!

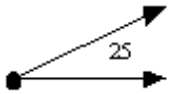
Directions: Determine the following angles whether ACUTE, RIGHT, or OBTUSE.

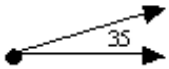
1) 

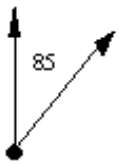
2) 

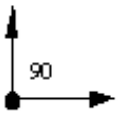
3) 

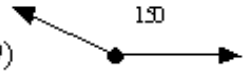
4) 

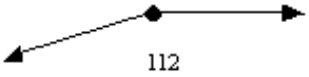
5) 

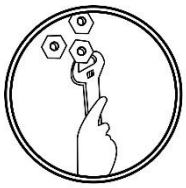
6) 

7) 

8) 

9) 

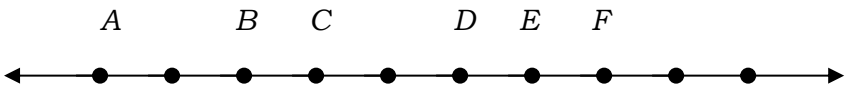
10) 



Deepen

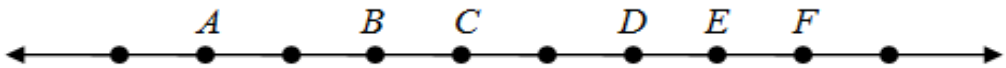
Directions: Identify the union and intersection of the given line segments using the figure below. The first two is made for you.

Example:



1. $\overrightarrow{DE} \cup \overrightarrow{CF}$ is the set of all points on the ray *DE* and segment *CF*. Thus, all these points determine ray $\overrightarrow{CD}$.

2. $\overrightarrow{BC} \cap \overrightarrow{ED}$ is the set of all points common to ray $\overrightarrow{BC}$ and ray $\overrightarrow{ED}$. The common points are the points on the segment *BE*.



1) $\overline{AB} \cup \overline{BE}$ = _____

2) $\overrightarrow{DF} \cup \overline{BD}$ = _____

3) $\overrightarrow{CB} \cup \overline{CE}$ = _____

4) $\overrightarrow{DE} \cup \overline{BD}$ = _____

5) $\overrightarrow{CA} \cup \overrightarrow{CD}$ = _____

6) $\overline{BF} \cap \overline{AD}$ = _____

7) $\overrightarrow{FD} \cap \overline{AB}$ = _____

8) $\overrightarrow{FE} \cap \overrightarrow{CD}$ = _____

9) $\overrightarrow{CA} \cap \overrightarrow{CE}$ = _____

10) $\overline{BC} \cap \overrightarrow{CE}$ = _____

Gauge

Assessment:

Directions: Read each statement below carefully. Choose the letter of the correct answer. Write your answer on a separate sheet of paper.

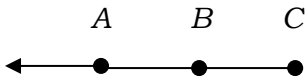
1. Which of the following materials is used to draw straight lines?

A. compass B. protractor C. ruler D. thermometer

2. What part of a line consisting of one endpoint and extending in one direction?

A. line segment B. plane C. ray D. triangle

3. What ray is found on the given figure?

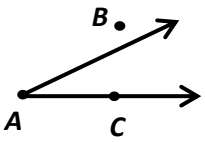


A. ray AB B. ray AC C. ray BC D. ray CA

4. Which of the following statements is **NOT** true in a point?

A. It has no dimension.
B. It is a one-dimensional figure.
C. Use a capital letter to name a point.
D. A point suggests an exact location in space.

5. On the figure shown below, what are A, B, and C?



A. lines B. line segments

C. points D. rays

6. How can you name the angle given in item number 5?

A. ∠ABC B. ∠ACB C. ∠BAC D. ∠CBA

7. What geometric term defined as points on the same plane?

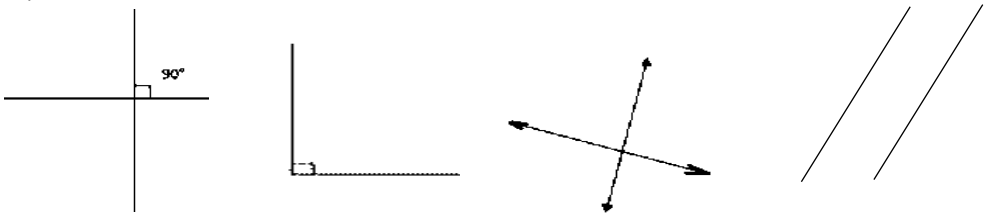
A. collinear points B. coplanar points
C. intersecting line D. line segment

8. What geometric term defined as points on the same line?

A. collinear points B. coplanar points
C. intersecting line D. line segment

9. Which of the following figures shows parallel lines?

A. B. C. D.



10. What do you call an angle larger than 90 degrees?

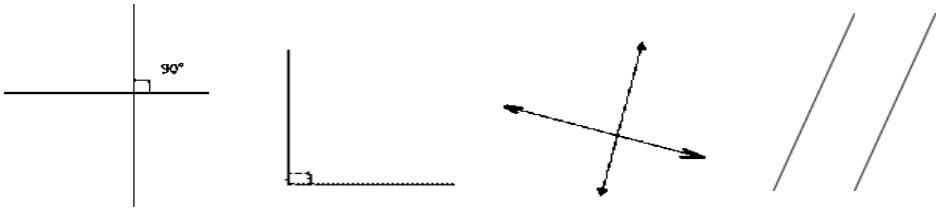
A. acute B. obtuse C. right D. straight

11. Which statement is TRUE on naming a plane?

A. any one point on the plane
B. any 3 collinear points on the plane and a lowercase script letter
C. any 3 non-collinear points on the plane and an uppercase script letter
D. both A and C

12. You are asked to construct a perpendicular line. What should it look like?

A. B. C. D.



13. Which of the following statements is TRUE in undefined terms in Geometry?

I. Two lines are intersecting if they have a common point. II. Three or more lines are concurrent if they all intersect at only one point. II. Parallel lines are coplanar lines that do not meet. IV. Skew lines are lines that lie on the same plane.

A. I and II B. II and III C. I and IV D. I, II, and III

14. You are asked to construct a plane. What should you make?

I. three non-collinear points II. two intersecting lines III. two parallel lines IV. a line and a point not on the line

A. I, II and III B. I, III, and IV C. II, III, and IV D. I, II, III, and IV

15. Which of the following statements is ***NOT*** true on angle pairs?

A. Two angles are complementary if the sum of their measures is 90^0.

B. Two angles are supplementary if the sum of their measures is 360^0.

C. Two angles form a linear pair if they are adjacent and supplementary.

D. Vertical angles are the opposite angles formed when two lines intersect.

References

A. Books

Mathematics – Grade 7 Learners' Material. DepEd IMCS, First Edition, 2013. ISBN:978-971-9990-60-4

Nivera, Gladys C., Ph.D., 2013, Grade 7 Mathematics Patterns and Practicalities, Makati City, Don Bosco Press

B. Online Resources

https://www.newellsecondarymath.blogspot.com

https://www.mathsisfun.geometry.com

https://mathforum.geometryworksheets.com