SECONDARY
JHS

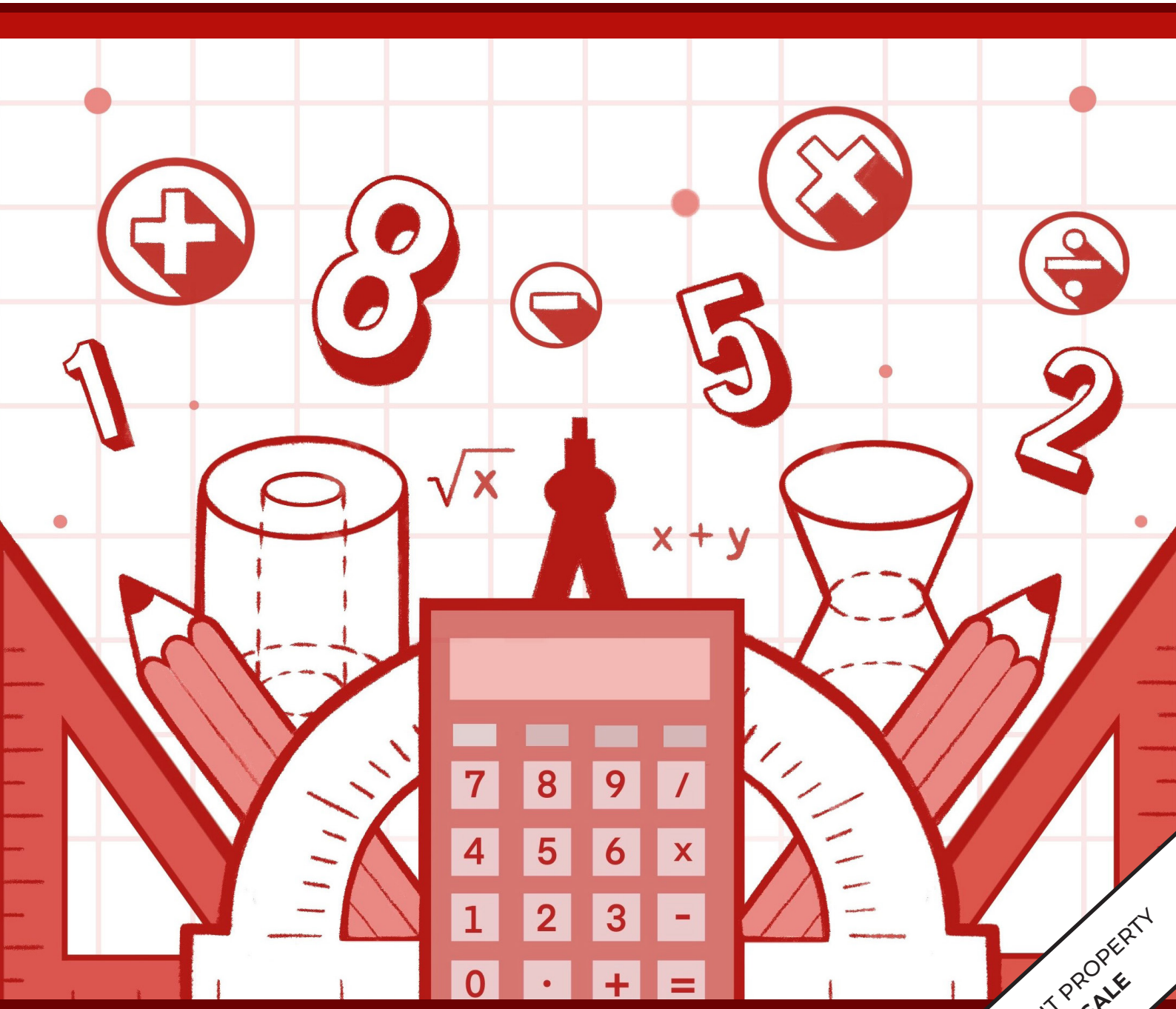
DepED DEPARTMENT OF EDUCATION

ALS Alternative Learning System LIFELONG LEARNING

LEARNING STRAND 3
MATHEMATICAL & PROBLEM-SOLVING SKILLS

SESSION GUIDES FOR MODULE 4:
RECOGNIZING SHAPES AND MEASUREMENTS AROUND ME

ALS Accreditation and Equivalency Program: Junior High School



UNESCO United Nations Educational, Scientific and Cultural Organization

KOICA Korea International Cooperation Agency

LEARNING STRAND 3

SESSION GUIDES

Alternative Learning System - Accreditation and Equivalency (ALS-A&E)

JUNIOR HIGH SCHOOL: MATHEMATICAL AND PROBLEM-SOLVING SKILLS

SESSION GUIDES FOR MODULE 4 (RECOGNIZING SHAPES & MEASUREMENTS AROUND ME)

ALS Accreditation and Equivalency Program: Junior High School
Learning Strand 3: Mathematical and Problem-Solving Skills
Session Guides for Module 4 (Recognizing Shapes and Measurements Around Me)

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User's Guide

For the ALS Teacher/Instructional Managers/Learning Facilitator:

Welcome to the session guide of this module entitled Recognizing Shapes and Measurements Around Me under Learning Strand 3 Math and Problem-Solving Skills of the ALS K to 12 Basic Education Curriculum (BEC).

The module and the session guides were collaboratively designed, developed and reviewed by select DepEd field officials and teachers from formal school and ALS, and private institutions to assist in helping the ALS learners meet the standards set by the ALS K to 12 Basic Education Curriculum (BEC) while overcoming their personal, social, and economic constraints in attending ALS learning interventions.

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

As an ALS Teacher/Instructional Manager/Learning Facilitator, you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their learning. Moreover, you are expected to encourage and assist the learners as they do the tasks included in the module.

THE FOUNDATION OF SHAPES AND FIGURES
Session Guide No. 1

I. **Duration of Session:** 3 hours

II. **Key Understandings to Be Developed**
- Undefined Terms
- Subsets of a line
- Parallel and perpendicular lines

III. **Learning Objectives**
1. Represent point, line, and plane using concrete and pictorial models.
2. Identify objects that represent point, line, and place such as paper, rope, farmland, wall, ceiling, etc.
3. Illustrate subsets of a line.
4. Determine the conditions under which lines and segments are parallel or perpendicular.

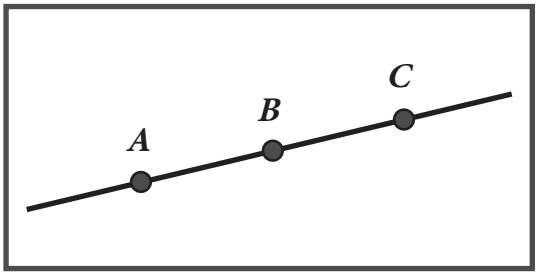
IV. **Resources** (if available)
- Sticks, piece of clean paper, box

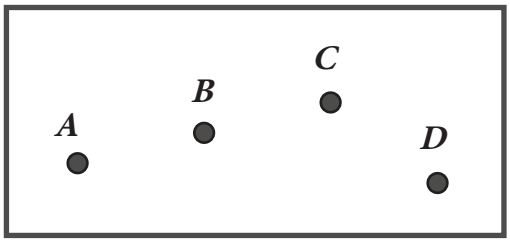
V. **Activity**
1. Ask the learners to get two pieces of sticks, a piece of clean paper, and a box. Guide them in following the directions in the Learner's Module on what to do with these materials.

   The activity is designed to show that real world common objects around us, such as sticks and papers, can be used to represent basic terms and figures in geometry, putting focus on how these concepts are all around us. Other readily available materials may also be used so long as they have similar characteristics required to explain the concepts.

Preliminary

1. Put one stick on the piece of paper. Then, use the stick as a guide to mark three dots on the paper as shown on the figure on the right. Name them using *A*, *B*, and *C*, respectively.

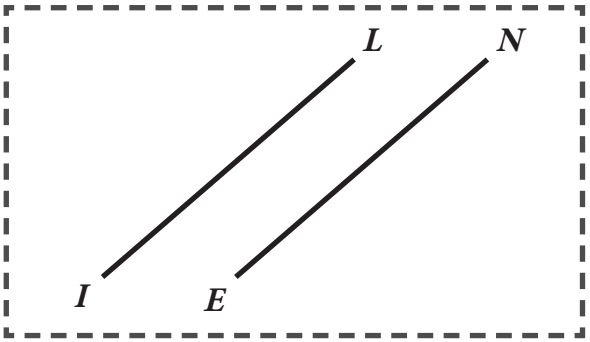




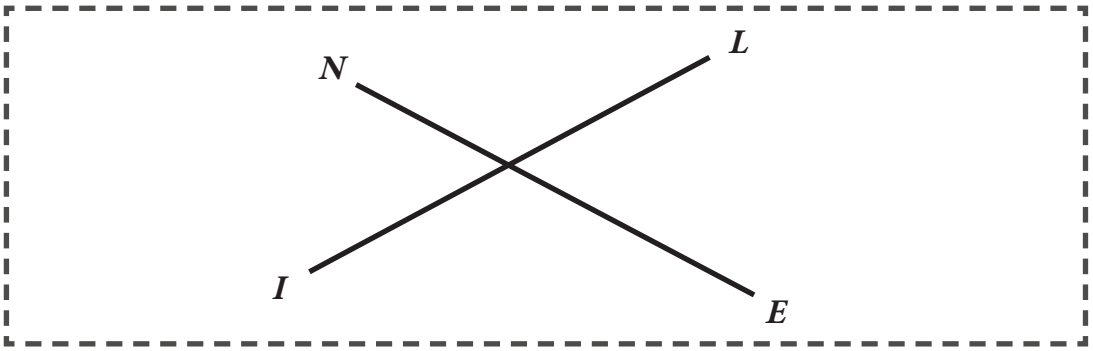
2. Mark a fourth dot on the paper away from the first three and name it *D*.

Investigate

1. **STICKS:** Mark the ends of the sticks as *L* and *I*, and *N* and *E* as shown in the figure on the right.



We will name these two sticks using the points they are connecting. We have two lines—**line *LI*** and **line *EN***. Now, try to cross lines *LI* and *EN* with each other by putting one on top of the other.



What figure represents where these two lines meet?

2. **PAPER:** Mark the corners of the paper using the letters *J, K, L,* and *M* as shown in the figure (see next page). We will name the piece of paper using the letters we wrote on each corner points. So, we name this as **Plane *JKLM*.**

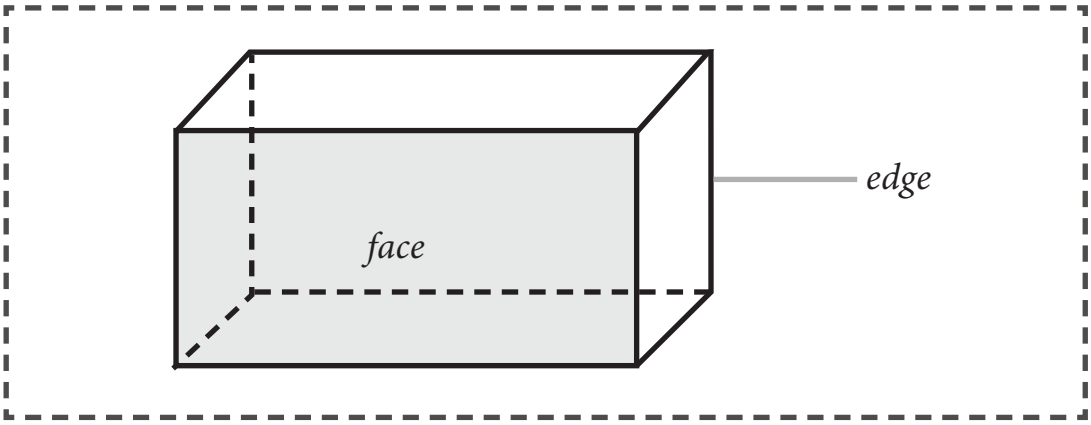
Question 2

A. What figure represents each side of the paper?
B. What figures meet at the following points?

- Point *J* - Point *K* - Point *L* - Point *M*

C. What pairs of sides in the paper are across each other?
D. Imagine extending the sides of the paper in all direction. Will the extended portion of the sides of the papers cross each other?

3. **BOX:** Now, look at the box on the next page and answer the questions using your observations.



Question 3

A. What figure represents the edges of the box?
B. What figure represents the faces of the box?
C. What relationship exists between the faces and the edges of the box?

2. Ask the learners to present their work to the rest of the class

VI. Analysis

1. Discuss and put emphasis on the representations of the objects used in the activity as follows:

   - **Point** is represented by the following: dots marked on the paper, ends of the of the sticks, corners of the paper
   - **Line** is represented by the following: the two sticks used in the activity, each side of the paper (Answer to question 2(a)), each edge of the box (Answer to question 3(a))
   - **Plane** is represented by the following: the paper used in the activity, each face of the box (Answer to question 3(b))

2. Discuss that these are called the undefined terms which are the basic figures in geometry.

- Ask the learners to cite other representations of points, lines, and planes that they can see around them.

3. Guide the learners to the next part of the module where the questions posed in the activity will be answered.
4. Demonstrate the intersection of two (or more) lines and planes using the materials used in the activity:

   - The intersection or meeting of two lines is a point (Answer to question 1). Ask the learners to cite some other examples around them such as the intersection of the sides of windows, walls, and ceilings, intersection of streets, etc.
   - The intersection or meeting of two planes is a line (Answer to question 3(c)). Ask the learners to cite some other examples around them such as the intersection of the following: wall and ceiling of a room, the wall and floor, sides of a cabinet, etc.

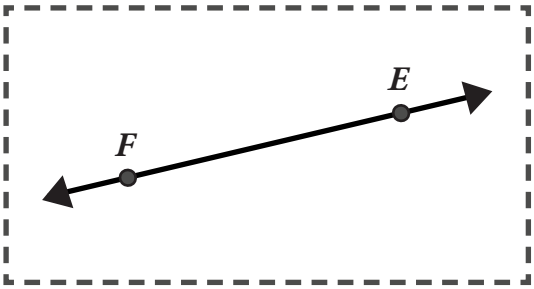
VII. Abstraction/Generalization

1. Present the definition of terms and examples.
2. **Undefined terms:**
   - Explain that points, lines, and planes are called undefined terms because they cannot be formally defined but rather only be described.

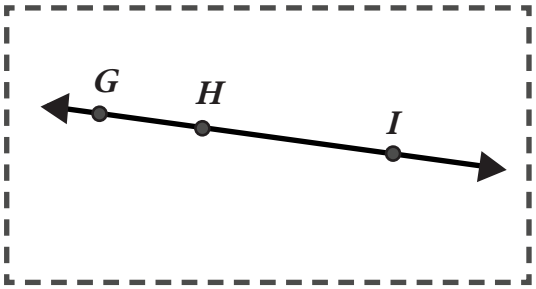
     Points, lines, and **planes** are called the undefined terms in geometry and are the basic figures that make up other more complex and difficult shapes and objects.

   - Emphasize the relationship between the undefined terms where a set of connected points form a line and a set of three or more lines intersecting each other form a plane. Summary of development: point → line → plane

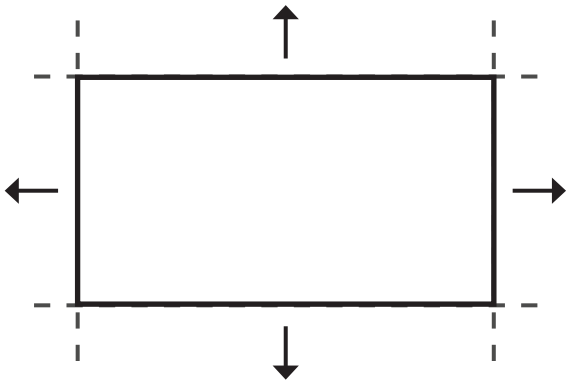
   - Lines and planes extend on all sides without end or infinitely. This characteristic is represented by arrow heads on lines.

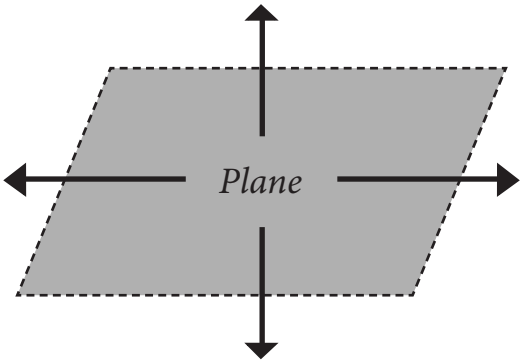


This can be named as line FE or EF.

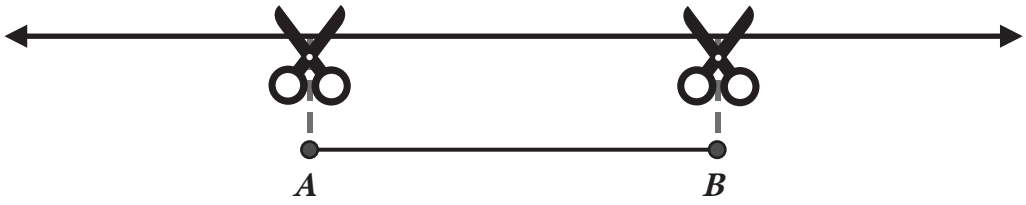


This can be named as line GH, HI, or GI.

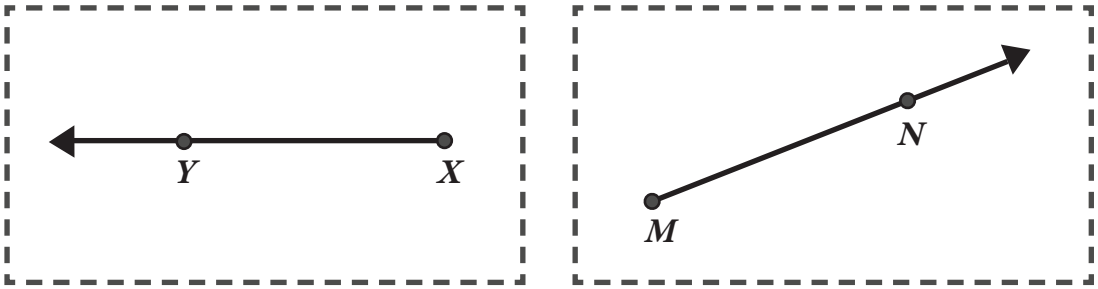




- Explain the different subsets of a line.
  - Line segments do not have arrow heads. They have two endpoints and are like part of a line that has been cut at two points.



  - Rays have only one endpoint and an arrow, extending in only one side. It looks like a line that has been cut at one point.

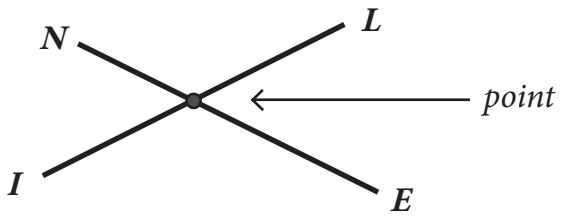


Ray *YX* or $\overrightarrow{YX}$ **Ray *MN* or $\overrightarrow{MN}$**

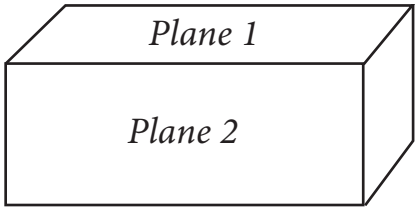
- Guide learners in naming the figures correctly using capital letters.
    - Lines – Use any two points that belong to it.
    - Line Segments – Use the two endpoints of the figure being described.
    - Ray – Write the letter of the endpoint first followed by any other point on the ray.
    - Planes – Use all the points in the plane (usually there are four).

3. **Intersection of lines and planes:**
    - Emphasize that the intersection of two or more lines is a point and the intersection of two or more planes is a line.

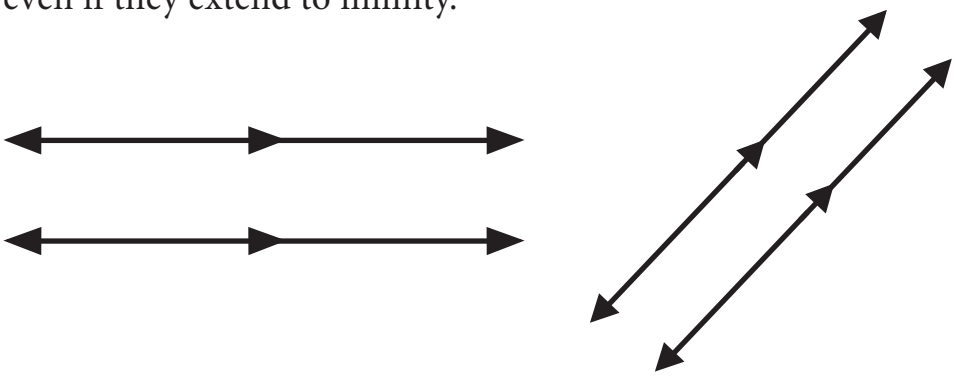
    Two lines intersect at a point.



    Two planes intersect at a line.



4. **Parallel and perpendicular lines:**
   - Provide a variety of examples showing perpendicular lines such as windowsill, door jambs, corners of walls, ceilings, floors, tables, etc. Street intersections are also an example. Ask the learners to provide their own example.
   - Learners might ask how parallel lines do not meet; the answer is that a constant distance is maintained between the two lines even if they extend to infinity.



   - Provide real life examples showing parallel lines such as sides of the road, pedestrian crossings, railways for trains, etc. Ask the learners to provide their own example.

VIII. Application

1. Ask the learners to describe the three undefined terms.
2. Have them compare the subsets of a line.
3. Ask them to differentiate parallel and perpendicular lines.
4. Present the *Sharpening Your Skills* and *Treading the Road to Mastery* assessments which aim to further develop their skills on:

   a. identifying and naming geometric figures.
   b. identifying the intersection of lines and planes.
   c. identifying perpendicular and parallel lines.

5. Process the activity by allowing learners to explain their answers.

IX. Concluding Activity

End the session by reviewing the key understandings developed and relating the concepts of points, lines, and planes to real life.

HOW OPEN IS IT?
Session Guide No. 2

I. **Duration of Session:** 3 hours

II. **Key Understandings to be Developed**
- Angles and its types

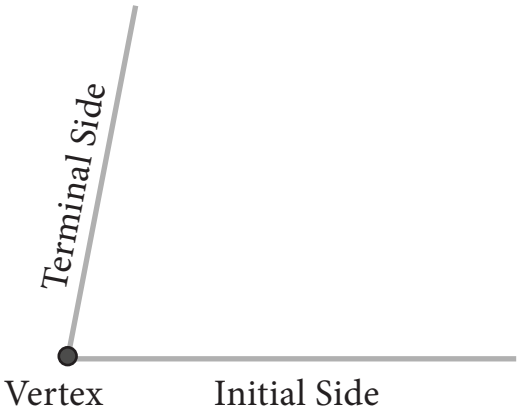
III. **Learning Objectives**
1. Illustrate an angle.
2. Draw different types of angles (e.g. right angles, acute angles, obtuse angles) found in the objects used in daily life.
3. Measure angles found in geometric shapes using a protractor.

IV. **Resources**
- Protractor

V. **Activity**
1. Ask the learners to use a protractor in measuring the figures presented in the Learner's Module. *Not all learners may have a protractor. They can use the image or figure of a protractor provided in the module by either tracing it or cutting it out. It is designed specifically for that purpose.*

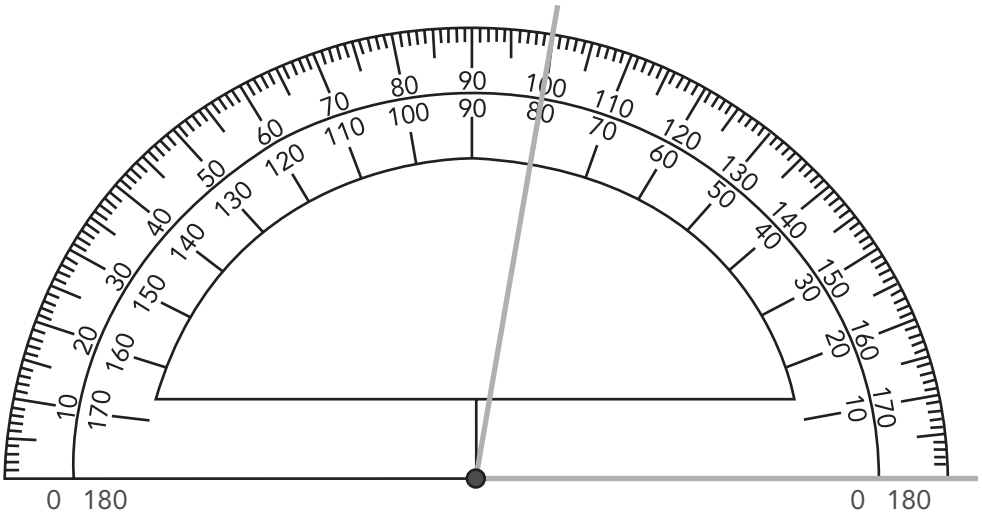
   The activity is a practice on drawing angles corresponding to the exact measures given and measuring angles which is central in identifying the different types of angles.

   Example:
   Suppose we want to measure angles such as the given figure on the next page.

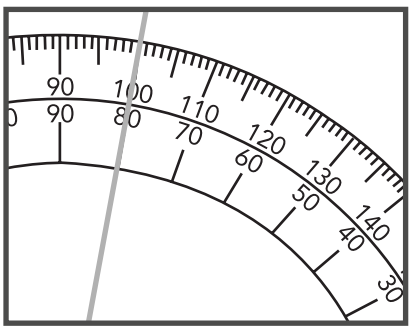


a. Refer to the figure to see the names of each part of the angle.

b. Make sure that the vertex is aligned to the center of the protractor and the initial side is aligned to the horizontal length of the protractor.



Vertex aligned to center and initial side aligned to the horizontal length of protractor



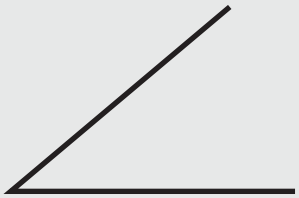
c. Then, carefully read at which measure the terminal side is aligned.

Read the measurement from zero (numbers in the lower group).

d. We see that the terminal side aligns with 80. Therefore, the measure of the angle is **80°.**

Try measuring some of the angles as practice.

A.



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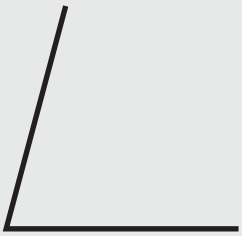
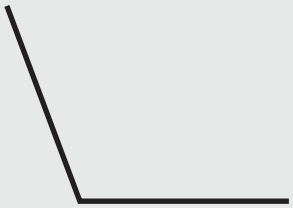


C.



2. In measuring the angles, make sure that the learners are able to follow the instructions when using a protractor by placing the zero (0) at the vertex of the angle and aligning the horizontal line to one of the sides of the angle being measured.

3. In drawing the angles, emphasize that they must create an initial side by tracing a horizontal line from the center point (vertext) to the right, marking the point corresponding to the measure of the angle to be drawn and connecting the vertex to the marking made to complete the angle.

VI. Analysis

1. Provide examples where angles are used such as measuring the steepness of terrain, fitting together two pieces of objects smoothly such as in laying out tiles or house materials in construction and carpentry, sewing, measuring lands, etc.

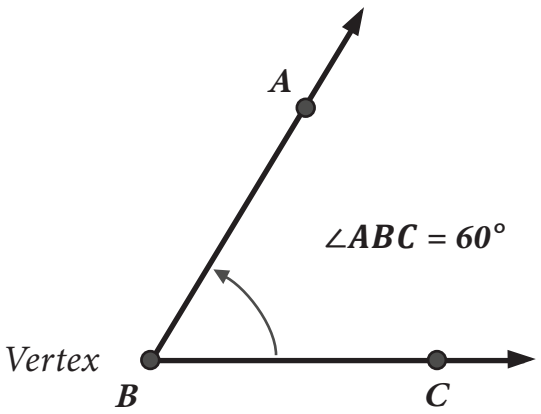
2. It could happen that students would have different answers especially if they used improvisations of the protractor. If the answers are very close to the correct ones, they are acceptable.

3. Familiarizing the students to what an angle is, ask them how they can define or describe an angle in their own words, with possible answers like the opening or space between two lines.

VII. Abstraction/Generalization

1. Present the definition of terms and examples.
2. **Angle:**
   - Emphasize that an angle is the space or opening created by two rays.
   - When naming an angle, use the three points in the angle, but the letter corresponding to the vertex must always be in the middle of the other two.
   - Some angles use single letters or numbers only, they are acceptable.
   - Explain that angles can be measured using the unit of degrees (°).

   Example:

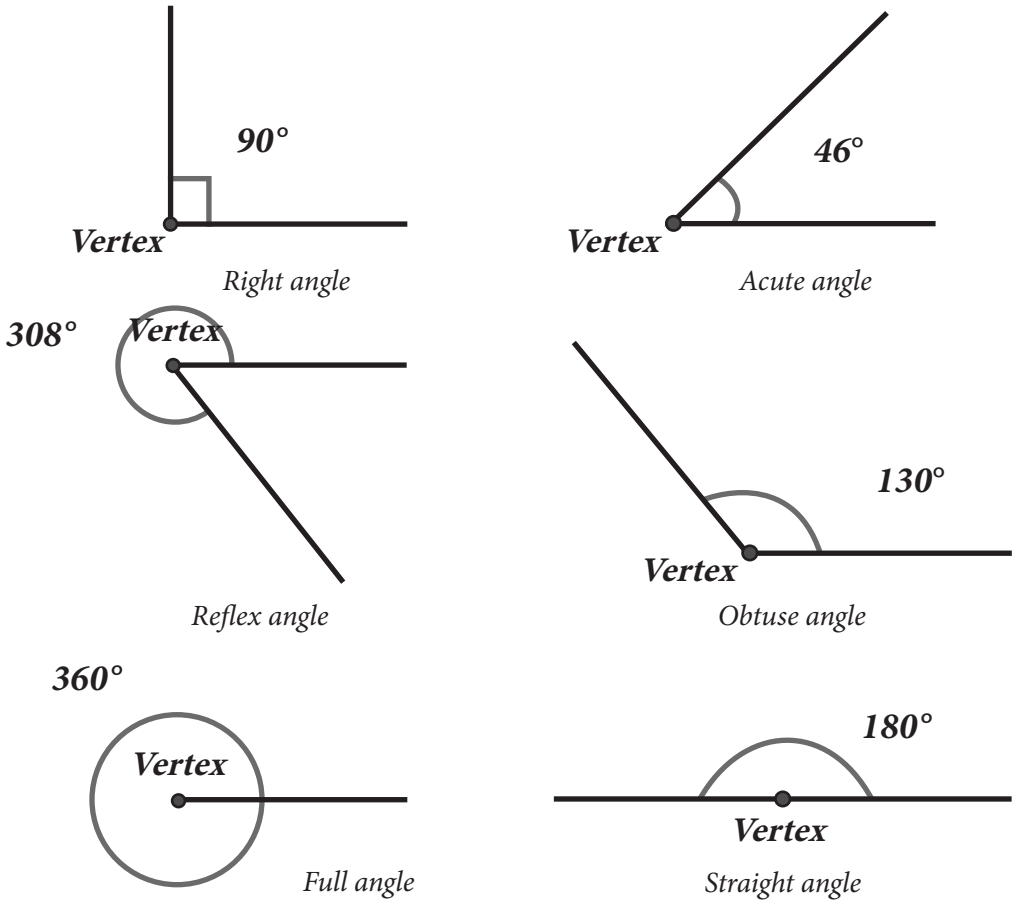


   - You may use a circular wall clock to explain angles. A full rotated angle (circle) has a measure equal to 360°.

3. **Types of angles and angle pairs:**
   Adjacent angles are pairs of angles that share the same vertex and a common side. In other words, these are angles that are side-by-side.

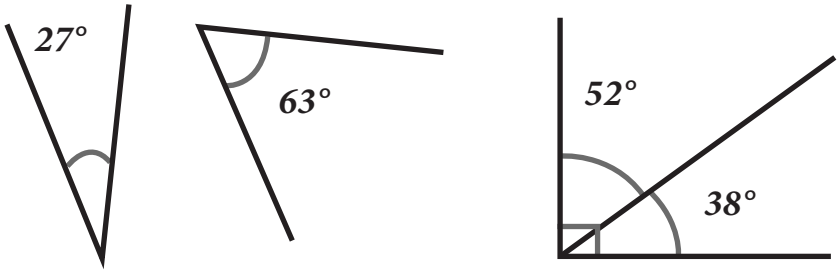
   - Adjacent angles must share one side between them, otherwise they are not adjacent.

- Emphasize that the types of angles are based on their measurement in degrees.

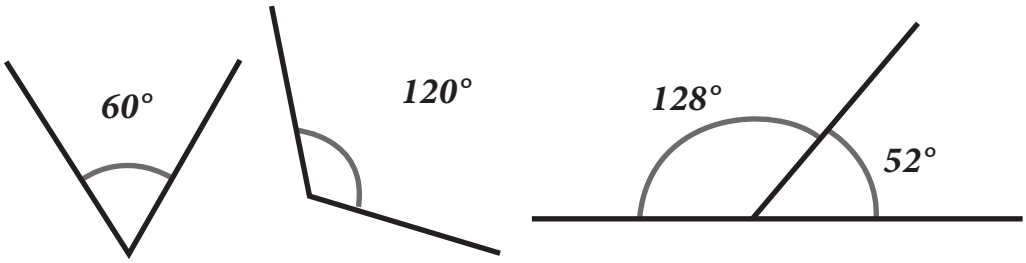


- Emphasize that complementary angles have measure equal to 90° when added while supplementary angles have measure equal to 180° when added.

  Complementary angles



Supplementary angles



VIII. Application

1. Ask the learners to define an angle.
2. Have them discuss the different types of angles.
3. Present the *Sharpening Your Skills* and *Treading the Road to Mastery* assessments which aim to further develop their skills on

    a. identifying the type of given angle according to its measure.
    b. using a protractor correctly to create the described angle with proper labels and illustrating adjacent angles.
    c. solving for the complement and supplement of an angle

4. Process the activity by allowing the learners to explain their answers.

IX. Concluding Activity

End the session by reviewing the key understandings developed and relating the concepts of angles to real-life scenarios.

MANY ANGLES
Session Guide No. 3

I. **Duration of Session:** 3 hours

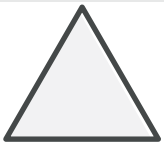
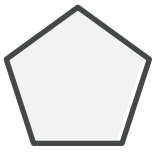
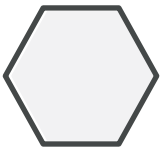
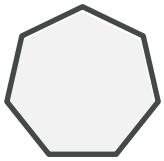
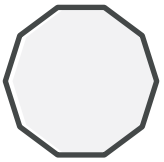
II. **Key Understandings to Be Developed**
- Polygons

III. **Learning Objectives**
1. Illustrate polygons: (a) convexity, (b) angles, and (c) sides.
2. Solve problems involving sides and angles of a polygon.
3. Apply the principles of geometric shapes in daily life situations.

IV. **Resources** (none)

V. **Activity**
1. Ask the learners to help Miranda discover the different shapes by copying/cutting the sketches of figures. *The activity uses hands-on activities which aim to facilitate a better understanding of the concepts and ideas to be presented.*

How many corners does each tile have?

FIGURE	CORNERS	FIGURE	CORNERS
			
			
			

2. Make sure that the learners can follow the instructions.

VI. Analysis

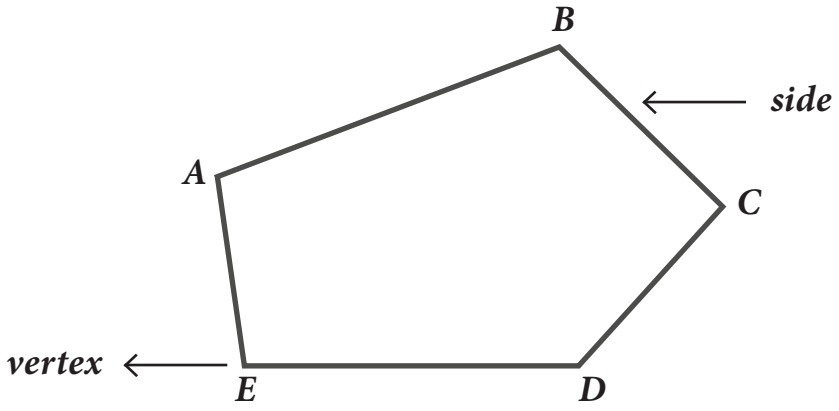
1. Let the students discover that there are different shapes that can be used in floor tiles. Each shape has different number of corners and when laid down together can create a beautiful work.
2. Emphasize that these shapes have special names and introduce the concept of polygons.

VII. Abstraction/Generalization

1. Present the definition of terms and examples.

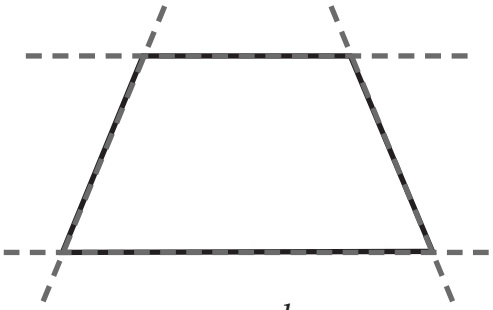
   A **plane figure** is a figure that lies in a plane.

2. **Polygons:**
   - Emphasize that polygons are closed figure formed by straight lines. Ask the learners to provide their own example of polygons.

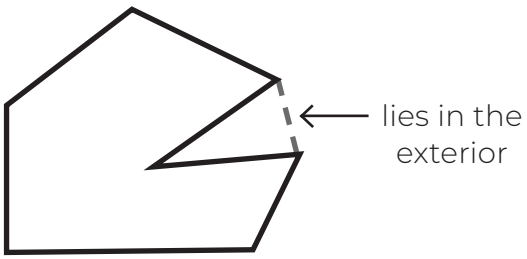


   - Emphasize that polygons can be classified as convex and concave and the most common polygons in the real life are convex.

     A polygon is **convex** if all line segments connecting any pair of vertices do not lie in the exterior of the polygon. A polygon that is not convex is called **concave.**

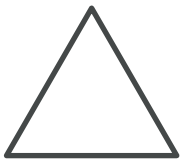
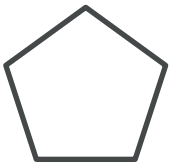
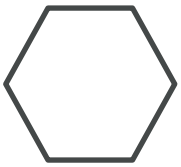
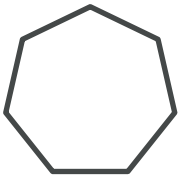


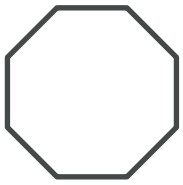
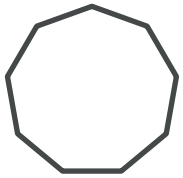
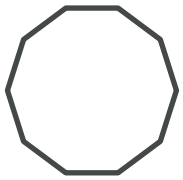
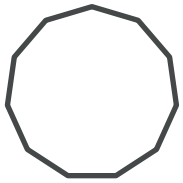
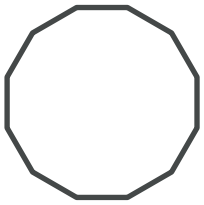
convex polygon



concave polygon

- Explain that polygons can also be classified according to the number of sides and measure of interior angles. Emphasize that the names of polygons are based on the number of sides.

NUMBER OF SIDES	TYPE OF POLYGON	ILLUSTRATION
3	TRIANGLE	
4	QUADRILATERAL	
5	PENTAGON	
6	HEXAGON	
7	HEPTAGON	

NUMBER OF SIDES	TYPE OF POLYGON	ILLUSTRATION
8	OCTAGON	
9	NONAGON	
10	DECAGON	
11	UNDECAGON or HENDECAGON	
12	DODECAGON	

- Make a summary of the concept of polygons in terms of convexity, sides, and angles.
- Guide the learners carefully in applying the formula for the measure of interior angles and sum of measures of interior angles.

  The measure of interior angles of regular polygons can be computed using the formula:

$$A = \frac{180(n-2)}{n}$$

and the sum of the measure of interior angles is given by

$$S = 180(n - 2)$$

where n is the number of sides of the polygon.

Example:
Since a triangle has 3 sides, $n = 3$.

$$A = \frac{180(n-2)}{n} = \frac{180(3-2)}{3} = \frac{180(1)}{3} = \frac{180}{3} = 60$$

$$S = 180(n - 2) = 180(3 - 2) = 180(1) = 180$$

VIII. Application

1. Ask the learners to define polygons.
2. Ask them to identify the different polygons based on the number of sides.
3. Present the *Sharpening Your Skills* and *Treading the Road to Mastery* assessments which aim to further develop their skills on

   a. identifying the type of polygon in terms of convexity.
   b. classifying the type of polygon according the number of sides and measure of interior angles.
   c. finding the measure of interior angle of a polygon.
   d. finding the sum of measures of interior angles of a polygon.

IX. Concluding Activity

End the session by reviewing the key understandings developed and relating the concepts of polygons in real-life scenario.

ANSWER KEY

PRE-ASSESSMENT

PAGE 2

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

LESSON I: THE FOUNDATIONS OF SHAPES AND FIGURES

TRYING THIS OUT

PAGE 5

1. The intersection of the two sticks can be represented with a point.
2. **(a)** The sides of a paper can be represented as line segments.
   (b) At point J, lines JK and JM meet.
   At point K, lines JK and KL meet.
   At point L, lines KL and LM meet.
   At point M, lines JM and LM meet.
   (c) The sides of the paper that are across each other are the pairs JK & LM and JM & KL.
   (d) The sides of the paper will never cross.
3. **(a)** The edges of the box can be represented as line segments.
   (b) The faces of a box can be represented as planes.
   (c) The edges of the box is where the faces of the box meet.

SHARPENING YOUR SKILLS

PAGE 17

ACTIVITY I

1. ray *CS*
2. plane *LOVE*
3. line *AM* or line *MA*
4. $PR \perp AT$
5. $CR \parallel AT$
6. line segment *PR*

ACTIVITY II

1. 

2. 

3. 

4. 

ACTIVITY III

$ZY \perp XR$
$MN \perp RX$
$MN \perp PT$
$YZ \parallel MN$
$RX \parallel PT$
$VW \parallel SU$

TREADING THE ROAD TO MASTERY

PAGE 19

1. **(a)** point *E*
(b) point *C*
(c) point *C*
(d) no intersection

2. **(a)** point *B*
(b) point *C*
(c) no intersection

3. **(a)** no intersection
(b) line *p*
(c) line *q*

4. **(a)** line *a*, line *FQ,* or line *FW*
(b) point *F*

5. **(a)** point *J*
(b) point *J*
(c) point *J*
(d) line *MN*

LESSON II: HOW OPEN IS IT

TRYING THIS OUT

PAGE 22

A. 50°
B. 80°
C. 105°

SHARPENING YOUR SKILLS

PAGE 31

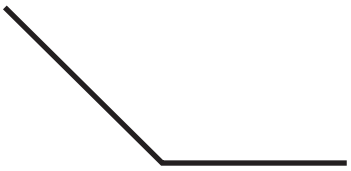
ACTIVITY I

1. obtuse
2. reflex
3. acute
4. right
5. reflex
6. right
7. reflex
8. acute

ACTIVITY II

1.

2.



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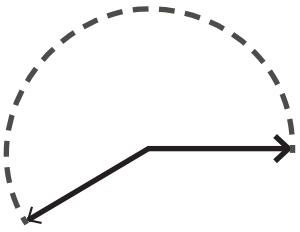

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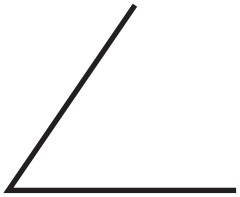

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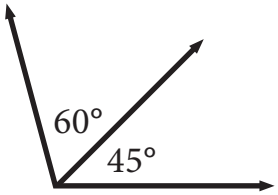

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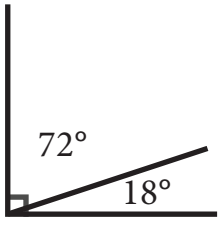


TREADING THE ROAD TO MASTERY

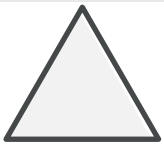
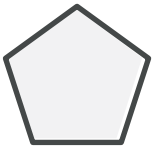
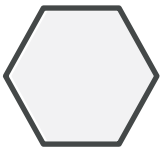
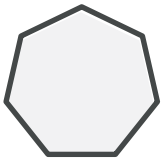
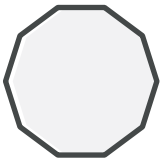
PAGE 33

1. measure of angle = 45° measure of complement = 45°
2. measure of angle = 60° measure of complement = 30°
3. measure of angle = 10° measure of complement = 80°
4. measure of angle = 125° measure of supplement = 55°
5. measure of angle = 115° measure of supplement = 65°
6. measure of angle = 145° measure of supplement = 35°

LESSON III: MANY ANGLES

TRYING THIS OUT

PAGE 35

FIGURE	CORNERS	FIGURE	CORNERS
	3		4
	5		6
	7		10

SHARPENING YOUR SKILLS

PAGE 44

ACTIVITY I

1. polygon, convex
2. polygon, convex
3. polygon, concave because some pairs of vertices connects at the exterior
4. not a polygon because the bottom part is curved

ACTIVITY II

1. octagon, regular
2. pentagon, regular
3. triangle, equiangular
4. triangle
5. quadrilateral, equilateral
6. quadrilateral, equiangular

TREADING THE ROAD TO MASTERY

PAGE 46

1. 156°
2. 1620°
3. 150

REACH THE TOP

PAGE 53

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

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