7

Republic of the Philippines
Department of Education
NATIONAL CAPITAL REGION
Misamis Street, Bago-Bantay, Quezon City

UNIFIED SUPPLEMENTARY LEARNING MATERIALS (USLeM)

MATHEMATICS

Week 5

EXPECTATIONS:

You will **illustrate polygons: (a) convexity; (b) angles; and (c) sides.**
Specifically, this module will help you to:

- Classify polygons according to number of its sides and angles;
- Determine convex and nonconvex polygons.

Let us start your journey in learning more about classifying polygons. I am sure you are ready and excited to answer the Pretest. Smile and cheer up!

PRE-TEST

Directions: Read the questions carefully. Encircle the letter of the correct answer. If the answer is not found in the choices, write "E".

1. What is a polygon?
   a. A closed plane figure made up of line segments
   b. An open plane figure made up of line segments
   c. A closed plane figure made up of rays
   d. An open plane figure made up of rays

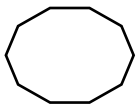
2. How many sides does a Pentagon have?
   a. 4 b. 3 c. 5 d. 9

3. How many sides does a Hexagon have?
   a. 6 b. 4 c. 3 d. 9

4. Why is a triangle called an obtuse triangle?
   a. It has zero obtuse angles.
   b. It has 2 obtuse angles.
   c. It has 1 obtuse angle.
   d. It has 3 obtuse angles.

5. Which is NOT a polygon?
   a. A brick b. A donut c. A window d. A stop sign

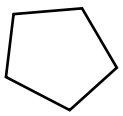
6. What shape is this?



   a. Hexagon
   b. Decagon
   c. Triangle
   d. Nonagon

7. What do you call a polygon with equal side lengths and angle measures?
   a. vertex b. nonconvex c. irregular polygon d. regular polygon

8. Tell whether the figure at the right is a polygon. If it is, name it by the number of sides.

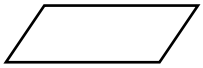


   a. not a polygon
   b. polygon – hexagon
   c. polygon – pentagon
   d. polygon – convex

9. If all the sides and angles in a parallelogram are equal then, which shape is it?
   a. rectangle b. triangle c. square d. rhombus

10. What do you call a polygon that is both equilateral and equiangular?
    a. segment b. irregular polygon c. regular polygon d. vertices

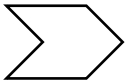
11. Which is not represented by the figure shown below?



    a. polygon
    b. parallelogram
    c. quadrilateral
    d. rectangle

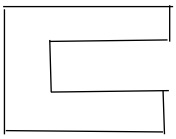
12. How many diagonals must pass outside the figure to classify a polygon as nonconvex?
    a. zero b. at least one c. at least two d. all of them

13. Which best describes the polygon below?



a. a regular hexagon
b. a convex hexagon
c. an arrow
d. a nonconvex hexagon

14. Tell whether the figure below is a polygon. If it is, name it by the number of sides.



a. not a polygon
b. polygon – octagon
c. polygon – hexagon
d. polygon- nonconvex

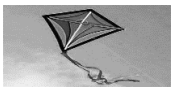
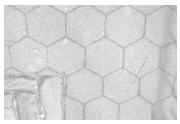
15. Which is a polygon?

a. 
b. 
c. 
d. 

Great, you finished answering the questions. You may request your facilitator to check your work. Congratulations and keep on learning!

LOOKING BACK TO YOUR LESSON

Before going further, let us try to do a fun game. You may start by figuring the object shown and for every correct answer, your doll will move 2 steps forward. The first one to reach the school will be declared the winner.

1. 
2. 
3. 
4. 
5. 
6. 

BRIEF INTRODUCTION

Read the selection below

THE ICONIC "MET"

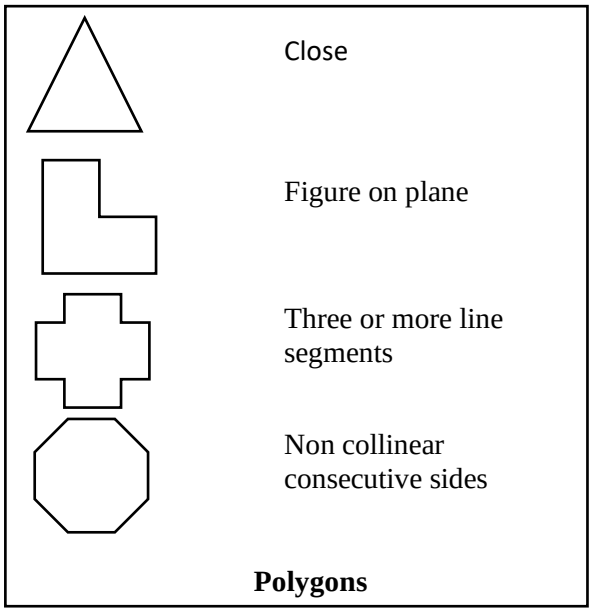
The Manila Metropolitan Theater (a.k.a. the MET), has long been a part of Manila's vibrant history. It had hosted the country's brilliant and colorful events and was graced by the presence of important people in Philippine entertainment, politics, and society. This place is one of the most well-known landmarks that can be found in the city that continually reminds the people of Manila's glamorous past.

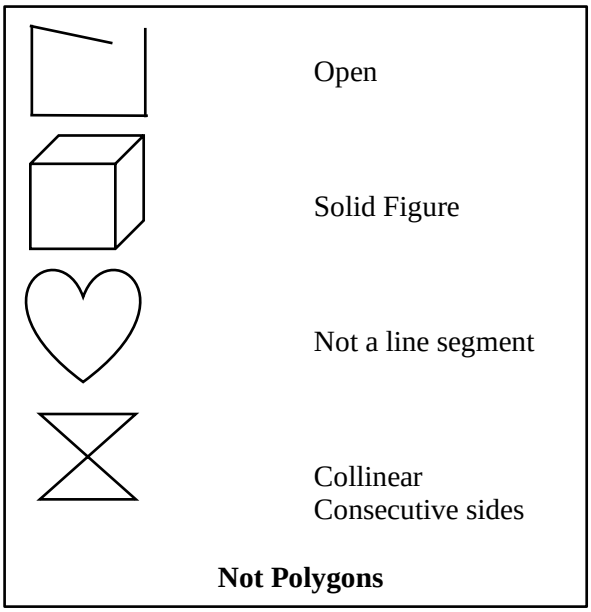
The Manila Metropolitan Theater or MET is an art deco building in Manila, designed by Filipino architect Juan M. Arellano. It was inaugurated on December 10, 1931. Like the rest of Manila, it was partially destroyed during World War II. A restoration was initiated three times in the past. Now, this fourth attempt to restore the theater was initiated by the National Historical Commission of the Philippines.

If you were part of the team behind the restoration, what shapes or polygons would you apply for your design?

In the ancient Greek language, the word ***polygon*** meant "many angles." Today, however, it is more common to think of the word as meaning "many sides."

A **polygon** is a plane figure that is formed by three or more segments called **sides of the polygon** and each endpoint where the sides meet is called the **vertex of the polygon**. Note that consecutive sides cannot be collinear and no more than two sides can meet at any one vertex.





A polygon is classified by the number of sides it has. The table at the right shows the names of a polygon. For polygons with 13 sides or more, you name the polygon by the number of sides and then add -gon. A polygon with 18 sides is called an 18-sided polygon or an 18-gon.

Number of sides	Type of Polygon
3	Triangle (tri = three)
4	Quadrilateral (quadri = four)
5	Pentagon (penta = five)
6	Hexagon (hexa = six)
7	Heptagon (hepta = seven)
8	Octagon (octa = eight)
9	Nonagon (nona = nine)
10	Decagon (deca = ten)
11	Undecagon (un + deca = eleven)
12	Dodecagon (duo + deca = twelve)
n	n-gon

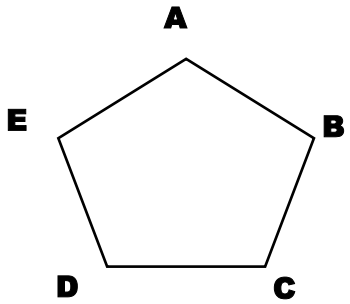
When the vertices of a polygon are identified by letters, you can name the polygon by listing its vertices consecutively.

A **diagonal** of a polygon is a segment that joins two non-consecutive vertices. Every segment that joins two vertices of a polygon must be either a side or a diagonal of the polygon.

To get the number of distinct diagonals in a given polygon, we use the formula: $d = \frac{n\,(n-3)}{2}$, where n is the number of vertices of a given polygon.

To get the number of diagonals in one vertex, we use the formula $d = n - 3$, where n is the number of vertices of a given polygon.

Example



Use the figure at the right.

a. Name the polygon.
b. How many diagonals can you form?
c. Identify its diagonals, angles, vertices, and sides
d. Identify a pair of each:
   - consecutive angles
   - consecutive vertices
   - consecutive sides.

Solutions:

a. Name the polygon : pentagon ABCDE

b. $d = \frac{n\,(n-3)}{2}$

$d = \frac{5\,(5-3)}{2}$

$d = \frac{5\,(2)}{2}$

$d = \frac{10}{2}$

$d = 5$

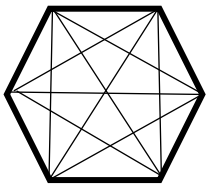
c. Diagonals: $\overline{AC}$, $\overline{BD}$, $\overline{CE}$, $\overline{DA}$, $\overline{EB}$
Angles: ∠A, ∠B, ∠C, ∠D, ∠E
Vertices: A, B, C, D, and E
Sides: $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, $\overline{DE}$, and $\overline{EA}$

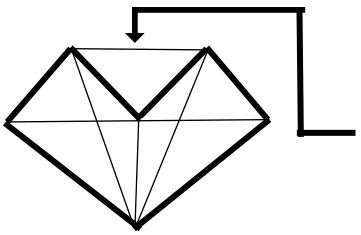
d. consecutive angles:
∠A and ∠B, ∠B and ∠C, ∠C and ∠D
∠D and ∠E, ∠E and ∠A

consecutive vertices:
A and B, B and C, C and D, D and E, E and A

consecutive sides:
$\overline{AB}$ and $\overline{BC}$, $\overline{BC}$ and $\overline{CD}$, $\overline{CD}$ and $\overline{DE}$, DE and EA, EA and AB

Convex and Non-convex (concave) polygons



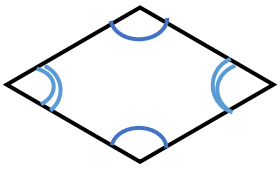


Diagonal outside the polygon

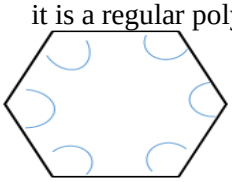
Polygons can also be classified as convex or non-convex (concave). The polygon shown at the left is an example of a convex polygon because no diagonal can be drawn outside the polygon. While the polygon shown at the right is a diagonal that can be drawn outside the polygon therefore it is a non-convex (concave) polygon.

A polygon is **equilateral** if all its sides are congruent. It is **equiangular** if all its interior angles are congruent. A polygon is **regular** if it is equilateral and equiangular.

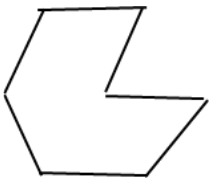
a. This quadrilateral is equilateral but not equiangular. Hence, it is not a regular polygon.



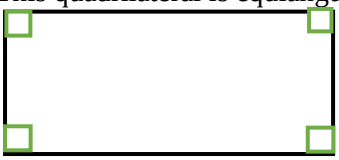
b. This hexagon is equilateral and equiangular. Hence, it is a regular polygon.



c. This heptagon is equilateral but not equiangular. Hence, it is not a regular polygon.



d. This quadrilateral is equiangular but not equilateral. Hence, it is not a regular polygon.



ACTIVITIES

Activity 1: POLYGON RIDDLES

Fill in the blanks with the correct answer to each riddle.

1. I am any figures with four sides and four angles. Who do you think I am?
   _____

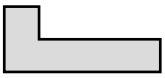
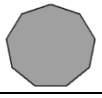
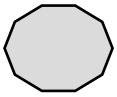
2. I am any closed shapes with straight sides. Who am I?
   _____

3. If you count my sides, You will find three. Who could I be?
   _____

4. I have six sides and the same number of angles. What shape am I?
   _____

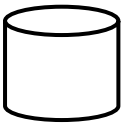
5. I am a polygon.
   I am a quadrangle.
   All my sides are the same length.
   None of my angles are right angles.
   What am I?
   _____

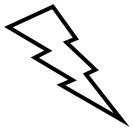
Activity 2: Fill in the missing spaces.

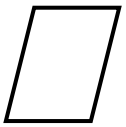
# of sides	Name	REGULAR	IRREGULAR
3			
4	Quadrilateral		
5			
6	Hexagon		
7			
8			
9			
10			

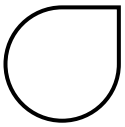
Activity 3:

A. Write if the given figure is polygon or not a polygon.

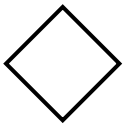
1.  _____

2.  _____

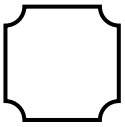
3.  _____

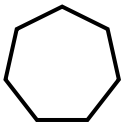
4.  _____

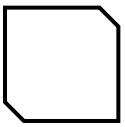
5.  _____

6.  _____

7.  _____

8.  _____

9.  _____

10.  _____

B. Use the figure at the right to answer the following.

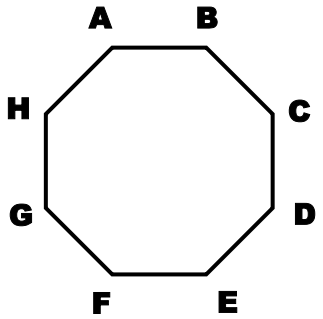
a. Name the polygon. _____

b. How many diagonals can be drawn from vertex E?

_____

c. Is the polygon convex or concave? _____

d. Is it a regular polygon? _____



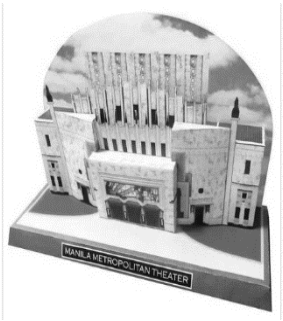
C. Determine the number of distinct diagonals and the number of diagonals that can be drawn from one vertex by the following polygon.

1] decagon	no. of diagonals = ___	no. of diagonals from one vertex = __
2] 17-gon	no. of diagonals = ___	no. of diagonals from one vertex = __
3] 22-gon	no. of diagonals = ___	no. of diagonals from one vertex = __
4] 35-gon	no. of diagonals = ___	no. of diagonals from one vertex = __
5] 50-gon	no. of diagonals = ___	no. of diagonals from one vertex = __

REMEMBER

- A **polygon** is a plane figure that is formed by three or more segments called sides of the polygon and each endpoint where the sides meet is called the vertex of the polygon. Note that consecutive sides cannot be collinear and no more than two sides can meet at any one vertex.
- Polygons can also be classified as convex or non-convex (concave).
- A **diagonal** of a polygon is a segment that joins two non-consecutive vertices. Every segment that joins two vertices of a polygon must be either a side or a diagonal of the polygon.
  - To get the number of distinct diagonals in a given polygon, we use the formula: $d = \frac{n\,(n-3)}{2}$, where n is the number of vertices of a given polygon.
  - To get the number of diagonals in one vertex, we use the formula $d = n - 3$, where n is the number of vertices of a given polygon.
- A polygon is **equilateral** if all its sides are congruent. It is **equiangular** if all its interior angles are congruent. A polygon is **regular** if it is equilateral and equiangular.

CHECKING YOUR UNDERSTANDING



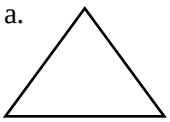
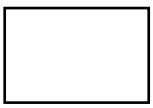
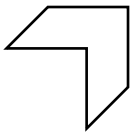
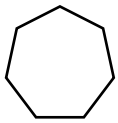
The team behind the restoration of the Metropolitan Theater encourages students to do their part in conserving one of the country's most important heritage sites. The team suggested five things and one of them is to create 3D paper art.

As a student, you can relive the glory of MET by identifying the different shapes of polygons and creating your own model figure. Have fun learning our heritage. See the link to download the pattern. Source: https://ncca.gov.ph/childrens-corner/ncca-paper-craft-series/

POST-TEST

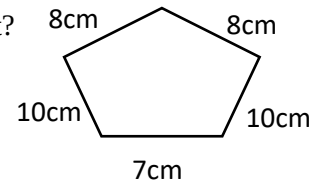
Directions: Read the questions carefully. Encircle the letter of the correct answer. If the answer is not found in the choices, write "E".

1. Which polygon is not convex?

a. 
b. 
c. 
d. 

2. Complete the statement: 'An irregular polygon is _____.'
   a. a polygon with different sides and different angles
   b. a polygon with congruent vertex
   c. a polygon with congruent sides and congruent angles
   d. not a polygon

3. What do you call the polygon given at the right?



   a. Pentagon Regular
   b. Hexagon Regular
   c. Pentagon Irregular
   d. Hexagon Irregular

4. How many sides does an Octagon have?
   a. 4 b. 3 c. 9 d. 8

5. Why is a triangle called an acute triangle?
   a. It has three acute angles.
   b. It has two acute angles.
   c. It has one acute angle.
   d. It has zero acute angles.

6. A polygon's sides must be what?
   a. straight b. even numbered
   c. odd numbered d. long

7. What does the term "non-convex polygon" mean?
   a. All of the vertices are pointed out.
   b. One or more of the vertices are pointed in.
   c. It is not real polygon.
   d. There are three vertices.

8. A closed plane figure formed by three or more line segments called sides. Each intersects exactly two sides, one at each vertex, so that no two sides with a common vertex are collinear. What polygon is this?

a. polygon b. area c. n – gon d. triangle

9. Each is true about a polygon except:

a. It is made of 3 or more line segments.
b. It is a closed figure.
c. The sides can be round.
d. The segments only intersect at endpoints.

10. What do you call a parallelogram with all sides of equal length?

a. triangle b. trapezoid c. rhombus d. pentagon

11. What do you call a polygon that is both equilateral and equiangular?

a. irregular polygon b. segment
c. regular polygon d. vertices

12. Which has 4 sides and exactly 1 pair of opposite sides parallel?

a. pentagon b. parallelogram c. trapezoid d. square

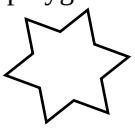
13. Complete the statement: 'In a convex polygon, the _____ do not go outside the figure."

a. diagonals b. angles c. areas d. sides

14. What is a vertex?

a. The point where two waves meet.
b. The point where two lines meet
c. The point where two sides meet
d. The point where two segments meet

15. Tell whether the figure below is a polygon. If it is a polygon, name it by the number of sides.



a. not a polygon b. polygon – dodecagon
c. polygon –decagon d. polygon – 14-gon

E-SITES

To further explore the concept learned today and if it is possible to connect to the internet, you may visit the following links:
https://www.khanacademy.org/math/geometry/hs-geo-foundations
https://www.youtube.com/watch?v=E_-3ulbtcLk&feature=share
https://www.khanacademy.org/math/basic-geo/basic-geometry-shapes/v/recognizing-shapes

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https://quizizz.com/admin/quiz/5e7bf298f5b53f001bdff176d/polygons

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