

Polygon: Ponder the Polygon

Brief Overview:

***Ponder the Polygon* allows students to identify and classify polygons. Using hands-on manipulatives, the students will be able to correctly identify regular and irregular polygons, as well as identify the number of sides and angles for each. Students have had exposure to solid figures, lines and line segments, and angles.**

NCTM Content Standard/National Science Education Standard:

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

Grades 3-5 Expectations: Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes.

Grade/Level:

Second/third grades

Duration/Length:

Three 60-minute lessons

Student Outcomes:

- **Students will identify and describe polygons by the number of sides and angles: triangles, quadrilaterals, pentagons, hexagons, octagons.**

Materials and Resources:

- **Development/Procedures: Pattern blocks: triangle, hexagon, square, trapezoid, rhombus (blue), rhombus (tan) – overhead if possible**
- **Copy of Teacher Resource 1 *Polygon Checklist***
- **Definition of polygon**
- **Wipe boards**
- **Markers**
- **Erasers**
- **Copies of Teacher Resource 2 *Polygons Chart***
- **Teacher Resource 3 *Identifying Polygons* (Transparency)**
- **Copies of Student Resource 1 *Assessment Day 1***
- **Teacher Resource 4 *Sample Assessment Response Day 1 and 2***
- **Blank paper for *Polygon Playground***

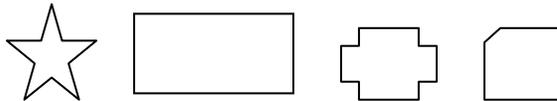
Lesson 1

Pre-Assessment/Launch-

- **Place a pattern block on the overhead.**
- **Ask: *What is the name of this shape?***
- **Students will use the wipe boards to respond to the teacher's question.**
- **Ask for a student to share his/her response.**
- **Place another pattern block on the overhead.**
- **Follow the same procedures, using the wipe board, while responding to the teacher's question.**
- **This process will be repeated for each pattern block (triangle, hexagon, square, trapezoid, rhombus (blue), and rhombus (tan)).**
- **Use Teacher Resource1, *Checklist*, to record student identification of shapes.**

Teacher Facilitation –

- **Ask: *Does anyone know what we can call all of the shapes on the overhead?* Listen to a few student responses.**
- **Tell the students that all of the shapes on the overhead are polygons.**
- **Read objective: *Today we will identify and classify polygons.***
- **Refer back to the polygons on the overhead.**
- **Draw unusual polygons underneath the polygons on the overhead.**



- **Ask students: How are the shapes similar. (Possible student responses could be they are closed and they all have straight lines.)**
- **Ask students: What attributes does a shape need to be classified as a polygon. Teacher will elicit student responses.**
- **Explain the definition of a polygon. (*Polygons are closed figures made up of straight-line segments.*)**
- **Tell students to think back to previous lessons to review parallel lines and right angles and/or square corners. Ask: *Explain why the lines on the rectangle are parallel.***
- **Draw a shape that is not a polygon.**
- **Ask: *Is this shape a polygon? Why or why not?* (Possible student response is that it does not have straight-line segments and it is open.)**

- **Distribute wipe boards, markers, and erasers to each student.**
- **Have students draw a shape that is not an example of a polygon.**
- **Circulate around the room while students are responding on the wipe boards.**
- **Ask: *How can you change your drawings to make the shapes into polygons?* (Possible student response is that the polygon needs to be closed and have straight-line segments.)**
- **Instruct the students to switch markers with a classmate. Using a different color, redraw the shape to make it into a polygon.**

Student Application –

- **Distribute copies of Teacher Resource 2 *Polygon Chart*. The teacher can decide to have the students work in partners or small groups.**
- **Ask the students to silently reread the definition of a polygon.**
- **Instruct the students to use what they know about polygons to classify the shapes on the correct side of the chart. Once the group has classified all the shapes, have one student tape it to the front board.**
- **Ask: *Are the shapes categorized correctly? How do we know? Do we need to change any of our responses?***
- **Distribute copies of Student Resource 1 *Assessment Day 1*. This assessment will determine possible reteaching/extension groups for Day 2 lesson.**

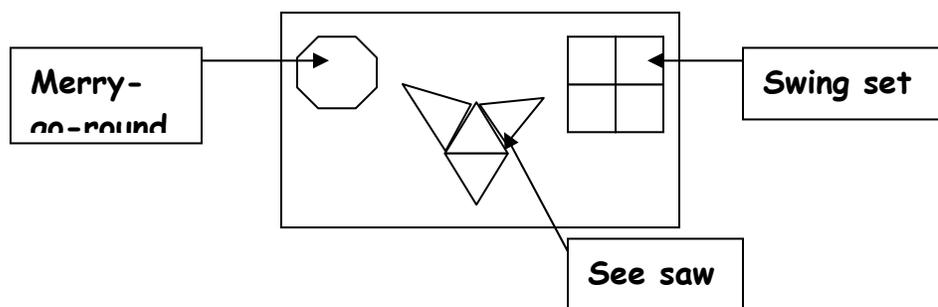
Embedded Assessment –

- **Assessment Day 1 is a BCR. In Part A the students need to correctly identify the name of the polygon. In Part B, the students need to explain why the hexagon is a polygon. The sample response for this BCR is located on Teacher Resource 4 Day 1.**

Reteaching/Extension –

- **Reteaching – Students who cannot identify polygons will work in small groups to receive further instruction.**
- **Write on the board the following questions: *Is the figure a closed shape? Is the figure made up of only straight-line segments?***
- **Remind the students that they need to answer yes to both questions for the figure to be a polygon.**
- **Teacher will hold up a pattern block. Students will use the designated questions to determine if the figure is a polygon.**

- Teacher will continue this process using other polygons and non - polygons. The teacher has the option of creating a chart if the group is composed of visual learners.
- Extension – Students who can identify polygons will continue to practice the skill.
- Students will create a *Polygon Playground*. In order to create the playground, students must use at least 2 of each pattern block (hexagon, square, triangle, blue rhombus, tan rhombus, and trapezoid).
- Once the students have designed their playground, they need to trace it on to blank paper and then label their equipment. (See below.)
- The students will find a partner and explain their playgrounds to each other. The explanations should include the names of the polygons used.
- Sample playground is shown below.



Lesson 2

Materials and Resources:

- *The Greedy Triangle* by Marilyn Burns
- Overhead geoboard
- Geoboards
- Student Resource 3 *Assessment Day 2*
- Teacher Resource 4 *Sample Assessment Response Day 1 and 2*
- Wipe boards
- Markers
- Erasers
- Polygon Books (per student) crayons, 2 pieces of construction paper for covers, 5 pieces of plain paper for book pages, hole punch, paper fasteners
- Magazines
- Glue
- Scissors
- Geodot Paper
- Pattern Blocks

Pre-Assessment/Launch –

- Call the students to the rug.
- Read *The Greedy Triangle* by Marilyn Burns.
- Ask: *What polygons were in the story?* As the students respond, have them reference the text where polygons were mentioned. Samples of polygons include square, quadrilateral, rhombus, pentagon, etc.
- Ask a student to remind the class about the definition of a polygon.
- Instruct the students to go on a scavenger hunt around the room. During their hunt, they need to locate an example of a polygon. Be sure students choose two-dimensional examples and not space figures.
- Encourage students to share their findings.

Teacher Facilitation –

- Display a geoboard with the following shape. 
- Ask students to respond on wipe boards to the following questions:
 1. *Is it a polygon? (Yes)*
 2. *How many sides are there in the polygon? (5)*
 3. *How many angles? (5)*
- Distribute Geoboards to the students.
- Ask students to make a polygon with three sides.
- Ask students: *How many angles are there? (3)*
- Ask students to make a polygon with four sides.
- Ask students: *How many angles are there? (4)*
- Ask students: *Does anyone notice any connections between the number of sides and the number of angles?*
- Ask students to make a polygon with 5 angles. Ask: *How many sides would the polygon have?* Do two or three more examples alternating between giving the students the number of sides or angles.
- Ask students: *Do any of the polygons have parallel lines or right angles/square corners?*
- Ask students to make a polygon with two sides.
- Ask students: *Is this possible?* During this process make informal observations about the students who know that polygons are closed figures.
- Ask a student to explain why it is not possible to make a two-sided polygon. Possible student response – *This is not possible because a third side is needed to make a closed figure.*

Student Application –

- **Assign each student a partner. One partner will be A and the other will be B.**
- **Partner A will use the geoboards to make a polygon.**
- **Partner B will use the wipe board to record the number of sides and angles.**
- **The partners will each take five turns using the geoboards and the wipe boards.**
- **Instruct the students to give the geoboard to Partner A.**
- **Instruct Partner A to make a triangle on the geoboard and pass it to his or her partner.**
- **Instruct Partner B to identify the new polygon when two more sides are added.**
- **Continue with additional examples.**
- **Circulate and determine who will need reteaching for this skill and who will be able to extend his/her learning.**
- **Distribute copies of Student Resource 3 Assessment Day 2. This assessment will determine possible reteaching/extension groups for Day 3 lesson.**

Embedded Assessment –

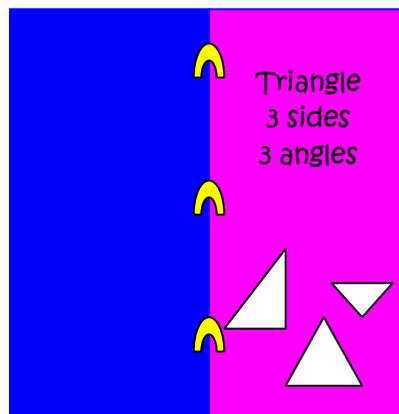
- **Assessment Day 2 is a Selected Response. The students need to read the question. Using the information about polygons, the number of sides and angles, they need to determine how many angles are on a ten-sided polygon? The answer for the Selected Response is located on Teacher Resource 4 Day 2.**

Reteaching/Extension –

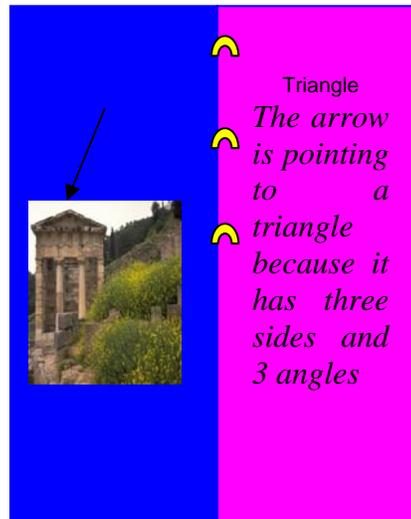
- **Reteaching – Students who cannot determine the number of sides and angles for a polygon will receive small group instruction.**
- **Remind students that a polygon is named by the number of sides it has. The number of sides on a polygon will also determine the number of angles.**
- **Below is an example of a chart that can be created on the board/overhead for the group.**

Polygon	Number of Sides	Number of Angles
Triangle		
Quadrilateral		
Pentagon		
Hexagon		
Octagon		

- Using the Geoboards, make a triangle.
- Ask: *How many sides does a triangle have?*
- Ask: *If the triangle has three sides, then how many angles will it have? (3) How do you know? (The number of sides equals the number of angles.)*
- Ask: *What polygon has four sides? (Rhombus, parallelogram, square, trapezoid, rectangle)*
- Ask: *What polygon has 6 sides and 6 angles? (Hexagon)*
- Continue using these types of questions for pentagons and octagons.
- Extension – Students who can determine the number of sides and angles for a polygon will continue to practice this skill by making a *Polygon Book*.
- The students will need the following materials in order to construct their *Polygon Book*: crayons, 2 pieces of construction paper for the covers, 5 plain pieces of paper for the book pages, hole punch, paper fasteners.
- The cover of the *Polygon Book* should be titled: _____'s *Polygon Book*.
- Each page in the *Polygon Book* should have the name of a polygon, the number of sides and angles, and two or three examples of that type of polygon.



- Additional/Challenge Extension of *Polygon Book*
- Each page in the *Polygon Book* should have the name of a polygon. Using magazines, students need to cut and paste three real-life examples for each polygon. Students should also explain why those pictures are an example of the polygon.



Lesson 3

Materials and Resources:

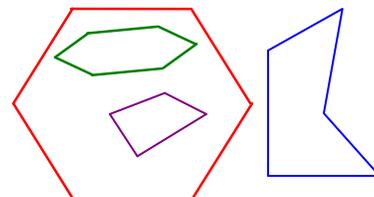
- Pencils
- Copy of Teacher Resource 5 *Polygon Check*
- Overhead pattern blocks
- All Pupil Response Yes and No cards (optional)
- Overhead markers
- Riddle Clues on overhead
- Copies of Student Resource 4 *Sign Sorts*
- Copy of Teacher Resource 6 *Sign Sort Answer Key*
- Copies of Student Resource 5 *Summative Assessment*
- Copy of Teacher Resource 7 *Summative Assessment Answer Key*
- Extension materials (per group)- Pattern Blocks, real life examples of polygons, hula-hoops for Circle, copy Teacher Resource 9-*Circle Cards*
- Reteach materials - toothpicks

Pre-Assessment/Launch –

- Place a trapezoid on the overhead.
- Record the number of sides and angles.
- Distribute the yes/ no cards.

- **Ask:** *Are these the correct number of sides and angles for this polygon?* Students will show either yes or no.
- **Ask:** *How do you know the number of sides and angles are correct for the polygon? (Number of sides equals the number of angles.)*
- While the students are responding yes or no, use Teacher Resource 5, *Polygon Check*, to record students' ability to correctly identify the number of sides and angles for each polygon.

Teacher Facilitation –



- **Draw this picture on the overhead.**
Large hexagon-red

Small hexagon-green

Trapezoid- purple

Pentagon-blue

- **Distribute Teacher Resource 8- *Polygon Pinch Card*.**
- **Using the pinch cards, students will respond to the riddles.**
- **Read the riddles to the students. Answer each riddle with the name of a polygon shown on the overhead.**

Riddle Clues:

I am outside the red polygon. What am I? (Pentagon)

I am inside the red polygon, but I am not a hexagon

What am I? (Trapezoid)

I have 2 fewer sides than the red polygon.

What am I? (Square)

Student Application –

- The teacher has several options for this part of the lesson. Student Resource 4 *Sign Sorts* can be completed as a matching exercise, a cut

and paste, or technology project. Student Resource 4 *Sign Sort* can be reproduced in *Kidspiration*. Answers can be found on Teacher Resource 6.

- Using information learned from Day 1 and 2 lessons, the students need to match the street sign to the polygon's definition.
- After completing *Sign Sorts*, arrange the students into groups of four.
- Using one geoboard per group, the first group member will create a line segment and pass the geoboard to the next person in the group.
- The students will continue to pass the geoboard until the polygon is made.
- Once the group agrees that the polygon is complete, students will correctly identify the name of the polygon, the number of sides and angles it has, and identify parallel lines.
- Distribute and administer the Summative Assessment, Student Resource 5.

Embedded Assessment –

- Use informal observations to determine who accurately matched the street sign with its correct definition.

Reteaching/Extension –

- Reteach - If the students are continuing to demonstrate difficulty with polygons, continue to use the reteach strategies from Day 1 and 2.
- If the students are not successful on the summative assessment, the following reteach strategy can be used:
Have the students use toothpicks to create polygons. Working as a group, identify the number of sides and angles each polygon has.

Extension – Students will be placed in groups of 3 or 4. One student will be assigned as the group facilitator. The facilitator will make two circles from hula-hoops on the floor. The teacher will distribute circle cards to the facilitator. The Circle cards will allow the facilitator to tell the group “Yes” or “No” as they place the polygons on the circles. The group will continue with the extension activity until all polygons are sorted. Once all polygons are in the circles, students must then discuss the placement of the objects. The facilitator can then share the circle card with the group.

Summative Assessment:

The summative assessment will allow students to demonstrate their understanding of polygons. This includes correctly identifying the name of the polygon, the number of sides, and the number of angles. The first question is a

Selected Response. The students are asked to identify the name of the polygon that has five sides and five angles. The second question is also a Selected Response. The students have to look at the polygon and determine its number of sides. The third question is a Brief Constructed Response. In Part A, the students need to identify the polygon using the clues from the riddle. In Part B, the students need to explain why their shape is a polygon. They may use words or pictures in their explanations. The answers to the Summative Assessment are located on Teacher Resource 7.

Authors:

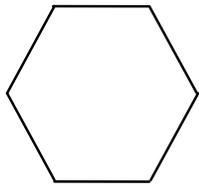
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Student Resource 1
Assessment Day 1

Name _____ Date _____

A. Name this polygon.



B. Use what you know about geometry and attributes of polygons to explain why this is a polygon. Use words and/or pictures in your explanation.

**Student Resource 2
Geodot Paper**

Name _____ **Date** _____

• •	• •	• •
• •	• •	• •
• •	• •	• •
• •	• •	• •

Student Resource 3
Sample Assessment Day 2

Name _____ Date _____

Polygons are named by the number of sides they have. A decagon is a polygon with ten sides. How many angles will the polygon have?

- A. 12 angles**
 - B. 8 angles**
 - C. 10 angles**
 - D. 9 angles**
-

Student Resource 3
Sample Assessment Day 2

Name _____ Date _____

Polygons are named by the number of sides they have. A decagon is a polygon with ten sides. How many angles will the polygon have?

- A. 12 angles**
- B. 8 angles**
- C. 10 angles**
- D. 9 angles**

Student Resource 4

Sign Sorts

Name _____ Date _____

Match the definitions to the street signs.



Triangle
3 sides
3 angles



Pentagon
5 sides
5 angles



Octagon
8 sides
8 angles



Square
4 sides
4 angles

Student Resource 5
Summative Assessment p1

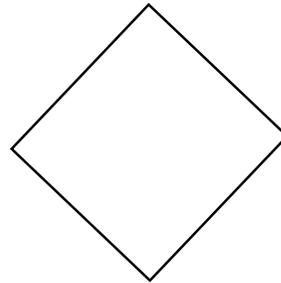
Name _____ Date _____

1. Identify the Polygon that has 5 sides and 5 angles.

- A. Square**
- B. Pentagon**
- C. Hexagon**
- D. Polygon**

2. How many sides does this polygon have?

- A. 4**
- B. 3**
- C. 7**
- D. 10**



Student Resource 5
Summative Assessment p2

I am a polygon with 6 sides.
I have 3 sets of parallel lines.
I have no right angles.

Part A:
Identify the polygon. _____

Part B:
Use what you know about polygons to explain why you know your answer is correct. Use words and/or pictures in your explanation.

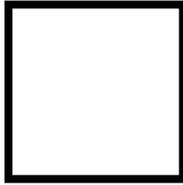
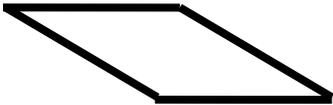
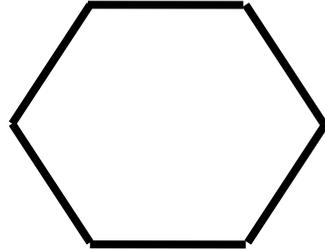
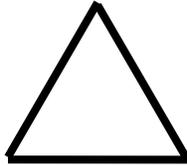
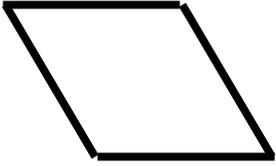
Teacher Resource 2
Polygons Chart

Polygons

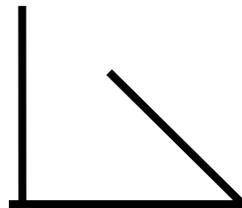
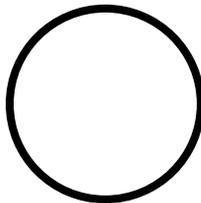
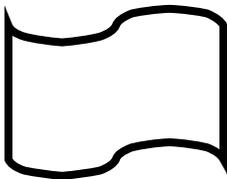
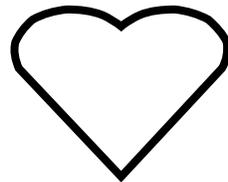
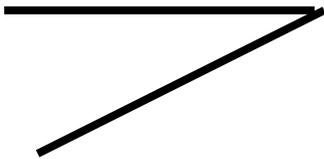
Not Polygons

Teacher Resource 3
Identifying Polygons

Polygons



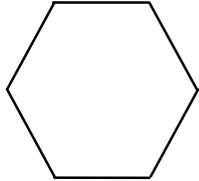
Not Polygons



Day 1

Name _____ Date _____

A. Name this polygon.



_____ Hexagon _____

B. Use what you know about geometry and attributes of polygons to explain why this is a polygon. Use words and/ or pictures in your explanation.

I know a hexagon is a polygon because it has straight-line segments and the shape is closed.

Day 2

Polygons are named by the number of sides they have. A decagon is a polygon with ten sides. How many angles will the polygon have?

- A. 12 angles
- B. 8 angles
- C. 10 angles
- D. 9 angles

Teacher Resource 6
Sign Sorts- Answer Key

Name _____ Date _____

Match the definitions to the street signs.

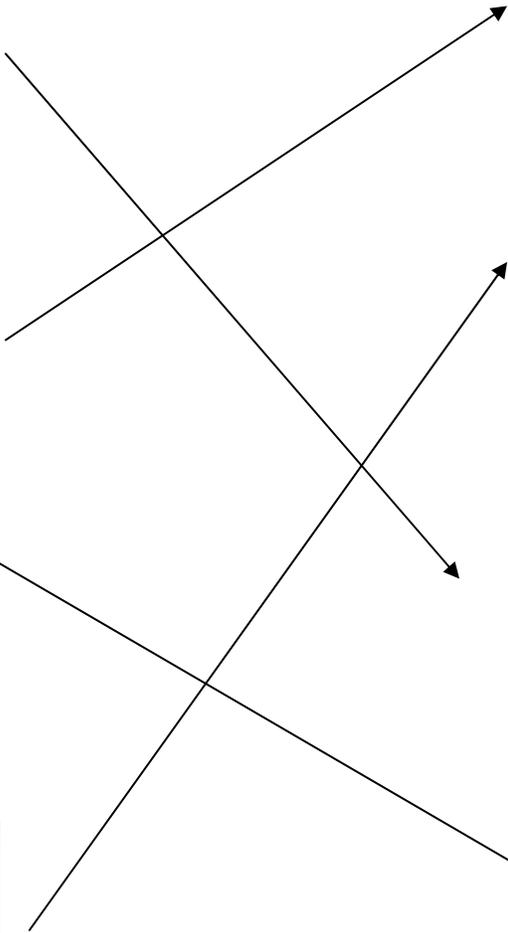


Triangle
3 sides
3 angles

Pentagon
5 sides
5 angles

Octagon
8 sides
8 angles

Square
4 sides
4 angles

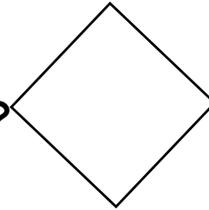


Teacher Resource 7
Summative Assessment

1. Name the shape that has 5 sides and 5 angles.

- A. Square
- B. Pentagon
- C. Hexagon
- D. Polygon

2. How many sides does this polygon have?



- E. 4
- F. 3
- G. 7
- H. 10

I am a polygon with 6 sides.
I have 3 sets of parallel lines.
I have no right angles.

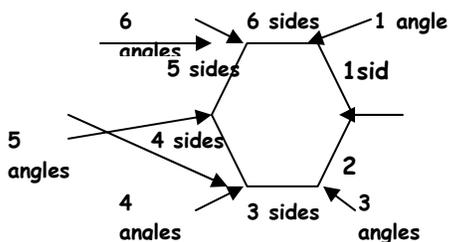
Part A:

Identify the polygon. Hexagon

Part B:

Use what you know about polygons to explain why you know your answer is correct. Use words and/or pictures in your explanation.

I know that the polygon is a hexagon because it 6 sides and 6 angles.



Directions: Distribute this paper cut and folded to the students. As the riddle is said, students will pinch their answers. Then the students will hold up their pinch cards so the teacher can see their response.

**Teacher Resource 8
Polygon Pinch Card**

Hexagon	Hexagon
Square	Square
Pentagon	Pentagon
Rhombus	Rhombus
Trapezoid	Trapezoid

Fold Here 

