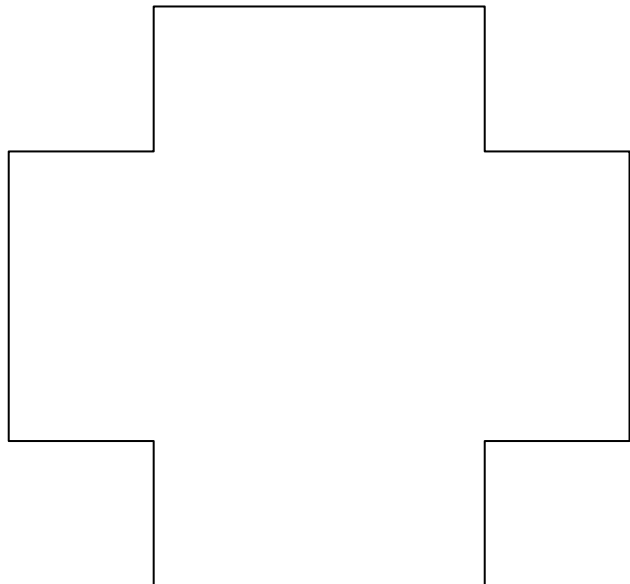
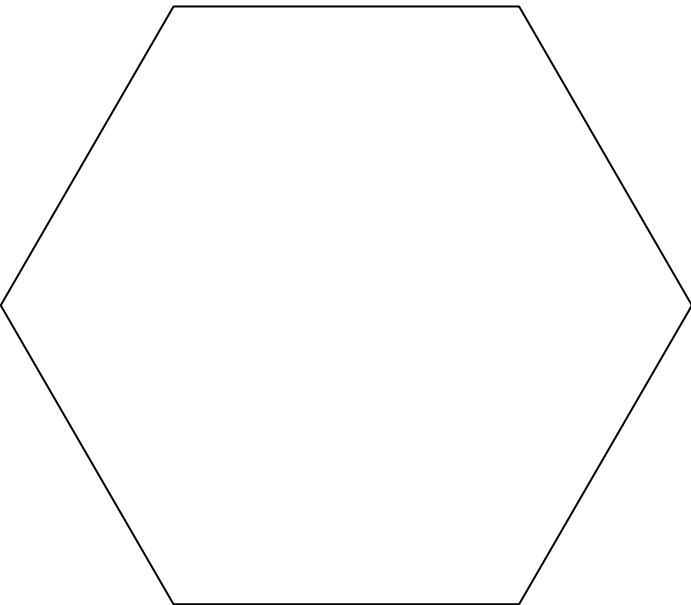
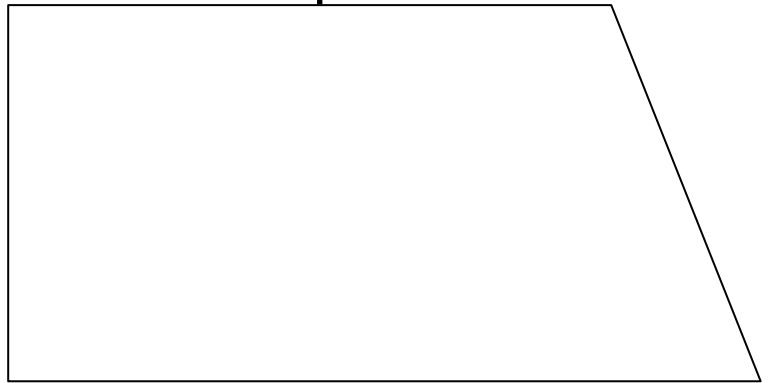
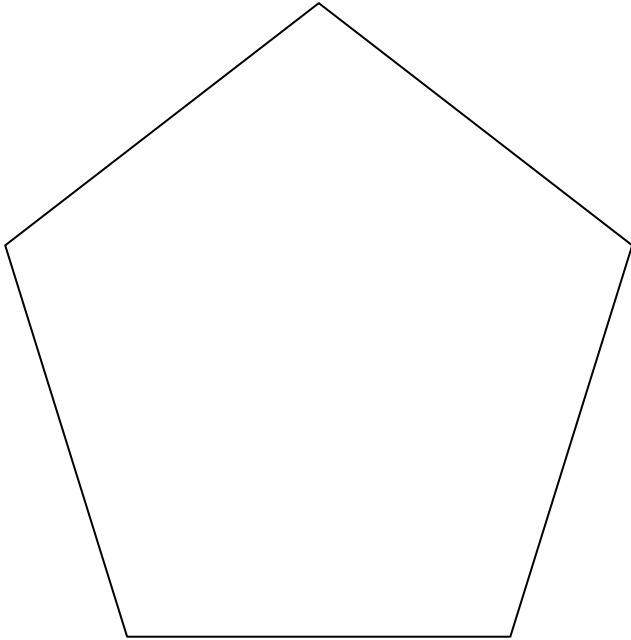
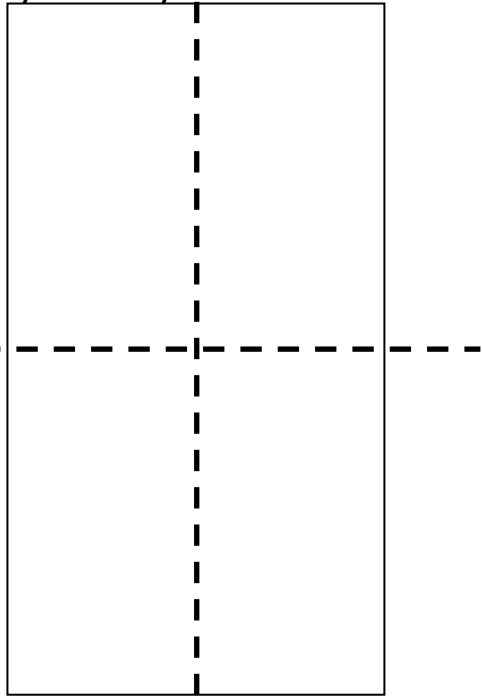
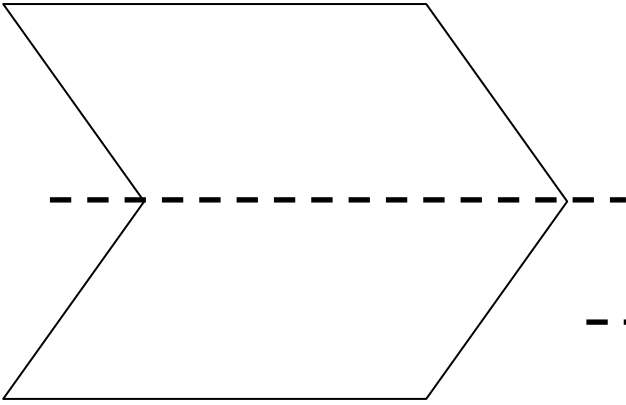
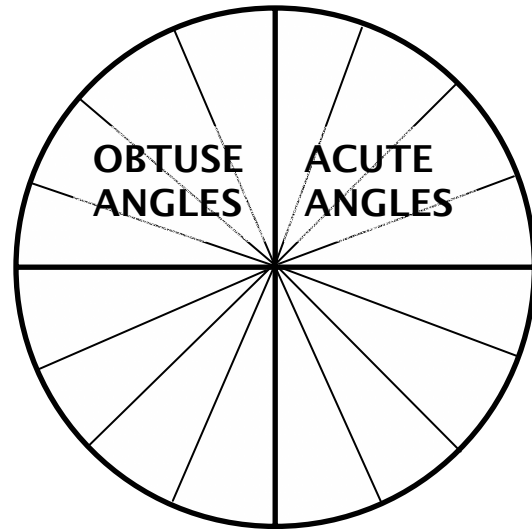
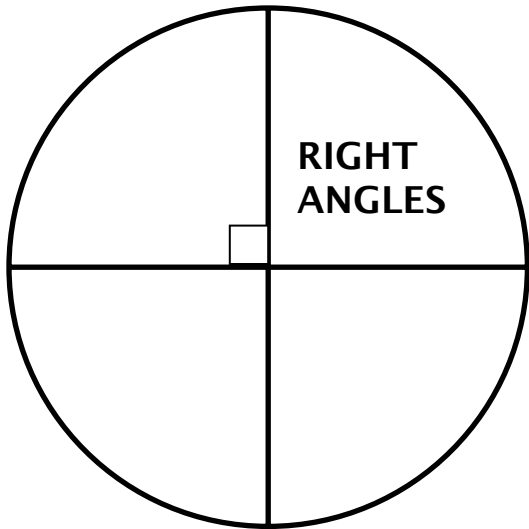
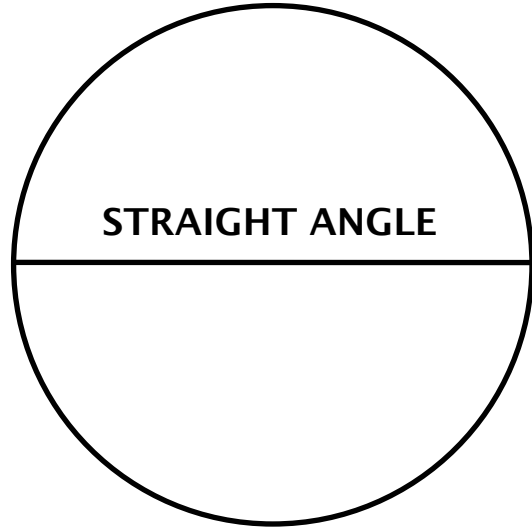
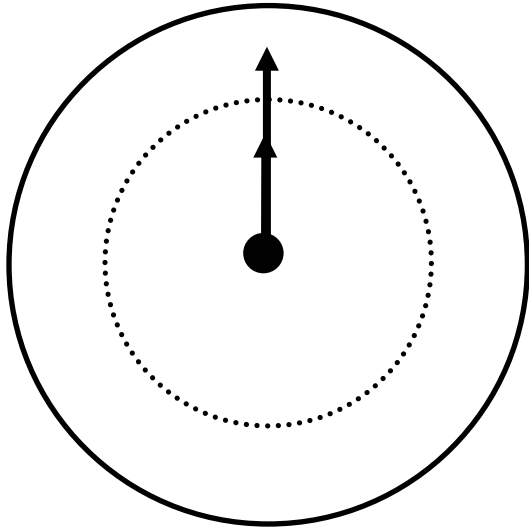


Polygons A-F
An Introduction to Symmetry



Classifying Angles

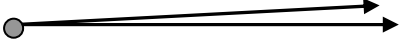
Review

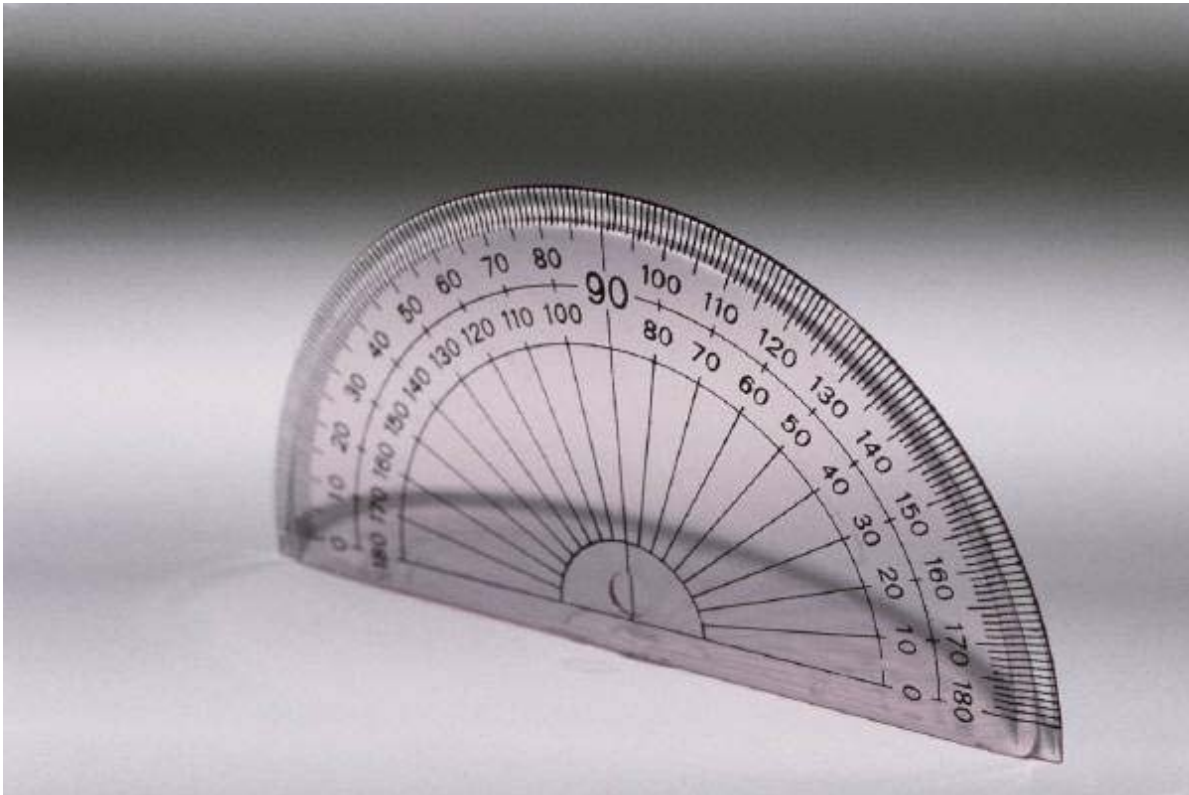


In a previous lesson, unit angles known as “**wedges**” were used to measure angles. Another unit angle known as the “**degree**” can also be used.

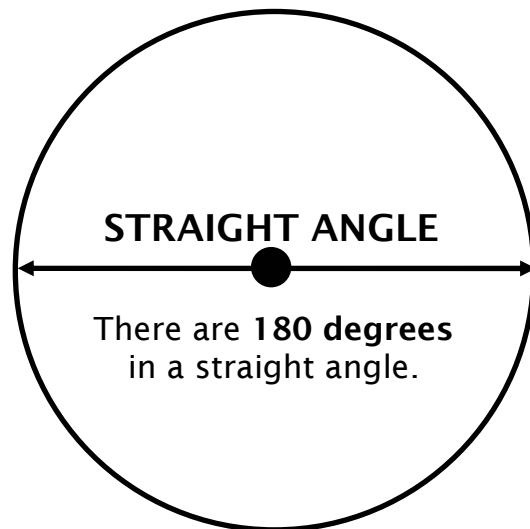
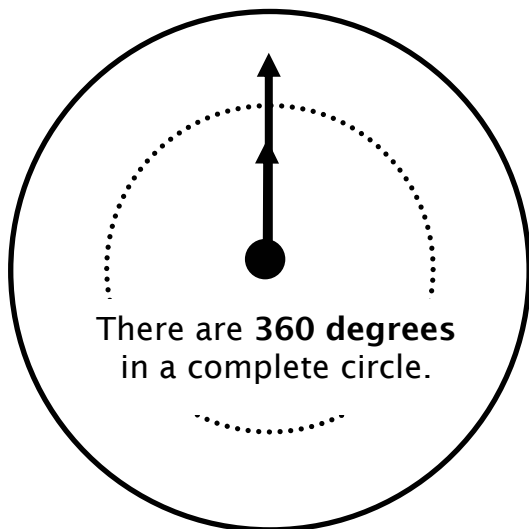
Classifying Angles

Using Degrees

A “**degree**” is a very small unit angle. There are 360 of these small unit angles in a complete circle. 

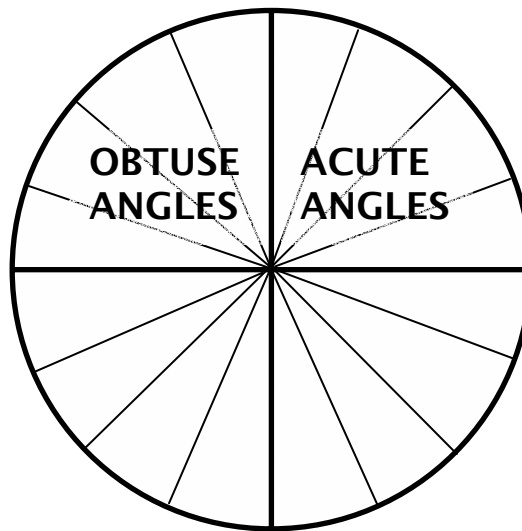
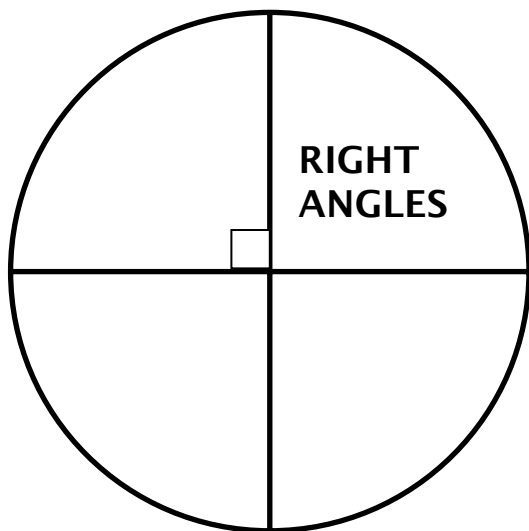


A **protractor** is a tool that mathematicians use to measure the **degrees** in an angle. Many protractors are in the form of a semi-circle, like the one shown above.



Classifying Angles Using Degrees

If there are 360 degrees (360°) in a complete **circle**,
and 180 degrees (180°) in a **straight angle**,
how many degrees are in a **right angle**? _____



The **right angle (90°)** is a reference point for **acute** and **obtuse** angles. Use what you know about acute and obtuse angles to complete the chart below.

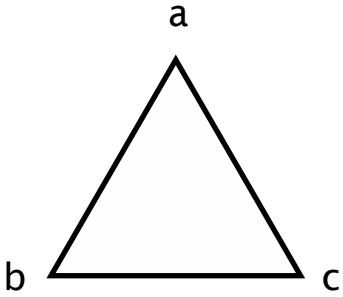
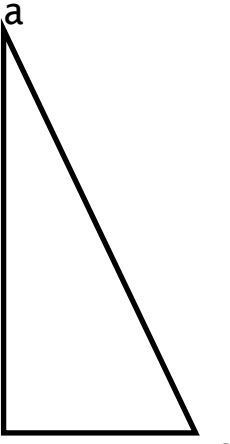
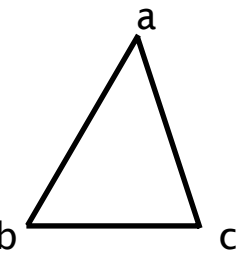
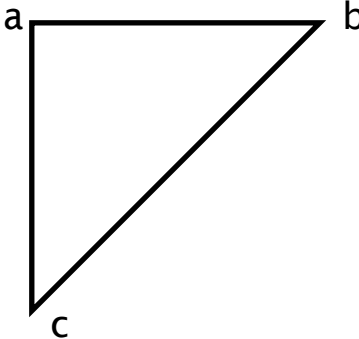
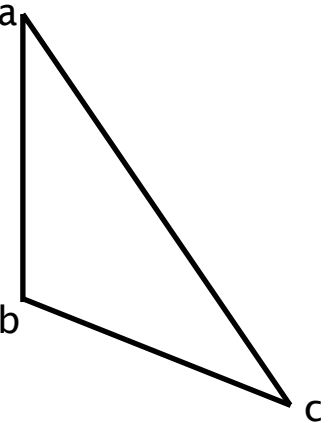
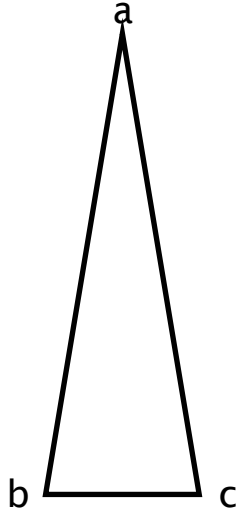
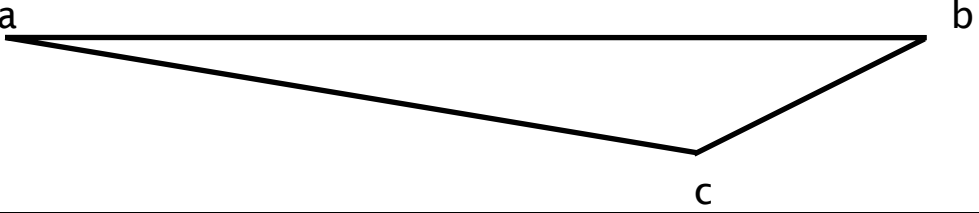
Angle	Example	Degrees (Circle one)
Acute		Less than 90° Greater than 90°
Acute		Less than 90° Greater than 90°
Obtuse		Less than 90° Greater than 90°
Obtuse		Less than 90° Greater than 90°

The "Fun" Polygon

Use these seven triangles and the "Classification and Measurement Chart" as you complete the following steps.

Step 1: Classify each angle as "acute," "right," or "obtuse."

Step 2: Measure and record the length of each side.

1. 	2. 	3. 
4. 	5. 	6. 
7. 		

The “Fun” Polygon

Classification and Measurement Chart

Triangles	Angle Classifications			Side Measurements*		
Draw a similar version of each triangle below.	$\angle a$	$\angle b$	$\angle c$	\overline{ab}	\overline{bc}	\overline{ca}
1.						
2.						
3.						
4.						
5.						
6.						
7.						

*Label the units of measurement (inches, centimeter, etc.)

Answer Key

Classification and Measurement Chart

Triangles	Angle Classifications			Side Measurements*		
Draw a similar version of each triangle below.	$\angle a$	$\angle b$	$\angle c$	\overline{ab}	\overline{bc}	\overline{ca}
1.	Acute	Acute	Acute	3.4 cm	3.4 cm	3.4 cm
ACUTE			EQUILATERAL			
2.	Acute	Right	Acute	5.3 cm	2.5 cm	5.9 cm
RIGHT			SCALENE			
3.	Acute	Acute	Acute	2.9 cm	2.3 cm	2.7 cm
ACUTE			SCALENE			
4.	Right	Acute	Acute	3.9 cm	5.5 cm	3.9 cm
RIGHT			ISOSCELES			
5.	Acute	Obtuse	Acute	3.8 cm	3.8 cm	6.3 cm
OBTUSE			ISOSCELES			
6.	Acute	Acute	Acute	6.2 cm	3.8 cm	6.2 cm
ACUTE			ISOSCELES			
7.	Acute	Acute	Obtuse	12.2 cm	3.4 cm	9.3 cm
OBTUSE			SCALENE			

Trying Triangles

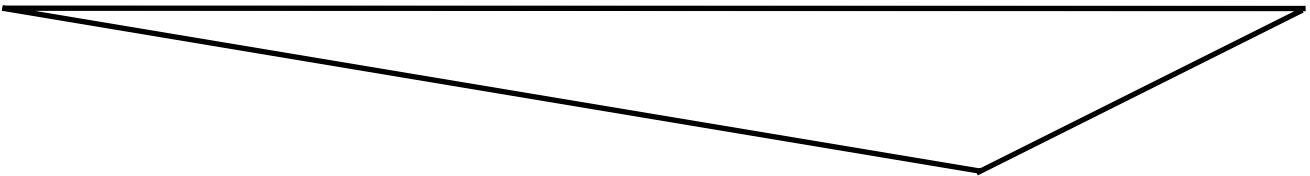
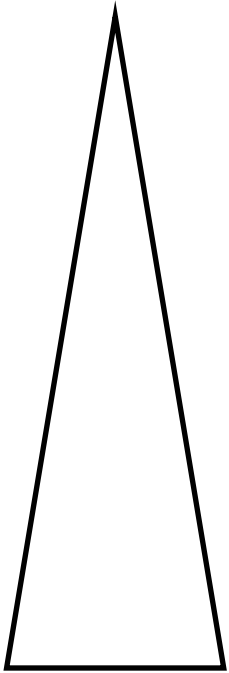
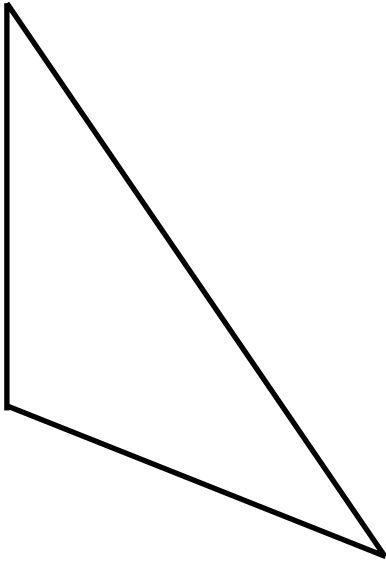
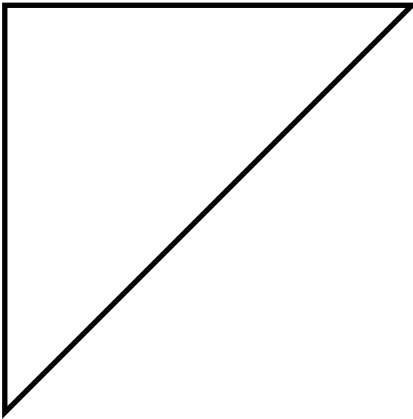
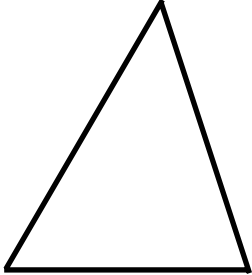
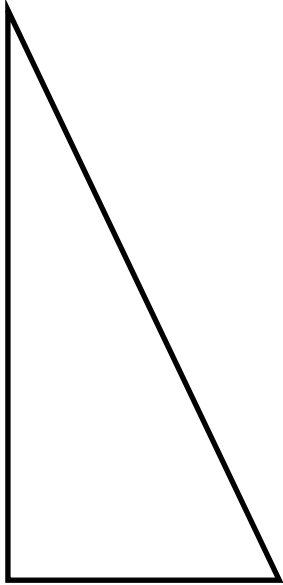
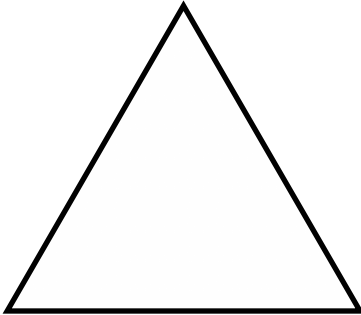
Directions:

Try your hand at building triangles! Using toothpicks, pipe cleaners, pencils, or other line segments of your choice, identify which of the following triangles can be constructed.

Is it possible to construct a triangle with...

Criteria	YES <input checked="" type="checkbox"/>	NO <input type="checkbox"/>	Evidence Similar drawings
One acute angle?			
Two acute angles?			
Three acute angles?			
One right angle?			
Two right angles?			
Three right angles?			
One obtuse angle?			
Two obtuse angles?			
Three obtuse angles?			

**The “Fun” Polygon
Manipulatives**

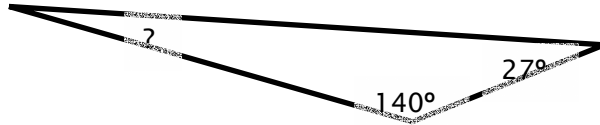
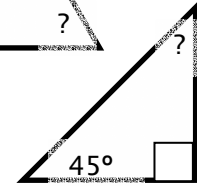
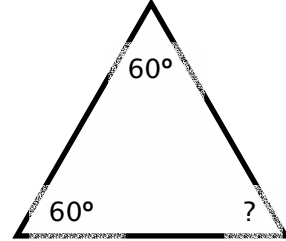
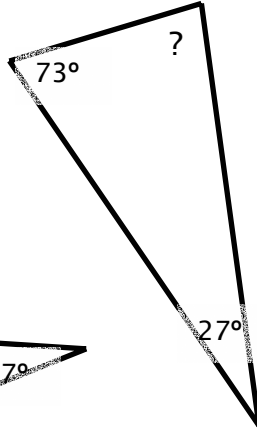
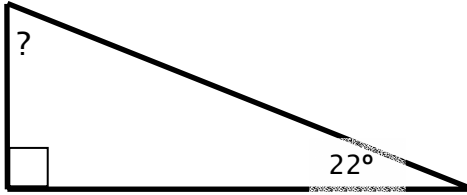


Copy polygons onto cardstock paper for sturdier manipulative pieces.

Tricky Triangles

Directions:

Find the measures of the missing angles *without* using a protractor.



Use the following problem-solving steps to guide your work:

- **Understand the Problem**
- **Decide on a Plan**
- **Carry out the Plan**
- **Look Back and Review**

Step 1: Restate the problem in your own words: _____

List any questions you have at this time: _____

Jot down any hypotheses you have at this point: _____

Share your questions and hypotheses with others.

Step 2: List the first steps you plan to take in order to solve the problem:

Share your steps and plan with others.

Step 3: Carry out the Plan

Step 4: Look Back and Review

NOTE: Steps 3 and 4 may occur several times before you find a solution. If new questions arise as you follow the plan, look back and review what you have learned. Do you need to adjust your plan in order to answer the new questions? If yes, then do so. Then, continue with your new plan. Remember, your goal is to find a solution!

.....

Problem:

“How can you find the measure of a *third* angle in a triangle without using a protractor?”

My Solution: (Remember to explain your answer in paragraph form.)

True Triangles

“The *sum* of the lengths of *any two sides* of a triangle *has to be greater* than the third side.” **True or False?**

Use the following problem-solving steps to guide your work:

- **Understand the Problem**
- **Decide on a Plan**
- **Carry out the Plan**
- **Look Back and Review**

Step 1: Restate the problem in your own words:

List any questions you have at this time:

Jot down any hypotheses you have at this point:

Share your questions and hypotheses with others.

Step 2: List the first steps you plan to take in order to solve the problem:

Step 3: Carry out the Plan

Possible manipulatives: Use straws cut into lengths of 2 cm, 3 cm, 5 cm, and 6 cm, or the strips provided below.

Step 4: Look Back and Review

Collect and record the data gathered during each step. If new questions arise, adjust your plan to solve them. Remember to “look back” after each step. Ask yourself, “So, what does this tell me? What can I learn? What do I need to do next?”

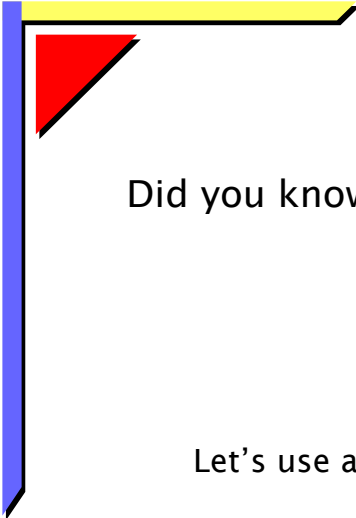
.....
Problem:

“The *sum* of the lengths of *any two sides* of a triangle *has to be greater* than the third side.” **True or False?**

My Solution: Explain your answer in paragraph form.

Label the strips (2, 3, 5, or 6 cm) and then cut them out to test your hypotheses.

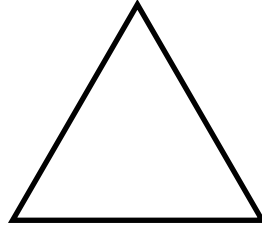
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Traveling Triangles

Flips and Slides

Did you know that polygons could *travel* within a plane?



Let's use an equilateral triangle and explore two of these transformations (movements).

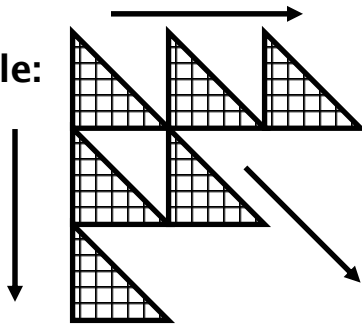


First, subdivide the triangle into different colored sections using one, two, or three lines of symmetry. (Be creative!)

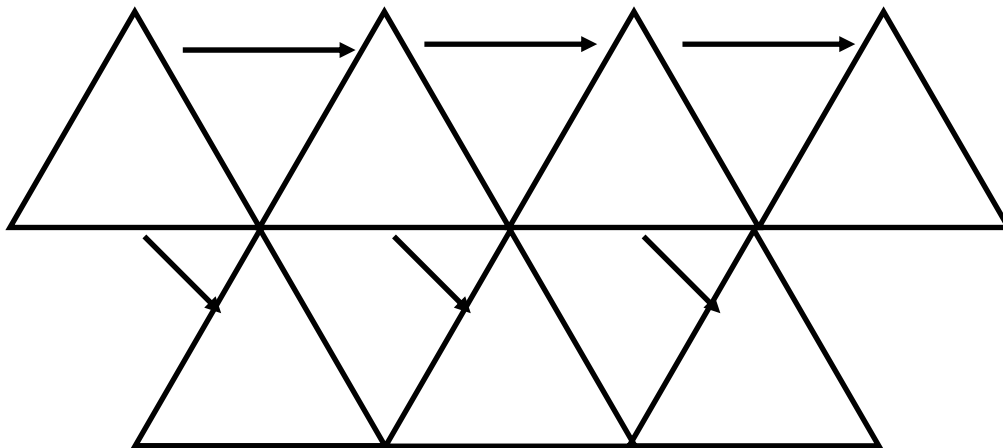
Transformation #1: Slides

A polygon can be slid from one point to another within a plane. This movement is called a "slide" or a "translation."

Example:



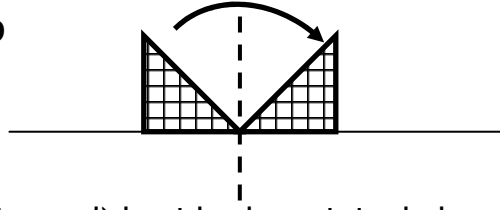
Use your equilateral triangle and SLIDES to travel the plane below.



Transformation #2: Flips

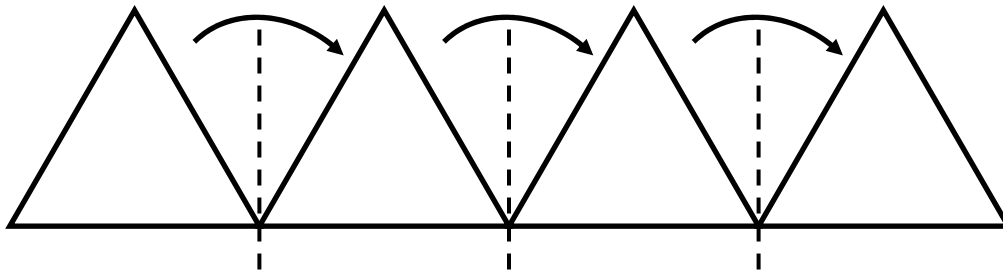
A polygon can be flipped horizontally or vertically. This movement is called a “flip” or a “reflection.”

Example: Horizontal Flip

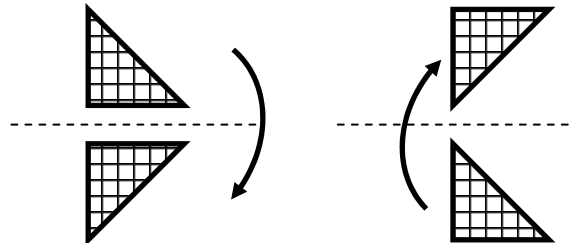


The pattern is reflected (or mirrored) beside the original shape.

How would your triangle look if it was flipped horizontally?

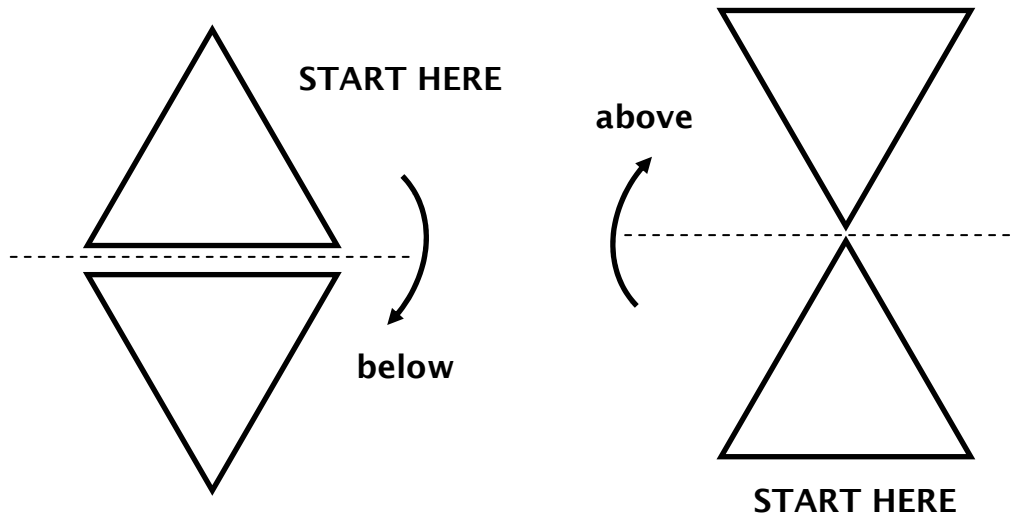


Example: Vertical Flip



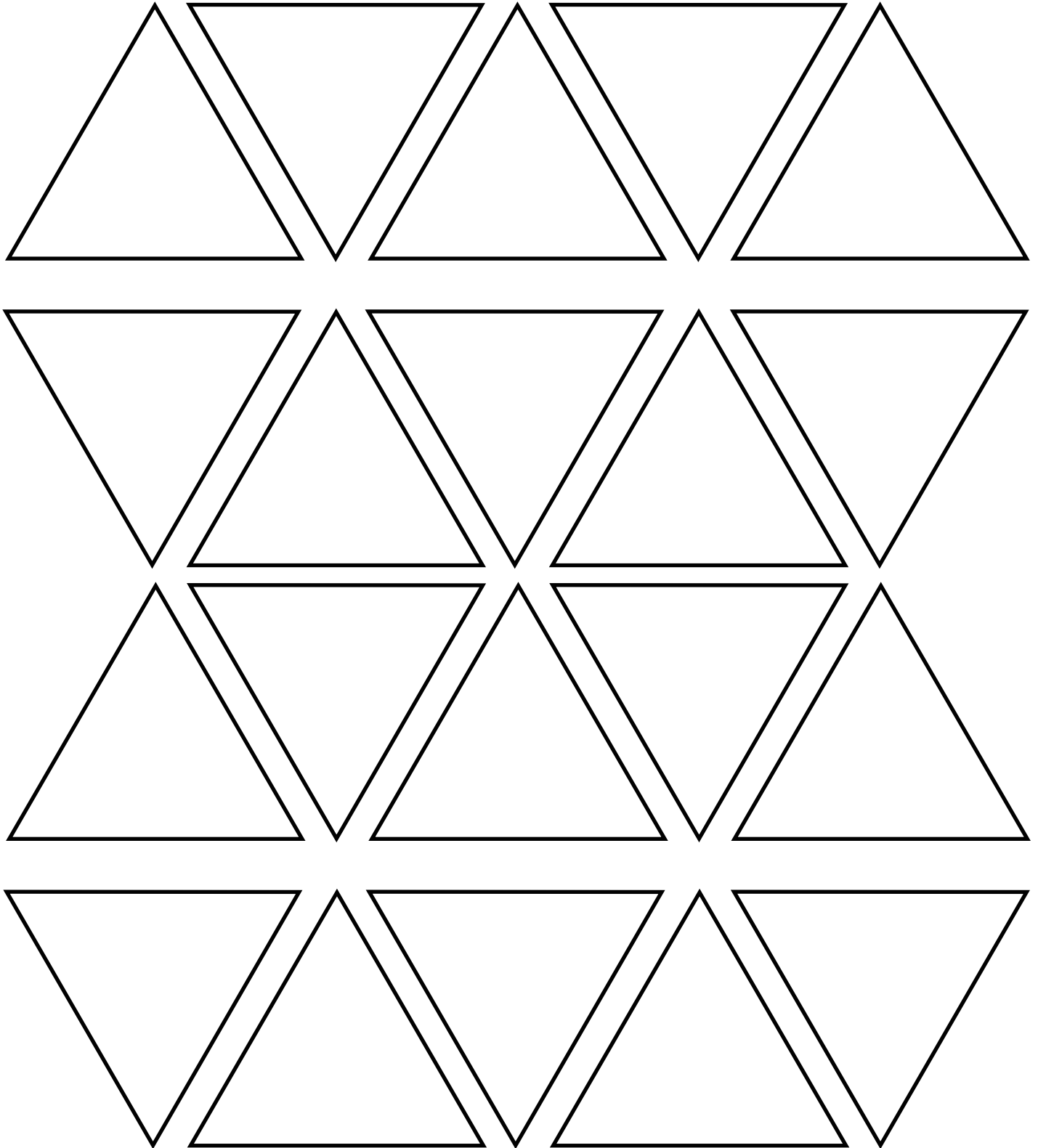
The pattern is reflected (mirrored) below or above the original shape.

How would your triangle look if it were flipped vertically?



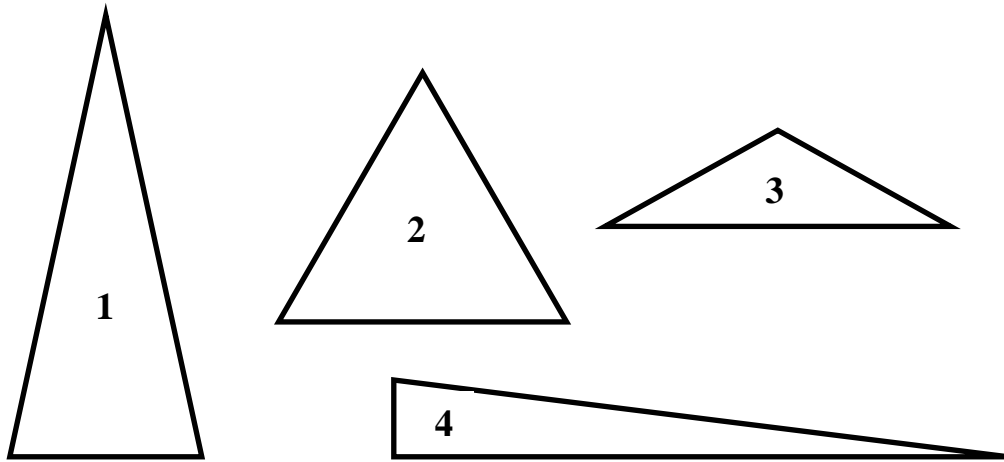
Equilateral Triangles

Manipulatives



Building Code Check-Up #4

The Fun Polygon



Part A

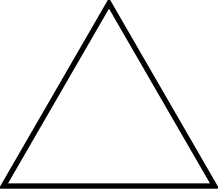
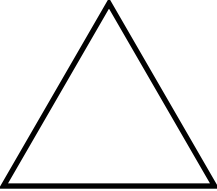
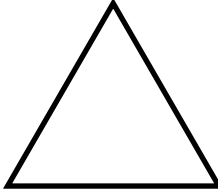
1. Use the shapes above to complete the following chart.

Triangle	Angle Classification	Side Classification
1		
2		
3		
4		

2. Explain how triangles are named. Your **paragraph** should include an introduction, related facts that support your ideas, and a conclusion.

Part B

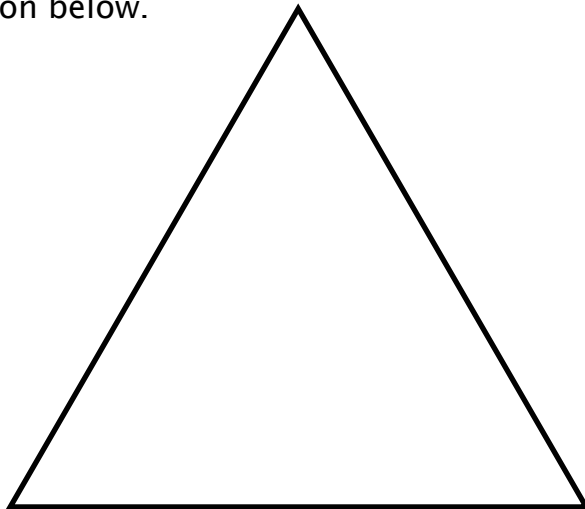
3. Draw one, two, and three lines of symmetry on the triangles below. (Fold and manipulate the paper triangle as needed.)


Lines of Symmetry		
One Line	Two Lines	Three Lines
a. 	b. 	c. 

4. Identify the **congruent** triangles that are formed within each of the three triangles and label them with a **C**.

Part C (Extra Credit)

5. Select one of the triangles above, and redraw its line(s) of symmetry in the similar version below.



6. Create a simple design on one of the congruent triangles.
7. Show the flipped version (or a reflection) of that triangle on the other congruent triangle.
8. Use a dashed line (- - -) and a curved arrow () to show how the figure was flipped.

Scoring Criteria

Part A

1. **20 points** Students complete the chart using the following vocabulary words (5 points per pair):

Triangle 1: acute - isosceles

Triangle 3: obtuse - isosceles

Triangle 2: acute - equilateral

Triangle 4: right - scalene

2a. The content of the paragraph is assessed as follows:

20 points Students include specific details and vocabulary to explain how triangles are named. *See the adapted Long-Answer Question rubric below to understand what a "clear and complete" answer looks like for this prompt (# of points x 5).*

	4 points	3 points	2 points	1 point
Explaining Your Answer	Your explanation is so clear and complete that the reader can use the specific details and vocabulary you provide to correctly name new triangles.	Your explanation is clear and complete. It is supported by specific and appropriate vocabulary. It is clear to the reader why the triangles have these names.	Your explanation is hard to follow. Appropriate vocabulary may be used, but specific details are lacking. It is hard for the reader to understand how triangles are named.	Your explanation is unclear and/or incomplete. It contains inappropriate or insufficient vocabulary. The reader is confused about how triangles are named.

2b. The format of the paragraph may be assessed as follows:

5 points Students begin the paragraph with an introductory sentence.

15-20 points Students develop supporting ideas by presenting facts and information that clearly relate to the focus (5 points per supporting fact or piece of information).

5 points Students conclude the paragraph.

Part B

3. **15 points** Students identify and draw three lines of symmetry (5 points per line).

4. **15 points** Students identify and label congruent figures in each triangle (5 points per triangle).

Part C (Extra Credit)

5. **1 point** Students redraw the line(s) of symmetry.

6. **1 point** Students create a simple design on one congruent figure.

7. **6 points** Students accurately reflect (flip) the congruent figure.

8. **2 points** Students show the line over which the figure was flipped.

Triangle Trivia

Nature

Art

1. What is considered the graveyard of the southern Atlantic Ocean? How does the triangle relate to this area?
2. Why is the center of Sao Paulo's business district called the Triangle?
3. What ancient form of writing was based on triangular, or wedge-shaped, characters? Who practiced this writing?

Architecture

THIS IS JUST A SPACER PAGE.

**THE FCAT LONG-ANSWER QUESTION RUBRIC
SHOULD BE NEXT.**

FCAT Long-Answer Question Rubric

	4	3	2	1	0
Answering the Problem	You arrive at a correct answer. Minor errors in your response do not take away from the understanding shown by your work.	You arrive at a correct answer, but minor errors in your response indicate that you have some misunderstanding of the concepts and procedures.	You may arrive at a correct answer, but the errors in your response reveal that there are essential parts of the concepts and procedures that you do not understand.	You arrive at an incomplete answer. The errors in your response reveal many flaws in your understanding of the concepts and procedures.	Your answer was incorrect or not given at all.
Showing your Work	You follow the given directions to show how the problem was solved. All steps are provided and they show correct math procedures.	You follow the given directions to show how the problem was solved. Steps are provided, but careless errors are shown in the math procedures.	You follow the given directions in an attempt to show how the problem was solved. Some of the steps provided show incorrect math procedures.	You attempt to show how the problem was solved. Some of the steps are addressed, but you fail to arrive at a complete answer.	You make no attempt to show how the problem was solved, or the procedures shown are all incorrect.
Explaining & Interpreting your Answer	You explain how to solve the problem so clearly and completely that someone else can find the answer in a new situation. The interpretations you give can be inferred from the information.	You explain how to solve the problem so that someone else can find the answer. The interpretations you give can be supported by the information.	You may begin to explain how to solve the problem, but you do not clearly show how to find the answer. The interpretations you give are not always supported by the information.	Your explanation of how to solve the problem is incomplete or flawed. The interpretations you give can not be supported by the information.	Your explanations and interpretations are not correct, understood, or given.
What each point value means...	<i>Your work shows a complete understanding of the concepts & procedures.</i>	<i>Your work shows an essential understanding of the concepts & procedures.</i>	<i>Your work shows a partial understanding of the concepts & procedures.</i>	<i>Your work shows a limited understanding of the concepts & procedures.</i>	<i>Your work shows no understanding of the concepts & procedures.</i>

