<u>CONSTRUCTING TASK:</u> My Many Triangles

This task requires students to sort triangles according to common attributes and then create triangles according to two properties.

<u>STANDARDS FOR MATHEMATICAL CONTENT</u>

MCC5.G3. Understanding that attributes belonging to a category of two-dimensional figures also belonging to all subcategories of that category.

<u>STANDARDS FOR MATHEMATICAL PRACTICE</u>

SMP 1. Make sense of problems and persevere in solving them.
SMP 2. Reason abstractly and quantitatively.
SMP 6. Attend to precision.
SMP 7. Look for and make use of structure.

<u>BACKGROUND KNOWLEDGE</u>

Students should be able to identify triangles by the lengths of their sides (isosceles, equilateral, and scalene) as well as by the measure of their angles (right, obtuse, and acute). Students will need to be able measure the sides and the angles in order to create the required triangles. Also, they will need to know that the sum of the measures of the angles of a triangle is 180°.
Of the nine triangles, two are not possible.

- An equilateral right triangle is not possible because an equilateral triangle also has equal angle measures (equiangular). A triangle can have no more than 180° however, 90° × 3 = 270° which is more than 180°.
- An equilateral obtuse triangle is not possible because an equilateral triangle has equal angle measures (equiangular). A triangle can have no more than 180° however, by definition an obtuse angle is greater than 90°. Multiplying a number greater than 90° by 3 will be greater than 180°.

<u>COMMON MISCONCEPTIONS</u>
Students think that when describing geometric shapes and placing them in subcategories, the last category is the only classification that can be used.

<u>ESSENTIAL QUESTIONS</u>

- How can angle and side measures help us to create and classify triangles?

<u>MATERIALS</u>

- "My Many Triangles" student recording sheet
- "My Many Triangles, Triangles to Cut and Sort" student sheet
- white construction paper (one sheet per student or per pair of students)

- colored construction paper cut into strips$\frac{1}{4}$" wide (each student will need approximately 10 strips of paper)

GROUPING

Partner/Small Group Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

This task requires students to sort triangles according to common attributes and then create triangles according to two properties.

Part 1

Adapted from Van De Walle, J.A., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and Middle School Mathematics: Teaching Developmentally* 7th Ed. Boston: Pearson Education, Inc., p. 413-414.

Comments

As an introduction to this task, students can be asked to fold different types of triangles. Using a piece of plain paper, ask students if they can fold to create any of the following triangles. (Small pieces of plain paper can be used, approximately 4" x 4".)
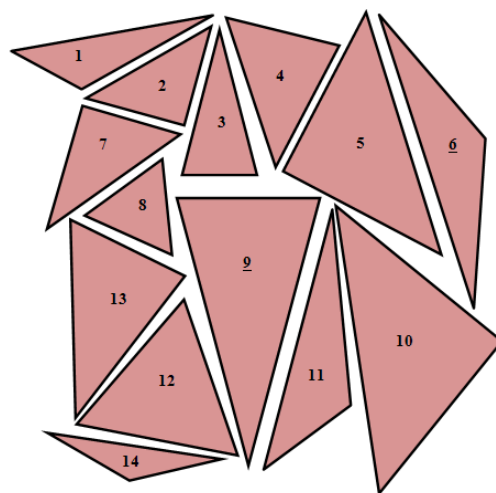
- Equilateral
- Right
- Acute
- Obtuse

Discuss how students know their triangle belongs to one or more of the categories listed above. (For some children paper folding can be a little challenging at first. Reassure children that it is okay to make mistakes when folding and to persevere until they are successful. It will be necessary to have several extra pieces of paper available for all students. This task helps students become more confident in their spatial abilities.)

The type of each triangle on the "My Many Triangles, Triangles to Cut and Sort" student sheet are shown below.

     #1, #11 – obtuse scalene
     #2, #7 – right scalene
     #4, #13 – acute scalene
     #5, #10 – right isosceles
     #8, #12 – acute equilateral
     #3, #9 – acute isosceles
     #6, #14 – obtuse isosceles

Allow students struggle a little bit with this part of the task. Students may need to try out a few possibilities before finding that lengths of sides and measures of angles are two ways to sort these triangles so that each triangle belongs to exactly one group when sorted.

Sorted according to side lengths	Sorted according to angle measures
Equilateral triangles: 8, 12	Acute triangles: 3, 4, 8, 9, 12, 13
Isosceles triangles: 2, 3, 5, 6, 9, 14 **or**	Right triangles: 2, 5, 7, 10
Scalene triangles: 1, 4, 7, 10, 11, 13	Obtuse triangles: 1, 6, 11, 14

Task Directions

Cut out the triangles below. Sort the triangles into groups where there are no triangles that do not fit into a group and there are no triangles that belong to more than one group. Then sort the triangles in a different way. Again, there should be no triangles that do not fit into a group and no triangles that belong to more than one group. Record how you sorted the triangles and the number of the triangles in each group. Be able to share how you sorted the triangles.
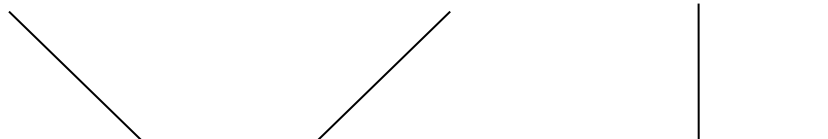
FORMATIVE ASSESSMENT QUESTIONS

- How do you know this is a(n) _____ (isosceles, right, equilateral, etc.) triangle?
- Are there any triangles that don't belong in a group?
- Are there any triangles that belong to more than one group?
- Can you think of another way to sort the triangles?
- What are some properties of this triangle? Can you use one of those properties to think of a way to group all of your triangles?

Part 2
Comments

Students may need some assistance using the chart to identify the triangles they need to create. Be sure students understand they need to attempt to make nine different types of triangles, two of which are not possible to create. Encourage students to try to make an equilateral obtuse angle and an equilateral right triangle so that they can see that it is not possible to create a three-sided closed figure with two obtuse angles or two right angles. (See below.)

Task Directions

Use the strips of construction paper to create the triangles described in each box below. Use the row label and the column label to identify the properties required for each triangle. For example, the box labeled "A" needs to be acute and isosceles because the row label is "Acute" and the column label is "Isosceles."

	Equilateral	Isosceles	Scalene
Acute			
Right			
Obtuse			

   Two triangles are not possible; for those, explain why each triangle is not possible on the lines below.

   Glue each triangle onto the construction paper and label it.

FORMATIVE ASSESSMENT QUESTIONS

- Can you create an equilateral right triangle? An equilateral obtuse triangle? How do you know?
- Is there a scalene equilateral triangle? How do you know?
- How do you know this is a _____ (i.e. scalene obtuse) triangle? Justify your answer.
- If it is a _____ (i.e. scalene obtuse) triangle, what is true about the length of its sides? The measures of its angles? Prove that the triangle you created has those attributes.

DIFFERENTIATION:

Extension
Challenge students to write directions for a triangle that they chose so that someone else could follow their directions and create the same triangle. Allow a partner to try these directions with to see how successful they were at describing how to create their triangle.

Intervention
Allow students to use a picture glossary or the triangles from Part 1 of this task to help them create the triangles for Part 2.

TECHNOLOGY CONNECTION:
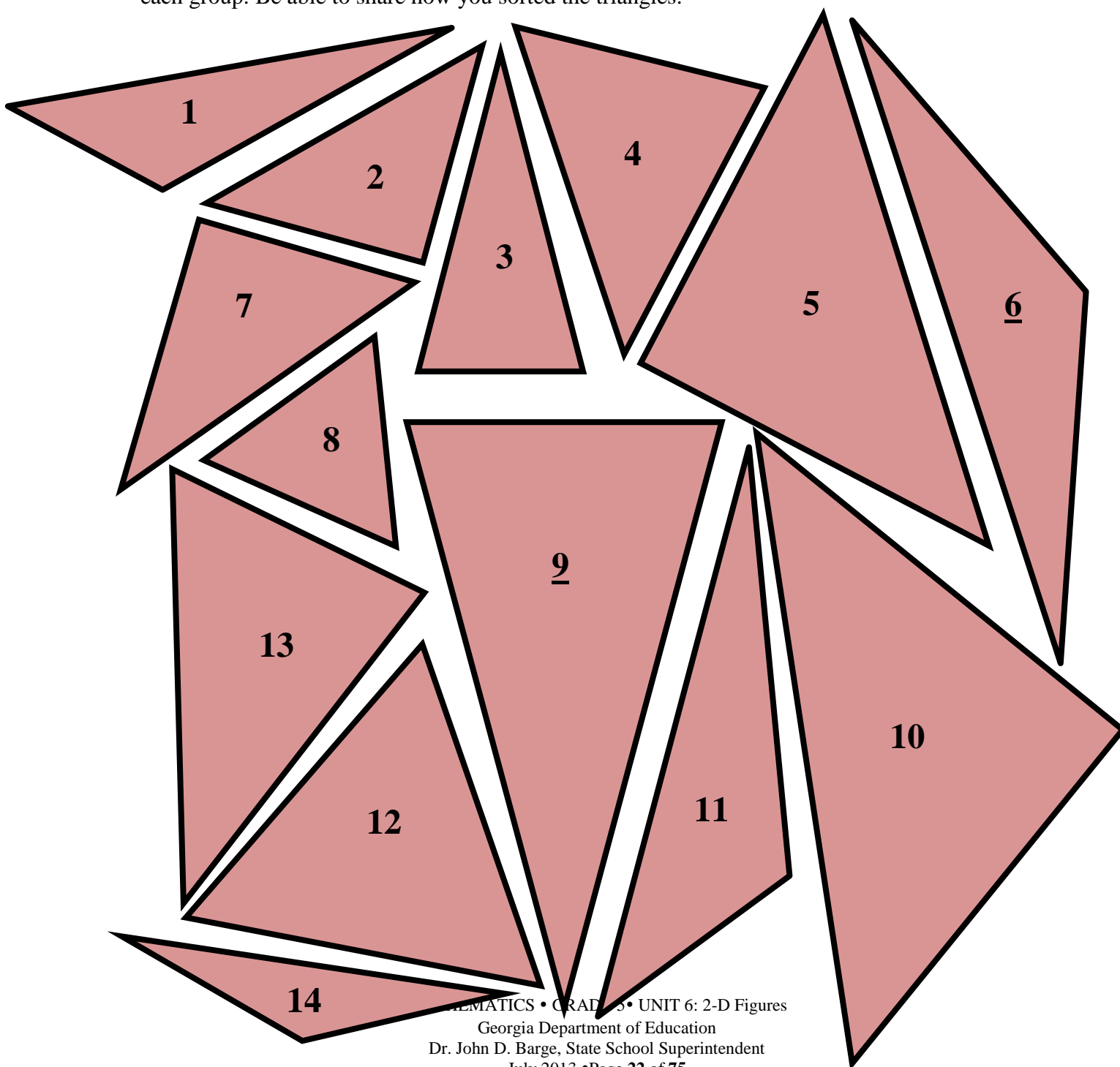
- http://www.basic-mathematics.com/types-of-triangles.html Gives basic definitions for the types of triangles. Note: this web site contains advertising.
- http://www.k-5mathteachingresources.com/Geometry-Interactive-Whiteboard-Resources.htmlThis resource has a triangle sort activity in which can be used for additional practice or remediation purposes.
- http://www.crickweb.co.uk/ks2numeracy-shape-and-weight.html#trianglesPlay the game Triangle Sort for additional practice or for remediation purposes.

My Many Triangles
Triangles to Cut and Sort

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Name _____ Date _____

My Many Triangles

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Acute			
Right			
Obtuse			

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