Unit 7 Culminating Task- Part 2

Performance Task: Angles of Set Squares

STANDARDS FOR MATHEMATICAL CONTENT

MCC4.MD.5. Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.
b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

MCC4.MD.6. Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

MCC4.MD.7. Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

Students should have had experience with exploring and measuring angles. Also, students need to know the sum of the angle measures of a triangle is 180°.

Students are confused as to which number to use when determining the measure of an angle using a protractor because most protractors have a double set of numbers. Students should decide first if the angle appears to be an angle that is less than the measure of a right angle (90°) or greater than the measure of a right angle (90°). If the angle appears to be less than 90°, it is an acute angle and its measure ranges from 0° to 89°. If the angle appears to be an angle that is

greater than 90°, it is an obtuse angle and its measures range from 91° to 179°. Ask questions about the appearance of the angle to help students in deciding which number to use.

ESSENTIAL QUESTIONS

- How can we use the relationship of angle measures of a triangle to solve problems?
- How can angles be combined to create other angles?
- How can we use angle measures to draw reflex angles?

MATERIALS

- "Angles of Set Squares, Angle Measures" student sheet (copied on cardstock)
- "Angles of Set Squares" student recording sheet
- "Angles of Set Squares, One Angle" student recording sheet (intervention)

GROUPING

Individual/Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this task, students will combine shapes to make angles and explore angle measures of triangles.

Comments

While this task may serve as a summative assessment, it also may be used for teaching and learning. It is important that all elements of the task be addressed throughout the learning process so that students understand what is expected of them.

A set square is not an actual square; it is a pair of triangular-shaped tools that are used in technical drawing. The set square typically contains two triangles, one with 30-60-90 degree angles, and the other 45-45-90 degree angles. The 30-60-90 triangle is half of an equilateral triangle, and the 45-45-90 triangle is half of a square. This lesson utilizes both types of set squares.

To introduce this task, students can be given a square and an equilateral triangle cut from paper. Students can fold the two shapes in order to create the two triangles used for this task. The shapes should be folded as shown and then cut along the dotted line.

Students should be able to determine that the diagonal of the square cuts the right angle into two equal angles of 45°. Also, the altitude of the triangle cuts the angle at the "top" into two equal angles. If each angle of an equilateral triangle is 60°, then two equal angles of 30° are formed.

Students may recognize that one angle in each triangle is a right angle. (All angles of a square are right angles, and the altitude of a triangle forms a right angle where it intersects the side.) Therefore, students know the measures of two of the angles of each of the "set squares" triangles. They will need to use what they know about triangles (previous task) to find the measure of the third angle.

90° + 30° = 120°; 180° - 120° = 60°; therefore, the measure of the third angle of the first triangle is 60°.

90° + 45° = 120°; 180° - 135° = 45°; therefore, the measure of the third angle of the first triangle is 45°.

The angles that can be created using the set squares are 30, 45, 60, 75, 90, 105, 120, 135, and 150 degrees and their reflex angles 330, 315, 300, 285, 270, 255, 240, 225, and 210 degrees.

Note that angle measures are multiples of 15 degrees, but we are missing angles with measures of 15 and 165 degrees. Challenge students to determine a method for drawing an angle of 15 degrees and then 165 degrees. (You can make a 15 degree angle by looking at the difference between 45 and 30 degree angles. Once you create a 15 degree angle, you can use it to create a 165 degree angle.)

Task Directions

Part 1

Students will follow the directions below from the "Angles of Set Squares, Angle Measures" student recording sheet.

> You will use the "set squares" below during this task.
>
> Directions:
>
> 1. Measure the angles of each triangle using a protractor.
> 2. Write the measure inside each angle.
> 3. Use what you know about the angle measures of a triangle to check to be sure you measured correctly. Show your work below:
>
> Cut out the triangles carefully.

Part 2

Next, students will follow the directions below from the "Angles of Set Squares" student recording sheet.

> Using the set squares you cut out, find all possible angles you can make with any angle or combination of two angles in the pair of set squares. Draw and label the measure of the different angles you find.
>
> Here are some hints:
>
> - There are at least 20 angles that can be found.
> - Don't forget reflex angles!

- Think about comparing angles to find new angle measures.

Organize your work in a way that makes it easy for others to understand.

FORMATIVE ASSESSMENT QUESTIONS

- How could you make your own set squares?
- How do you know the angle measures are correct? Can you tell me two ways?
- How can you combine angles to create new angles?
- How can you compare angles to create new angles?
- How do you know you have found all of the possible angles?
- What is a reflex angle?
- How could you draw the reflex angle for this angle?
- How are you organizing your work so that you are sure you have found all possible angles?

DIFFERENTIATION

Extension

- Have students use the angles of two different pattern blocks to create a new angle. For example, use an orange square (90^o angles) and a tan rhombus (30^o and 150^o).

Intervention

- Have students work with one of the set squares to determine the angles and make observations before introducing the second one. Use the "Angles of Set Squares, One Angle" student recording sheet (for the 30-60-90-triangle).

Name _____ Date _____

Angles of Set Squares

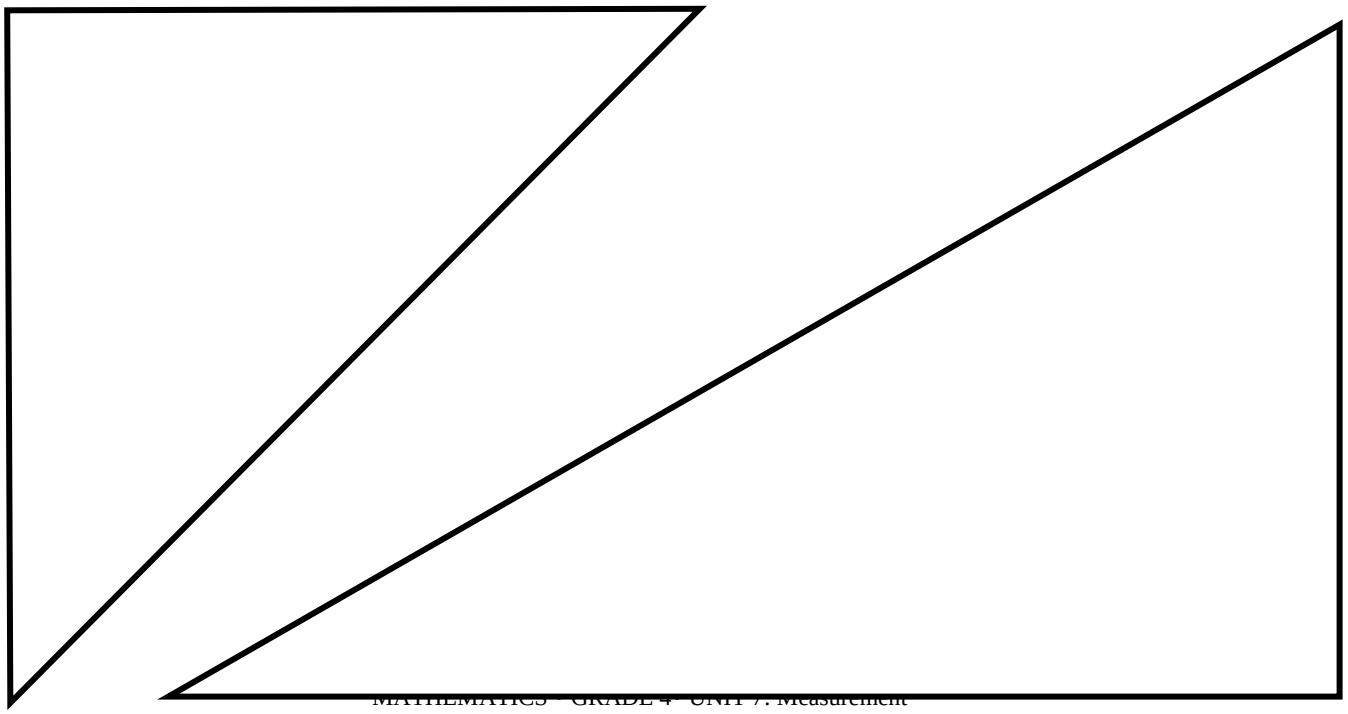
Angle Measures

You will use the "set squares" below during this task.

Directions:

1. Measure the angles of each triangle using a protractor.
2. Write the measure inside each angle.
3. Use what you know about the angle measures of a triangle to check to be sure you measured correctly. Show your work below:

4. Cut out the triangles carefully.



Name _____ Date _____

Angles of Set Squares

Using the set squares you cut out, find all possible angles you can make with any angle or combination of two angles in the pair of set squares. Draw and label the measure of the different angles you find.

Here are some hints:

- There are at least 20 angles that can be found.
- Don't forget reflex angles!
- Think about comparing angles to find new angle measures.

Organize your work in a way that makes it easy for others to understand.

Name _____ Date _____

Angles of Set Squares

One Angle

Complete the chart by tracing angles of your "set squares" with the given measures.

30°	60°
90°	270°
300°	330°