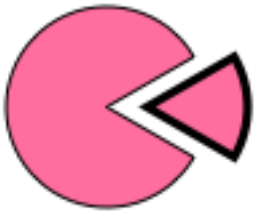
Scaffolding Task: Which Wedge is Right?



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.

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 have previously developed a conceptual understanding of linear measurement using non-standard units. They should also be able to identify different types of angles, i.e. right, acute, and obtuse.

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

- Why are standard units important?
- How does a circle help with measurement?

MATERIALS

- Cardstock circles or circular paper plates (one per student)
- "Which Wedge is Right?, Part 1 – Wedge Measures" student recording sheet
- "Which Wedge is Right?, Part 2 – Equal Wedge Measures" student recording sheet (copy on cardstock)
- Pattern blocks
- Scissors
- Plain paper

GROUPING

Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this task, students will use a non-standard measurement for angles and then explore finding the measurement of angles using common-sized wedges.

Comments

Common-sized wedges are an effective way to measure angles, allowing for easy communication about the size of angles. The goal of the lesson is for students to realize the need for developing a standard unit of measurement for angles similar to the standard units of linear measurement and weight.

Task Directions

Part 1

1. Give each student the "Which Wedge is Right? Part 1 - Wedge Measures" student recording sheet. As they are looking at the angles on the sheet, have them discuss the following questions with their partners or as a whole class:
    - Which angle do you think is the smallest?
    - Which angle do you think is the largest?
    - Can you order all of the angles from smallest to largest?
    - How did you decide the order?
    - Were some angles hard to compare? (Angles similar in size might be hard to compare.)
2. Explain to students that being able to compare angles is important. In addition, we need a way to give a numerical measure to angles.
    - Do you think we can use a ruler to measure angles? Why or why not?
3. This is a good place to help students draw the comparison between the type of object being measured and the type of measuring tool we use. We use linear inches and centimeters to measures segments and lengths. We use square units like square inches and square centimeters to measure area.
    - What could we use to measure angles?

4. Allow the students to discuss ideas on angle measurement options. Then give each student a circle. Have each student cut a 'wedge' from his or her circle. The students do not need to worry about cutting the same size wedges. Ask them to describe the wedge they just created.
    - Does it look like a right angle, an acute angle, or an obtuse angle?
5. Tell the students they will be using the wedges they created to measure angles. Ask them to measure the first angle on the student recording sheet using their wedge. Give them a few minutes to determine a method for using the wedge they created to measure the angle.
    - Pay close attention to students who created large wedges because they may not be able to measure the angle they drew. Encourage these students to make their wedges smaller and to try again.
6. Once everyone has figured out how to measure using wedges, each student needs to use their wedge to measure the other angles on the paper. Ask students to record each angle measure in the table chart at the bottom of the page.
    - Encourage students to use the term "wedge" when reporting their measures.
7. Help students do the following as students are measuring the angles with their wedges:
    - They need to line up the point of their wedge with the vertex of the angle.
    - They need to make sure they are not over-lapping the wedges too much as they are measuring.
    - They need to line up the straight side of the wedge with the side of the angle they are measuring.
8. Once students have measured their angles, ask them to compare their angle measures with a partner. Before the students compare measures, ask them to predict if their answers will match their partner's answers. Be sure to ask students to explain their thinking.
    - Have students record their angle measures in the chart at the bottom of their partner's paper.
9. Have students discuss the results of their partner's angle measures. Make sure their discussion addresses the following questions:
    - What did you like about using your wedges to measure angles?
    - What did you not like about using your wedges?
    - Why did you and your partner get different answers for the same angle? Is that reasonable?
    - Were your partner's answers always greater than or less than your answers? Why did this happen?
    - What could you do to make sure you get the same answers when you are measuring angles?

Part 2

Have students generate ideas about why it may be helpful for everyone to use the same size wedges.

Students will follow the directions below from the "Which Wedge is Right?" student recording sheet.

Get a one of each type of pattern block and a pair of scissors, and then complete the directions below.

1. Cut off the bottom of this paper along the dotted line.
2. Cut apart each of the wedges from the section you cut from this paper.
3. Trace one of each type of pattern block on this paper.
4. Measure each angle in the pattern blocks. Note: Each of the wedges has the same measure.
5. Record the measure of each angle in the outline of the each pattern block.

By tracing the pattern blocks, students are given a chance to show how they determined the measure of the angle and to record their answers. Some students may want to measure the physical blocks. However, all students will need to trace the pattern blocks on paper and record their answers on the appropriate shape and angle, or find another way to communicate their measurements to the class.

Watch for errors in measurement caused by students overlapping the wedges or carelessly turning the wedges as they count the number needed to cover the angle.

Make sure the students continue to use the word "wedge" in their measurements. They should not write the measure of the angle as 3; they need to write the angle measure as 3 wedges. As they continue having to re-write the word wedge every time, they may decide it would be easier to have an abbreviation or symbol for "wedge." In this case, students can agree to use a "w," wedge shape, or a different way to represent "wedge."

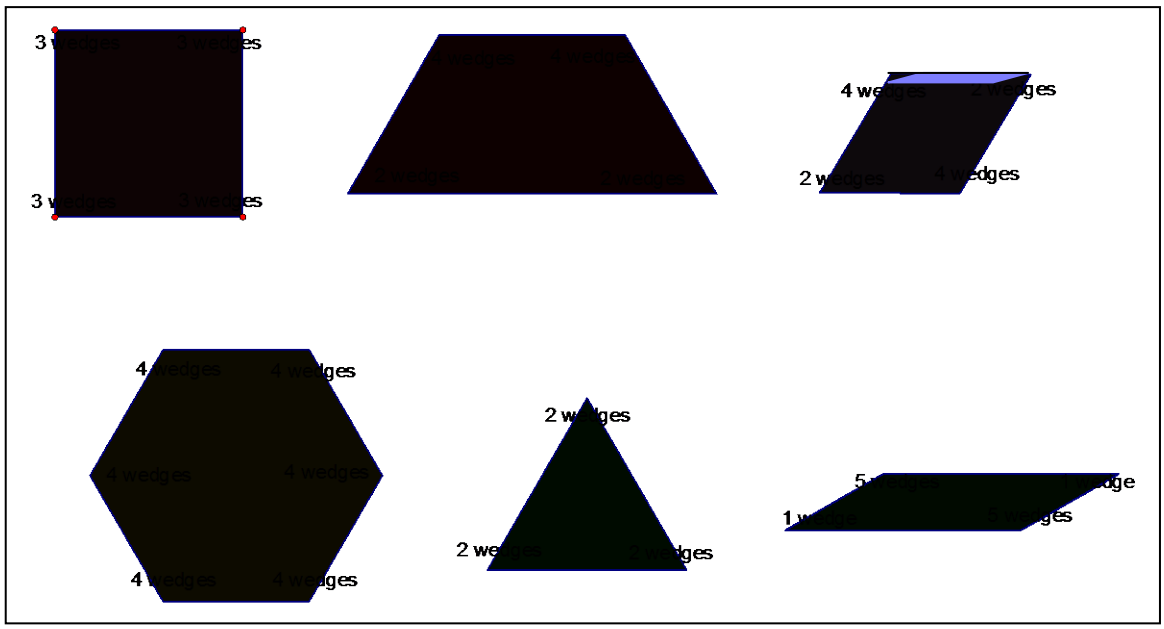
The students should realize the right angles are about 3 wedges and their measures should be more likely to agree with other students' measures because all wedges are the same measure. Allow time for the students to discuss their measures and any discrepancies they notice.

Make sure students have time to discuss the following:

- Were there angles that were difficult to measure? Some of the small angles may be more difficult.
- Were there any angles in the shapes that were the same size? Did you get the same measure for these angles?
- Did everyone get the same measure? If not, why? Should they all get the same answer?
- What would happen if we all cut our wedges in half? Would that change our answers? Would it be helpful in any way?

Part 2

- **Solutions to pattern blocks:**



FORMATIVE ASSESSMENT QUESTIONS

Part 1

- What did you like about using your wedges to measure angles?
- What did you not like about using your wedges?
- Why did you and your partner get different answers for the same angle? Is that reasonable?
- Were your partner's answers always greater than or less than your answers? Why did this happen?
- What could you do to make sure you get the same answers when you are measuring angles?

Part 2

- Were there angles that were difficult to measure? Some of the small angles may be more difficult.
- Were there any angles in the shapes that were the same size? Did you get the same measure for these angles?
- Did everyone get the same measure? If not, why? Should they all get the same answer?
- What would happen if we all cut our wedges in half? Would that change our answers? Would it be helpful in any way?

DIFFERENTIATION

Extension

- Use the equal size wedges and cut them each in half. Let students explore using different size equal wedges.

Intervention

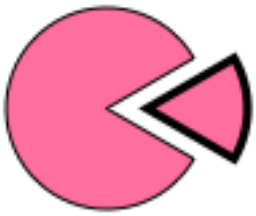
- Use larger angles drawn on paper and fraction circles for an easier manipulative.

- For students who struggle to recognize right, acute, and obtuse angles, prepare 12 angle cards. Use cardstock and draw one angle on each card. Make 4 right angles, 4 acute angles, and 4 obtuse angles. Have students move the angle cards into three groups. Continue working until students have correctly grouped them into right, acute, and obtuse angles. Write the name of each type of angle above the cards. Have the students practice reading the names and identifying the characteristics of each.

Name _____ Date _____

Which Wedge is Right?

Part 1 - Wedge Measures



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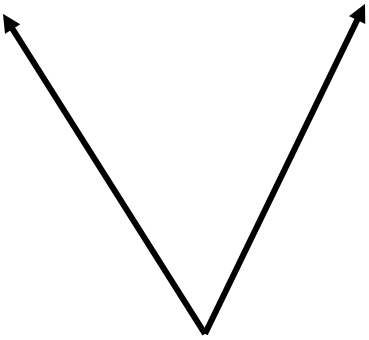

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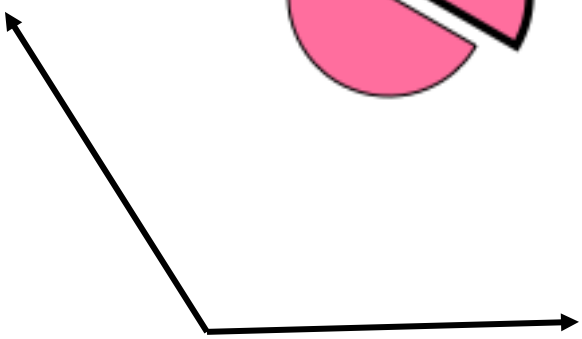

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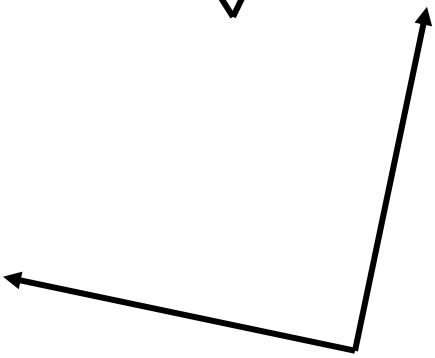

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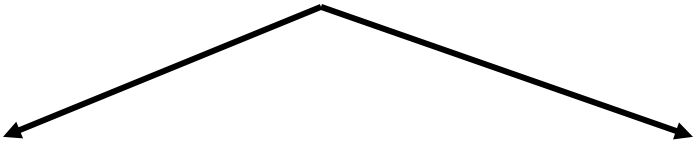

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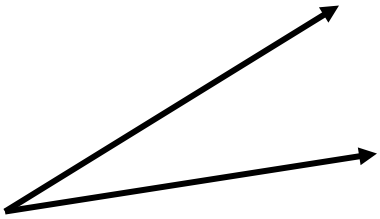

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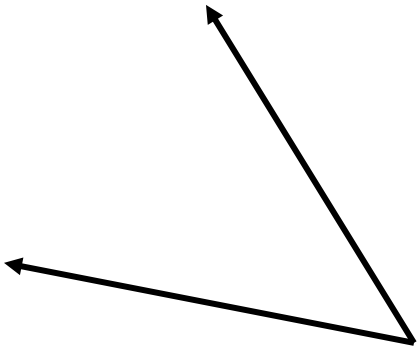
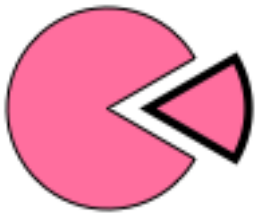


Angle	How large is the angle?	
	Your measure	Partner's measure
1.		
2.		
3.		
4.		
5.		
6.		

Name _____ Date _____

Which Wedge is Right?



Part 2 – Equal Measure Wedges

Get one of each type of pattern block and a pair of scissors, then complete the directions below.

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4. Measure each angle in the pattern blocks. Note: Each of the wedges has the same measure.
5. Record the measure of each angle in the outline of the each pattern block.