Constructing Task: Turn, Turn, Turn

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 be familiar with right, acute, and obtuse angles and half and full rotations.

ESSENTIAL QUESTIONS

- How does a turn relate to an angle?
- What does half rotation and full rotation mean?
- What do we actually measure when we measure an angle?

MATERIALS

- Scissors
- Two circles (see comments)

GROUPING

Whole Group

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In this task, students will form various angles by rotating the two inter-connected circles.

Each circle must be a different color. Copy half of the required circles on colored cardstock, the rest on white cardstock. Alternatively, different colored paper plates can be used.

Comments

This kinesthetic activity allows students to manipulate paper to form angles. The idea is to help develop the concept of angles as a rotation around a circle.

One way this task can be introduced is to ask students to move their arms to show the rotation that occurs when an angle is created. This strategy will help children develop the sense of an angle as a turn. While doing this, students will need to use both arms, one to indicate their starting location and one to point to how far they have turned. For example, you could go through the following directions and questions with your students:

- Look at the front wall and point to it with your right hand.
- Without moving your right hand, turn your left arm until your left hand is pointing to the wall on your left.
- What angle did you create with your arms?
- How far did you turn?
- If you moved your body 180º, how would that look? Show me.
- Can you turn more than 180 º? Can you make three 90° turns? How far did you turn in total?
- What if you turn in a complete circle? 2 circles? 1 and a half circles?

Students can often relate real-world activities to the concept of turning a certain number of degrees. A skateboarder wants to learn to do a 180, a 360, a 720, etc. The same can be said about snowboarders on a half-pipe, X-treme Motocross, etc. Many of these students will have seen this on television even if they have never actually experienced it themselves.

Task Directions

Part 1

Have students cut out two circles. (They should be cut from two different colored pieces of cardstock, or you may use two different colored paper plates.) Cut along the radius drawn on each circle. Slide the circles together and spin to make different angles.

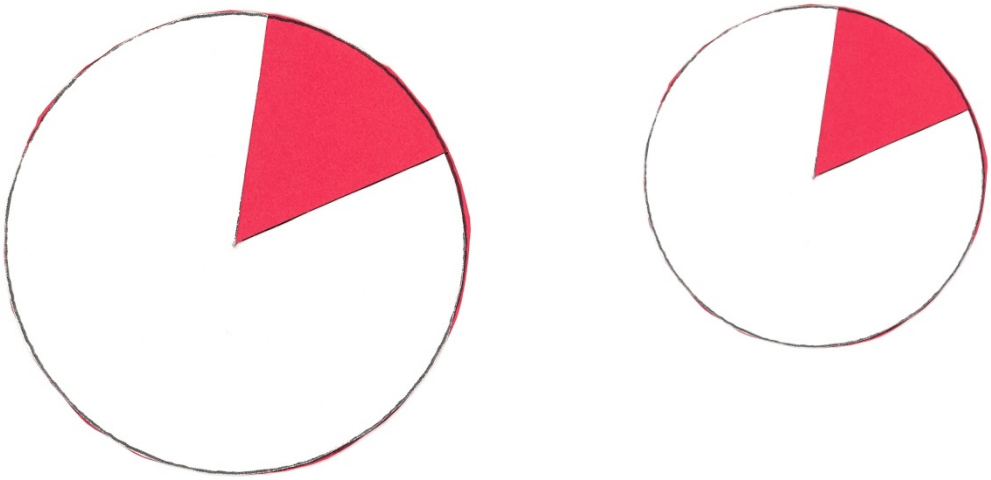
Encourage students to think of an angle as a turn or rotation. Have students make familiar angles (right, acute, obtuse). Then challenge them to make an angle that is the same as 3 right angles, an angle that has a right angle and an acute angle, etc.

Part 2

Students may have some common misconceptions about angle measurement. The activity below gives students another opportunity understand that the length of the sides of an angle do not affect the size of an angle.

Using two different sized circle sets, made in the same way as the sets formed by the students in this task, create two angles about the same size. Then ask, "Which angle is larger?"

Give the students opportunities to compare the effect of turning angles on the different sized sets.



Another way for children to relate to the fact that the length of sides is irrelevant to the size of an angle is to use clocks of different sizes. No matter how big or small a clock may be, it takes the same amount of time to go from, 12:00 to 12:15, or 1:00 to 2:00. Have students discuss the angles the hands of the clock make as they move around the clock. Note that the motion of each hand should be dealt with separately, since the movement of the hour hand is paced differently from the movement of the minute hand.

FORMATIVE ASSESSMENT QUESTIONS

- How are you using your two circles to create angles?
- What happens on your circles when you start with a smaller angle and create a larger one?
- Is there any place on your two circles that stays the same no matter what size angle you make? (The idea is for students to realize that the center point stays the same and movement occurs around this point.)

DIFFERENTIATION

Extension

- Paste a copy of a protractor onto the back of one of the circles so the angle created by rotating the circle can be measured from the back of the set. Have one student create an angle while another child estimates the size of the angle. The first student can simply turn the circle around so students estimating the angle size can determine if they are correct. They should continue in a back and forth manner allowing both children the opportunity to practice estimating angle measures. This would be easy to keep close by to use as a sponge activity and allows the students to have repeated exposure in estimating angle measures.

Intervention

- Allow students to measure angles whose sides are long enough to measure comfortably with a protractor.
- Before students measure an angle, discuss the type of angle (acute, obtuse, right) so that the student uses the correct numbers to measure the angle.

Turn, Turn, Turn
Circles