LEARNING TASK: Guess My Angle!

STANDARDS ADDRESSED

M4M2. Students will understand the concept of angles and how to measure them.

a. Use tools, such as a protractor or angle ruler, and other methods such as paper folding, drawing a diagonal in a square, to measure angles.

M4P1. Students will solve problems (using appropriate technology).

a. Build new mathematical knowledge through problem solving.
b. Solve problems that arise in mathematics and in other contexts.
c. Apply and adapt a variety of appropriate strategies to solve problems.
d. Monitor and reflect on the process of mathematical problem solving.

M4P2. Students will reason and evaluate mathematical arguments.

a. Recognize reasoning and proof as fundamental aspects of mathematics.
b. Make and investigate mathematical conjectures.
c. Develop and evaluate mathematical arguments and proofs.
d. Select and use various types of reasoning and methods of proof.

M4P3. Students will communicate mathematically.

a. Organize and consolidate their mathematical thinking through communication.
b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.
c. Analyze and evaluate the mathematical thinking and strategies of others.
d. Use the language of mathematics to express mathematical ideas precisely.

M4P4. Students will make connections among mathematical ideas and to other disciplines.

a. Recognize and use connections among mathematical ideas.
b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
c. Recognize and apply mathematics in contexts outside of mathematics.

M4P5. Students will represent mathematics in multiple ways.

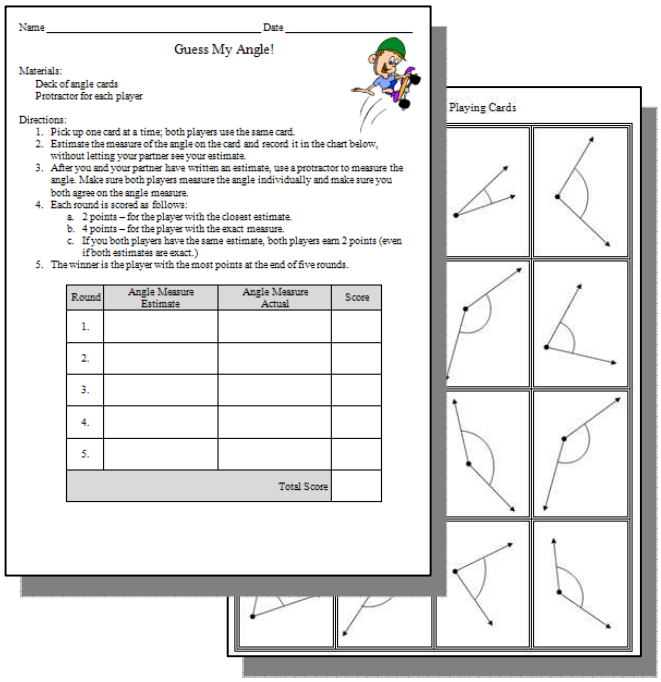
a. Create and use representations to organize, record, and communicate mathematical ideas.
b. Select, apply, and translate among mathematical representations to solve problems.
c. Use representations to model and interpret physical, social, and mathematical phenomena.

ESSENTIAL QUESTIONS

- How do we measure an angle using a protractor?
- Why do we need a standard unit with which to measure angles?
- What are benchmark angles and how can they be useful in estimating angle measures?

MATERIALS

- Angle ruler and completed student recording sheet from "Build an Angle Ruler"
- Protractor, one per student
- "Guess My Angle!" student recording sheet
- Deck of angle cards
- *Hamster Champs*, by Stuart J. Murphy or similar book about angle measurement


Name _____ Date _____

Guess My Angle!

Materials:
Deck of angle cards
Protractor for each player

Directions:
1. Pick up one card at a time; both players use the same card.
2. Estimate the measure of the angle on the card and record it in the chart below, without letting your partner see your estimate.
3. After you and your partner have written an estimate, use a protractor to measure the angle. Make sure both players measure the angle individually and make sure you both agree on the angle measure.
4. Each round is scored as follows:
   a. 2 points – for the player with the closest estimate.
   b. 4 points – for the player with the exact measure.
   c. If you both players have the same estimate, both players earn 2 points (even if both estimates are exact.)
5. The winner is the player with the most points at the end of five rounds.

Round	Angle Measure Estimate	Angle Measure Actual	Score
1.			
2.			
3.			
4.			
5.			
		Total Score	

Playing Cards

Comments

This task requires a deck angle cards. To use the cards repeatedly, copy onto cardstock and laminate before cutting them apart. There are 16 cards per deck.

GROUPING

Whole Group/Partner Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

In Part 1 of this task, students will transition from using an angle ruler to using a protractor to measure angles. In Part 2, students will practice using a protractor by playing "Guess My Angle!"

Comments

This activity should follow closely behind Rafe's design. The wedge used in the angle ruler in Rafe's design measures 10º. This allows an easy transition from using the wedges in the ruler to using degrees.

As students learn to use the protractor, watch for the following typical difficulties:

- The 0° mark, not the bottom of the protractor, should not be lined up with one of the sides of the angle.
- The hole in the center of the protractor should be lined up with the vertex of the angle.
- The solid black line on the protractor should be lined up on one side of the angle.

- The protractor should be rotated in whatever direction makes it easiest to line up the zero on one of the sides of the angle being measured.
- Make sure the students look at the angle and decide if it is acute or obtuse when deciding which number to read on the protractor. Also, have them 'read up' from one side of their angle to the other as they are measuring. Tell them it is just like starting at zero on a ruler and reading up to the answer.

As students learn to measure an angle with a protractor, sometimes it is necessary for them to extend the sides of a given angle, so that it will be visibly easier to measure. **Changing the length of the sides of an angle does not change the measure of the angle.** To help students see this, draw an angle on the board and have students measure it. Then have a student come up and extend the lengths of both sides of the angle. Ask if they think the measure of the angle has changed. Next, have the students re-measure the angle. Erase part of one side of the angle, so the two sides are of obviously different lengths. Ask them to discuss the effect this has on the size of the angle. They may need to do this several times to understand that the lengths of the sides do not affect the size of the angle.

Background Knowledge

Students should understand the parts of an angle and be familiar with ways to measure angles (angle ruler, wedges, and comparisons).

Task Directions

Part 1

This task can be introduced by reviewing the features of the angle ruler.

To introduce a protractor, begin by asking students to look at their angle ruler while discussing the following questions.

- How can an angle ruler be changed to measure angles even smaller than 1 wedge?
- What would be the advantage in cutting each wedge into 2 wedges? How many total wedges would we have? (18 x 2 = 36 wedges)
- What would happen if we divided each wedge into 3 wedges? How many total wedges would we have? (18 x 3 = 54 wedges)
- Imagine cutting each wedge into 10 wedges. How big would each wedge be? Would those wedges be easy to cut apart? How many total wedges would we have on our ruler? (18 x 10 = 180)
- If we divided each wedge into 10 wedges, how would that change the numbering on our ruler?

Give students a marker they can use on their transparency. Have them change the numbers on their ruler to reflect dividing each wedge into 10 wedges. (Multiply the wedge measure by 10.) Once students have labeled each wedge as a multiple of ten, discuss with students how their angle ruler is the same and how it is different.

Give each student a protractor. Tell students that the tool they were given is called a protractor and is used to measure angles. Explain that the smallest wedges have a special measure. Each smallest wedge has a measure of one degree. (Teachers might need to explain that each mark for one degree would need to be extended to the center point to create a one degree angle. Typically, protractors just use tick marks for one degree increments.) **A degree is like an**

inch or a centimeter; it has an agreed upon size. Ask students how their angle rulers and the protractors are alike? How are they different?

Students should notice there are numbers going in both directions on the protractor but not on the ruler they created. Make sure they discuss why this might be the case. Have them work with a partner to determine how they could use the protractor to measure angles.

Some suggested questions for students to answer while learning to use a protractor include:

- How many degrees would you find in a complete circle? There are 360º in a complete circle. The students can see this by noticing they have half a circle or by putting two of the protractors together to create a whole circle. Another approach would be to add the degrees on each protractor.
- Have students find a right angle on their desks and use their protractor to measure it. How many degrees are in this angle?
    - Based on their understanding that a right angle measures 90°, ask how many degrees will be in an acute angle. Students should remember an acute angle is smaller than a right angle, so an acute angle would be less than 90 but more than 0. (The idea that an acute angle has more than 0 degrees is important.)
    - How many degrees are in an obtuse angle? Because it is bigger than a right angle, it must have more than 90°, but less than 180°. Students may be unclear about a straight line, so be sure this discussion occurs. An angle that has exactly 180º is a straight angle, not an obtuse angle.
    - If there is time, have students experiment with reflex angles, angles whose measures are greater than 180º and less than 360º.
- Use the protractor to measure the angles of Rafe's Design. How are your answers the same? How are they different? The measure of the angles should be the number of wedges times 10. Some students may take this opportunity to try to be more accurate in measuring their angles. The angles are constructed to be multiples of 10, so their answers should be close.

Part 2

Hamster Champs, by Stuart J. Murphy or a similar book about measuring angles using a protractor is one way to introduce the second part of this task.

When students are comfortable using a protractor, let them work in pairs to play "Guess My Angle!" Students will follow the directions below from the "Guess My Angle!" student recording sheet.

Directions

1. Pick up one card at a time; both players use the same card.
2. Estimate the measure of the angle on the card and record it in the chart (right), without letting your partner see your estimate.
3. After you and your partner have written an estimate, use a protractor to measure the angle. Make sure both players measure the angle individually and make sure you both

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4. agree on the angle measure.
5. Each round is scored as follows:
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6. The winner is the player with the most points at the end of five rounds.

Questions/Prompts for Formative Student Assessment

- How are an angle ruler and a protractor similar/different?
- What steps do you take when using a protractor to measure an angle?

Questions for Teacher Reflection

- How do I know students understand the transition from wedges to degrees?
- Are students able to accurately measure angles using a protractor?

DIFFERENTIATION

Extension

- Have students trace pattern blocks on paper and measure the angles using a protractor. Compare the measures of the angles measured with a protractor with those measured with the angle ruler.
- Play STOP! Using a large angle manipulative, give an angle measurement. Move one side of the angle until someone says STOP. If they are within 5 degrees, they win and become the angle manipulator.

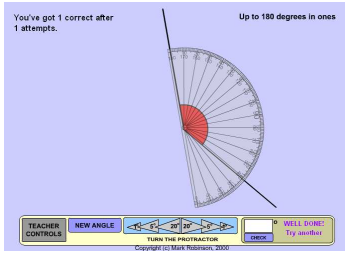
Intervention

- Have students work in pairs, one with an angle ruler and one with a protractor. Give each pair an angle to measure and have them use their own tool, then compare and check results. Switch tools and continue.

TECHNOLOGY CONNECTION

- Explanations and examples angles can be found at www.mathopenref.com
- http://pbskids.org/cyberchase/games/anglemeasurement/anglemeasurement.html A fun game where players use angle measures to point a telescope at different planets.

- http://www.woodlands-junior.kent.sch.uk/maths/shapes/angles.html#angles To demonstrate using a protractor, use "What's My Angle?"



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Guess My Angle! – Playing Cards