Tomb Robbers

Summary

In this activity students will identify benchmark angles as they are embedded into a circle grid.

Materials

For teacher:

    Timer

  - *Tomb Robbers Game Board 1*
    overhead
  - *Using Circle Grids* (overhead)

For each student:

  - *Star Spangled* worksheet
    Angle ruler (or protractor)
    Pencil
  - *Tomb Robbers Game Board 1*
  - *Tomb Robbers Game Board 2*

Additional Resources

Books

  - *What's Your Angle, Pythagoras?*
    , by Julie Ellis and Phyllis Hornung; ISBN 1570911509
  - *Angles Are Easy As Pie*
    , by Robert Froman and Byron Barton; ISBN 069000916X
  - *Key to Geometry: Angles*
    , by Hawley, Suppes, Gearhart, and Rasmussen; ISBN 0913684767
  - *Secret Treasures and Magical Measures: Adventures in Measuring: Time, Temperature, Length, Weight, Volume, Angles, Shapes and Money*
    , by Chris Kensler; ISBN 0743235258
  - *The Greedy Triangle*
    , by Marilyn Burns; ISBN 0590489917

Background for Teachers

The ancient Babylonians established a system for measuring angles in degrees. They set the measure of an angle that completely surrounds a point at 360. This number was likely chosen because the Babylonians used a number system based on 60, or because 360 has many factors. When looking at angles, students may struggle to appropriately measure angles because they are based on the number 360. The benchmark strategy is a useful strategy for students to use when dealing with these abstract concepts. This strategy teaches students useful benchmarks, or reference points, to use when measuring objects. Some common angle benchmarks are 45, 90, 180, and 360. We often talk of benchmark angles. Although students may have difficulty relating to specific angle measures, many students understand what a 180- turn or a 360-turn is in the context of snowboarding. Another common example of angles is seen in the marks on a clock.

In this activity, students identify benchmark angles as they are embedded into a circle grid like the one shown here.

Circular grids are similar to coordinate grids. As with coordinate grids, circular grids are used to identify the locations of points given by ordered pairs. Astronomers often use circular grids to identify objects in the night sky. To locate points on a circular grid, start at the vertex (center), move out the

number of units given by the first coordinate, and then move counterclockwise along that circle the number of degrees indicated by the second coordinate.

Vocabulary terms used in this lesson:

angle - The opening between two straight lines that meet at a vertex, measured in degrees or radians. The sides of an angle are rays that have the vertex as a starting point.

coordinate grid - A two-dimensional system in which the coordinates of a point are its distances from two intersecting, straight lines called axes.

coordinates - An ordered pair of numbers that identify a point on a coordinate plane or grid.

Intended Learning Outcomes

3. Reason mathematically.

Instructional Procedures

Invitation to Learn

Give a *Star Spangled* worksheet to each student. Allow students two minutes to estimate the measure of all of the angles on their page. Show students that angle measurements are usually recorded near the vertex of two lines and labeled with a sign, but do not discuss which objects have angles and which ones do not--allow the students to discover this as they go along. Start the timer.

At the end of the allotted time, have the students put their pencils down and hold a brief discussion on the assignment. Prompt student's thinking with the following questions:

What shapes can you identify and name on this page?
Are there any quadrilaterals on this page (rectangles, parallelograms, etc.)?
Which shapes have angles? Which shapes do not have angles? Why?

Next, demonstrate how to use an angle ruler. Give each student an angle ruler and allow students four to five minutes to check their estimates.

Instructional Procedures

Place students in pairs for this activity. Students may play against a partner or in teams of two.

Display an overhead transparency of the *Tomb Robbers Game Board 1* .

Explain that grid systems do not always have to be square. In fact, astronomers use circular grids frequently.

Explain the rules of play (see *Using Circle Grids* overhead). Play a brief game as a class.

Distribute a *Tomb Robbers Game Board 1* to each team.

Allow teams to play the game several times, using both game boards. Encourage each student to keep a journal entry of his/her strategies.

Have a class discussion about the game. Ask students to report their winning strategies. Focus the discussion on what they have learned about angles. You may want to create a new circular grid with 20-angle intervals (see *Tomb Robbers Game Board 2*) on an overhead and have students tell you how to locate points on it.

Extensions

Students create a 15 benchmark game board. They can use this board to play again or can take them home to play *Four-In-A-Row* with a family member (see family connections).

Family Connections

Use the *Tomb Robbers Game Boards* to play Four-In-A-Row. This game is similar to Tic-Tac-Toe. Before making a move, each player must accurately say the coordinates of a point. They may then

place an "X" or "O." over their point. The first player to get four marks in a row wins.

Assessment Plan
Give an *Angle Summary* worksheet to each student. Ask them to first record their estimates of the angles, then to check their measures using an angle ruler.

Bibliography
Research Basis

Joram et. al., (2005). Children's Use of the Reference Point Strategy for Measurement Estimation. *Journal for Research in Mathematics Education*, 36(1), 4-23.
"Mathematics educators frequently recommend that students use strategies for measurement estimation, such as the reference point or benchmark strategy… Relative to students who did not use a reference point, students who used a reference point had more accurate representations of standard units and estimates of length."

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