Artistic Angles

Summary

Students will learn about angles by using protractors.

Main Core Tie

Mathematics Grade 4
Strand: MEASUREMENT AND DATA (4.MD) Standard 4.MD.5

Additional Core Ties

Mathematics Grade 4
Strand: MEASUREMENT AND DATA (4.MD) Standard 4.MD.6
Mathematics Grade 4
Strand: MEASUREMENT AND DATA (4.MD) Standard 4.MD.7
Mathematics Grade 4
Strand: GEOMETRY (4.G.) Standard 4.G.1

Materials

Chalkboard protractor
10-15 different art prints

For each group:

Transparency sheets
Wax pencil

For each student:

Protractor
- *Angle Wheel* handouts

Protractor transparency
Metal brad
- *Angle Assessment* worksheet

Background for Teachers

Prior to this activity, students should have an understanding of right angle, acute angle, obtuse angle, and vertex.
The size of an angle depends on the opening between the two sides of the angle. Angles are measured in units referred to as degrees and labeled with the symbol.
The size of an angle can be described in relation to a complete circle (360), 1/2 of a circle (180), or 1/4 of a circle (90).
It is important to teach students how to extend rays of an angle when using a protractor. This not only helps them measure but, helps in the construction of angles. It is also important to make sure students understand how to use the interior and exterior numbers on a protractor.
When selecting art prints, try to select a wide variety. See *Art Print Suggestions* for ideas.
Twizzler Pull Aparts or Wikki Stix can be used in place of paper and pencil when constructing angles.
This lesson usually takes about three days to teach and assess.

Intended Learning Outcomes

1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.

Instructional Procedures

Invitation to Learn

Have each student spread out his/her fingers and look at his/her hand. Use the following questions to promote discussion and thinking about angles, "Do you think people with larger hands have larger angles between their fingers?" Take student predictions and explain that at the end of the lesson we will use our class as a sampling to answer the question, "Can you use your fingers to make a 90 angle?" (thumb and index)

Instructional Procedures

Developing "angle sense"

Use foam or fraction circles to help students visualize angle size in relation to a 360 circle. Start with a whole circle, 1/2s, 1/4s, and 1/8s. Add along the way (e.g., 1/4 = 90 so it will take four 1/4 pieces to equal the 360 whole).

- Give each student an angle wheel to help further develop "angle sense." Before moving on, make sure they understand that angles are measured in degrees.
- Allow students to experiment with their wheels, asking them to look for patterns. For example, the larger the angle the greater the measurement in degrees.
- Place students in pairs. Partners take turns displaying an angle while the other partner estimates the measurement of the angle.

Measuring Angles

- Display sets of angles on the chalkboard and ask, "Would the angle wheel be an effective measurement tool to measure these angles?"
- Introduce the protractor using the chalkboard protractor. Be sure to model several examples of measuring angles with a protractor before handing out individual protractors to each student. Explain interior and exterior numbers on the protractor. Show students how to extend rays when necessary for easier measuring. Does extending the rays of the angle change the measurement of the angle? Practice measuring angles in isolation before moving on to measuring angles in the prints. (Math books include such angles and work well for practicing.)
- Place students in pairs or groups of three. Using 10-15 different art prints, each pair/group measures an angle from each piece of art. Record the measurement of an angle from each print, including a description of the object it belongs to, in math journals. Allow each group three to five minutes with each print before passing the print to another group.
    - Numbering each print with a Post-it® note helps make sure each group has a chance to work with all of the prints. It also helps the students organize and record information about the prints in their journals.
    - Use transparency sheets to protect the prints. Sometimes ray extension will be necessary for easier measuring of angles. The students may only write on the transparencies with wax pencils.
- Instruct students to select their choice of prints to answer the following questions in their math journals. They must choose a different print to answer each question.
    - How does the artist use angles to create the overall feel in the piece of art?
    - How does the artist use angles to create depth and/or perspective?
    - Which styles/types of art use sharper, more definite angles?
    - Choose your favorite print. Did the artist use a variety of angles?
    - How did the use of angles affect the feel the piece?

Constructing Angles

- Using the information on how to measure an existing angle, ask students how they could use a protractor to create their own angles. Model angle construction using the chalkboard protractor. For guided practice, have a few students suggest angles for the class to construct. The *Angle Assessment* worksheet may also be used for guided practice.

Students use what they have learned by spreading their fingers apart and measuring the angles between them. This works best when done in pairs. Instruct students to use their protractors, pencil, and paper to neatly measure and construct the angles between two of their fingers. Record and compare data to answer the question posed at the beginning of the lesson.

Extensions

The following extension possibilities work well for students who need extra support:

Use a clock manipulative as an example of angles to help with recognizing different angles in their surroundings.

Start with a straight line (180) and progressively create a new angle every 10. This helps students see the correlation between angle size and the protractor.

The following extension possibilities work well for students who need extra challenges:

Design a perfect circle using a protractor.

Use a protractor to design runs for a ski resort. How will the angles of the more difficult runs compare to the beginner runs?

Use a protractor to design ramps for a skate park. How does the degree of difficulty relate to the measurement of the angle?

Research the relationship between landslides, glaciers, erosion, and slope angles.

Family Connections

Give students a protractor transparency to take home and demonstrate their new skills to their families.

Send family members on an angle scavenger hunt. For example, find something in the house that has an angle measurement between 120 and 140.

Assessment Plan

Have each student choose three to five of the angle measurements they measured and recorded from the art prints. Using the measurements, students construct the angles and include them in their own piece of hand drawn abstract art. Students could also create a piece that uses angles to create the illusion of depth or perspective (refer to M.C. Escher print *Ascending and Descending*). The use of protractors must be incorporated in their art.

Use protractors to complete the *Angle Assessment* worksheet.

Bibliography

Research Basis

Hartshorn, R. & Boren, S. (1990). Experiential learning of mathematics; using manipulatives. Eric Digest #ED321967

This lesson includes the angle wheel because it serves as a concrete representation of angles. Research suggests that incorporating the use of manipulatives in mathematic instruction is "useful in the transition from concrete to abstract taught in steps, semi-concrete to semi-abstract." In this lesson, the angle wheel serves as the concrete and is introduced before moving on to the abstract--measuring of angles on paper.

Gresham, G., Sloan T., and Vinson B. (1997). Reducing mathematics anxiety in fourth grade at risk students. Retrieved January 2, 2005, from Athens Stage College, School of Education Web site: http://www.Athens.edu/vinsobm/research_4.html.

Research also suggests that the use of mathematical manipulatives reduces the level of math anxiety in high risk students.

Lou, Y., Abrami, P.C., Spence, J.C., Paulsen C., Chambers B., & d'Apollonio,S. (1996). Within-class grouping: a meta analysis. *Review of Educational Research*, 66(4), 423-458.

The activities in this lesson plan were designed to be completed in pairs or groups of three. Research on cooperative learning and group work indicates that "small teams of three to four members" are more effective than larger groups. This lesson was created with the intention of maximizing the benefits of cooperative learning.

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