Angles, Degrees, Protractors...Oh My!

Summary

Activities require students to make their own protractor and use it to identify and measure various angles.

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

Group Size

Large Groups

Materials

Invitation to Learn

- Mystery Word

  Scissors

Using a Protractor

- *Label a Protractor*

  Overhead protractor

  Overhead projector

- Math Journal

  Glue

Classroom Protractors

- *Making My Protractor*

  Needle

  Thread

  Scissors

- *What's My Angle*

Additional Resources

Books

Sir Cumference and the Great Kingdom of Angleland: A Math Adventure, by Cindy Neuschander; ISBN-10: 157091169X

Angles (Let's Investigate), by Ted Evans; ISBN-10: 1854354663

Angles are Easy as Pie, by Robert Froman & Byron Barton; ISBN-10: 069000916X

Background for Teachers

The protractor is an instrument of measurement. A protractor is used to construct and measure angles. The simple protractor is an ancient device used for plotting the position of boats on navigational charts. There are different kinds of protractors, but the one used in elementary school is called a simple protractor. We have units for measuring angles and they are called degrees. These are not the same as temperature degrees, even though the same word is used. The simple protractor looks like a semicircular disk marked with degrees, from 0o to 180o.

Angles are formed when two rays intersect. Angles are measured in degrees. A complete circle measures 360 degrees. If you take a circle and cut it into 360 slices, each of those slices is one degree. Why 360 degrees? Historians believe this is because old calendars, such as the Persian Calendar, used 360 days for a year. When they watched the stars they saw them revolve around the North Star one degree per day. This ancient measurement is still recognized today as the measurement of a circle.
To adequately use and understand using a protractor, students need to have background knowledge of the following vocabulary: angle, acute, obtuse, right, straight, reflex, vertex, and arms.
Students in 4th grade need to recognize benchmark angles:
90 degree angle= 14 of a circle
180 degree angle = 12 of a circle
270 degree angle = 34 of a circle
360 degrees = full circle

Intended Learning Outcomes

2. Become mathematical problem solvers.
4. Communicate mathematically.

Instructional Procedures

Invitation to Learn

Place the strip of pre-printed letters on each student's desk. The students will cut the letters apart and manipulate the letters until they figure out what the mystery word is. Instruct students when they discover the mystery word to write it down on a piece of paper and wait for teacher to verify the word.
R C R P T R T O A O (Protractor)
After all students have discovered the mystery word, protractor, introduce the protractor lesson.
Instructional Procedures
Using a Protractor

- The teacher will demonstrate how to read and label a protractor. (overhead protractor).
- Cut out preprinted protractor. Glue in math journal.
- The students will record how to read and label a protractor in their journal.
- Points to label: outer scale, inner scale, center mark and zero- edge.

Cut out the protractor and place in Math Journals. Divide the page into 4 equal sections. Label the sections with the following headings. Review and discuss how to label. Record directions in journal.

Zero-Edge The zero-edge is always at the same level as the 0 mark.	Center Mark The center mark is always at the middle of the zero-edge.
Inner Scale The numbers on the inner edge of the protractor.	Outer Scale The numbers on the outer edge of the protractor.

Classroom Protractors

Fourth grade students generally find it difficult to read and calculate the degree marks accurately. A "homemade" protractor (with a dark thread) helps eliminate this problem. Manipulating the thread to lay on the exact degree, helps the students identify the exact degree on the protractor.
Constructing a Student Protractor

- Cut out laminated protractor.
- Thread needle and tie knot at end.

Bring needle up through the center mark on the protractor. Tape thread securely in place.
Students will manipulate the thread to line up with the angle to be measured.
Use the angle worksheet to practice measuring angles.

To Measure an Angle

Find the center mark on the straight edge of the protractor.
Place the hole over the vertex, or point, of the angle you wish to measure.
Line up the zero on the straight edge of the protractor with one of the sides of angle.
Find the point where the second side of angle intersects the curved edge of the protractor.
Place the thread on the second angle line.
Read the number that is written on the protractor at the point of intersection. This is the measurement of the angle in degrees.
There are two sets of scales on the protractor, an outer scale and inner scale. The degrees start at 0 on the straight edge, each going in opposite directions. The lines are the same so when naming angles make sure you identify which angle is being measured.

Constructing an Angle

Use the straight edge of the protractor to draw a straight line. This line will form one side of your angle.
Find the center hole on the straight edge of the protractor.
Place the hole over one end point of the line you have drawn.
Line up the zero on the straight edge of the protractor with the line.
Make a mark at the number on the curved edge of the protractor that corresponds to the desired measure of our angle. For example, mark at 90 for a 90 degree angle
Use the straight edge of the protractor to connect the mark to the end point of the first line, forming an angle.

Independent Practice

The protractor worksheet *What's My Angle* is given to each student.
Students will classify angles as acute, straight, obtuse or right.
Guide students in measuring various angles.
Record the measurements and type of angle on the worksheet.
Group students in pairs to check each other's work.
Next, on reverse side of worksheet, students will draw 3 angles to be measured by the other student.
Teacher will assess for accuracy.

What's My Name Worth?

How much is a first name worth? Calculate the value of your name by identifying angles. Start this activity by showing the class the "angle price list."
acute angles = 10 cents each
obtuse angles = 8 cents each
right angles = 5 cents each
vertical lines = 3 cents each
horizontal lines = 2 cents each
diagonal lines = 1 cent each
Each student will use the preprinted alphabet to print his/her first name in capital letters.
The student then examines the name for obtuse angles, acute angles, right angles, vertical lines and horizontal lines.
Next the student adds the various amounts and comes up with a total.
Example:

J A N E

5 acute angles @ 10 cents each =	$.50

2 obtuse angles @ 8 cents each =	.16
4 right angles @ 5 cents each =	.20
4 vertical lines @ 3 cents each =	.12
4 horizontal lines @ 2 cents each =	.08
1 diagonal lines @ 1 cent each =	.01
	$1.07

Extensions

Assessment Plan

Students draw and measure angles.
Formal assessment requiring identifying angle type, degrees, and vocabulary.

Bibliography

Research Basis

Van Hiele, P. M. (1999, February). Developing geometric thinking through activities that begin with play. *Teaching Children Mathematics*, 5 (6), 310-316.

"For children, geometry begins with play," writes Pierre van Hiele (1999). He goes on to say that for students to reach the higher levels of geometric thinking, their instruction should still begin with an exploratory phase, gradually building concepts and related language, and culminating in summary activities that help students integrate what they have learned into what they already know."

Ernest, P.S. (1994). *Evaluation of the effectiveness and implementation of a math manipulatives project*. (Report No. SE-057 682). Nashville, TN: Annual Meeting of the Mid-South Educational Research Association. (ERIC Document Reproduction Service No. ED 391 675).

The purpose of manipulatives would be to allow students to learn a geometric principle in more than one way. In other words, instead of just hearing about a math principle, they also get to see and feel it. The study confirms that students are more willing to participate, and experiment in math projects. Their attitudes towards math improved, thus raising their self-confidence in their math ability.

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