

Grade Band: 3-5

Lesson Length: Approximately 2 days

NCTM Standard and Expectation

Geometry Standard

1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
2. Use visualization, spatial reasoning, and geometric modeling to solve problems

Measurement Standard

1. Understand measurable attributes of objects and the units, systems, and processes of measurement
2. Apply appropriate techniques, tools, and formulas to determine measurements

Learning Objectives

1. The student will analyze and measure angles using a protractor.
2. The student will identify angles as right angle, acute angles, and obtuse angles.
3. The student will build and draw right, acute, and obtuse angles.

Connection to Bloom's Taxonomy

- ✓ Comprehension
- ✓ Application
- ✓ Analysis
- ✓ Synthesis

RG's Literary Connection



Sir Cumference and the First Round table: A Math Adventure by Cindy Neuschwander is a hilarious tale with a Geometry twist. Take your students back in time with King Arthur and his search for the perfectly shaped table. You'll be introduced to Sir Cumference, the mighty knight, and his lovely wife, Lady Di of Ameter. They are aided by their son Radius and the carpenter Geo of Metry in their pursuit of the first round table. An excellent conceptual book that introduces difficult geometry terms such as circumference, radius, and acute in a fun and humorous setting.

Word Origin by Hannie



Geometry is from the Latin word *geometria* and the Greek word *geometria*, both with the same spelling, which means "measurement or measure of earth or land." The prefix, *geo* or *ge* means "earth or land" plus *metria*, which means "to measure." *Geometry* is the study of mathematics that deals with the properties and relationships of lines, angles, points, surfaces and solids.

Vocabulary Words



1. Vertex – the meeting point of two lines or rays.
2. Right angle - has an exact measurement of 90 degrees.
3. Acute angle - has a measurement between 0 and 90 degrees.
4. Obtuse angle - has a measurement between 90 and 180 degrees.
5. Protractor - a tool used to measure angles.

Learning Model Component

- ✓ Making Connections
- ✓ Exploring and Learning
- ✓ Extended Learning and Practice
- ✓ Assessment
- ✓ Closure

Teaching Strategies

- ✓ Brainstorming
- ✓ Guided Practice
- ✓ Paired Learning
- ✓ Demonstration

Materials List

- ✓ Protractor
- ✓ Pencils
- ✓ Angle Facts
- ✓ Angle Worksheet
- ✓ Angle Worksheet Key
- ✓ Toothpicks
- ✓ Glue
- ✓ Construction paper
- ✓ Assessment of Student Progress
- ✓ Index Cards
- ✓ Crayons or colored pencils

Measuring Angles

Making Connections

Angles are a very important concept in geometry though they are not often thought about in our daily lives. However, angles impact our lives in more ways than we think. Explain to students that we all use angles without even realizing. Ask students to brainstorm how angles are used in the world around us. Create a list from the brainstorming session.

Discuss the following questions:

1. How do people in various professions use angles to complete their work?
2. How do all people use angles in their everyday lives?
3. How do you (as a child/student) use angles?

Some possible ideas include the following:

- A baseball player moves across the field at various angles to catch a ball
- A football player throws a pass at the correct angle for a receiver to catch the ball
- When parking a car a driver uses the concept of angles to park in a particular space, especially when parallel parking
- A pilot maneuvers an airplane using a variety of angles to fly and land
- A contractor uses angles to build a house, a school, or any structure
- A cook holds a knife at various angles to chop and prepare foods
- A child uses angles to build a skateboard ramp or a bike jump
- A child skis or sleds at various angles to complete a downhill run
- A nurse adjusts a bed to create an angle that is comfortable for a patient
- A student places books on a shelf at a slight angle to prevent them from tipping over
- Umbrella's can be tilted at an angle in order to stop rain or provide shade

Exploring and Learning

1. Take the students on a walk around the school, both inside and outside. Have students work in pairs to identify and list angles they see in and around their school. The list may include the following: bike wheel spokes, pizza slices, clothing hangers, binders, hands of a clock, a playground slide, an open door, door stopper or wedge, chair, and even a pencil is held at an angle when used for writing.
2. Gather the class and ask each team to share two examples of angles. Create a class list of angles on the board, flipchart, or overhead.

3. Next, provide each student with a copy of Angle Facts. Guide students through each bullet on the worksheet. Draw examples of a straight line, right angle, acute angle and obtuse angle on the board or overhead.
4. Have students create vocabulary index cards with drawings and definitions for each of the bolded words on the worksheet; vertex, degrees, right angle, obtuse angel, and acute angle.
5. Direct student attention back to the class list generated in #2, above. Ask if there are any right angles on the list? Most likely students did not identify right angles. We tend to forget that a straight corner measuring 90 degrees is actually an angle. Instruct students to look around their classroom and identify at least five right angles. Items might include a + television screen, computer monitor, calendar, book, window, and folder. This step can be repeated using acute angles and obtuse angles.
6. Present students with the following scenario:



RG and Hannie are working at the Raymond Geddes Elementary School Store. They are setting up a new sales display that includes several different math tools which includes rulers and protractors. RG and Hannie are not familiar with a protractor. "What is a protractor, ask RG?" Can you help RG and Hannie solve some problems using a protractor?

7. To help complete the scenario, ask students to define a protractor. Explain that a protractor is a tool used to measure angles. Ask the students if they have seen or used a protractor before?
8. Next, pair students together and provide each group with a protractor. Instruct students to make a list of observations based on the physical appearance of the protractor. Create a class list of observations by allowing each group to share 1 or 2 observations. The list may include the following:

- It is shaped like a semi circle (although some protractors can be a full circle)
 - It looks like a ruler
 - It has numbers labeled from 0 to 180
 - There are two rows or scales of numbers
 - The upper scale starts with 0 on the left side and increases to 180 on the right
 - The lower scale starts with 180 on the left side and decreases to 0 on the right
 - The upper scale measures angles with openings on the left ($>$)
 - The lower scale measures angles with openings on the right ($<$)
 - The protractor is clear so that the angle can be seen and measured accurately
9. Demonstrate how a protractor is used. Draw an angle on an overhead transparency or the board. Align the straight edge of the protractor along the bottom of the angle. Align the center of the protractor at the vertex of the angle. Use the scale to measure the angle accordingly.
10. Pair students together and provide them with a copy of [Angle Worksheet](#) . Instruct students to use a protractor in order to find the angle degree and the type of angle. Students can refer to the [Angle Facts](#) worksheet for help in identifying the types of angles.
11. Additional measurement and angle identification can be done by having students create angles out of toothpicks. Angles can be created out of simple toothpicks and glued to construction paper creating a sheet of angles. Students can exchange angle sheets and then measure each angle with a protractor, record the measurement in degrees, and identify the angle.
12. Using the toothpick models, ask students to identify some objects that might resemble or contain each of the angles created. For example, a rectangle end table contains right angles at the corners, a recliner set back might resemble an obtuse angle, and the beak of bird may look acute.
13. Provide students with crayons or colored pencils to turn the toothpick models into images and drawings. Display the creative work of your students.

Extended Learning and Practice

1. Discuss another measuring tool called the geometric compass. The school store might even have these for sale. Have students research who invented the geometric compass and its purpose. They will learn that the geometric compass was invented by Galileo and is a tool used to create a perfect circle.
2. Visit *Mathisfun* <http://www.mathsisfun.com/geometry/index.html> for additional information about angles and protractors. This site has an animated tutorial on how to use a protractor for measuring angle. Most angles can be defined as right, obtuse, or acute. Using the *Mathisfun* website, locate the name of an angle that is exactly 180 degrees (straight angle) and one that is greater than 180 degrees (reflex angle).

Assessment

The lesson objectives can be assessed by evaluating Angle Worksheet with Angle Worksheet Key. Use the Assessment of Student Progress to assess students' overall abilities to meet the lessons learning objectives which include identifying, drawing, and building various angles.

Closure

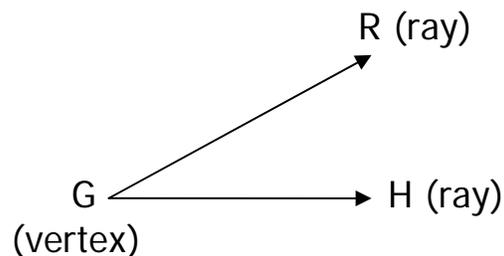
Provide each student with an index card and have them answer the following questions on one side of the index card:

1. Describe two new things that you have learned.
2. What else would you like to learn about this topic?

On the back side of the index card, instruct the students to draw a picture of something they learned about during this lesson. The index cards can be hole punched and held together with a simple shower curtain ring.

Measuring Angles Angle Facts

- Angles are formed when two lines or rays meet. (A line connects two points and can go on forever in two directions. A ray has one endpoint and can go on forever in one direction.)
- The meeting point of two lines or two rays is called the **vertex**.



- Angles are measured in units called **degrees**. Angles can range in size between 0 and 180 degrees. (Remind students that a straight line is 180 degrees.)
- There are three major categories of angles: **right angle**, **obtuse angle**, and **acute angle**.
- A **right angle** has an exact measurement of 90 degrees.
- An **acute angle** has a measurement between 0 and 90 degrees.
- An **obtuse angle** has a measurement between 90 and 180 degrees.
- Angles are named either by the one letter assigned to the vertex ($\angle G$) or by three letters with the vertex as the center letter and the remaining two letters denoting the lines or rays ($\angle RGH$) of the angle.



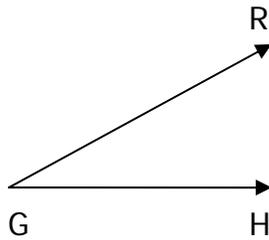
Measuring Angles

Angle Worksheet

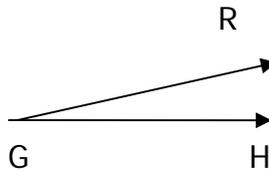
Name: _____

Part I

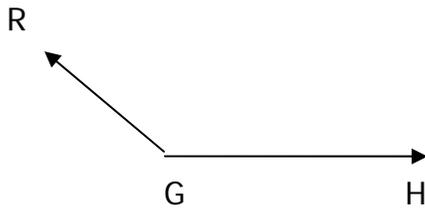
Help RG and Hannie measure the following angles. Record each measurement in degrees. Identify each angle as an acute, obtuse, or right angle.



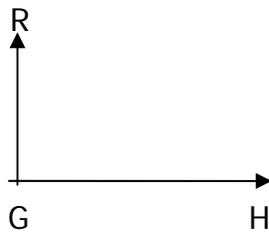
Measurement: _____ Type of Angle: _____



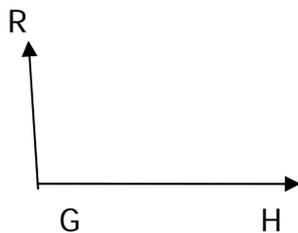
Measurement: _____ Type of Angle: _____



Measurement: _____ Type of Angle: _____



Measurement: _____ Type of Angle: _____



Measurement: _____ Type of Angle: _____



Measuring Angles

Angle Worksheet

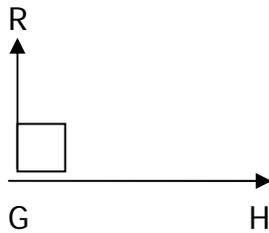
Part II

The right angle RGH has a measurement of 90° . Divide the angle in half by drawing a ray from the G Vertex and label it S.

What is the measurement of the RGS angle?

What is the measurement of the SGH angle?

Explain how you know your answers are correct.



Measurement of \angle RGS: _____

Measurement of \angle SGH: _____

Explain: _____

Part III

1. A truck is climbing a hill with a 15 degree grade. The grade is the pitch or steepness of the road. Draw a picture of the hill using your protractor.

2. A pizza is a circle. A circle measures 360° . Assume the center of the pizza is the vertex. Divide the pizza into four equal slices.

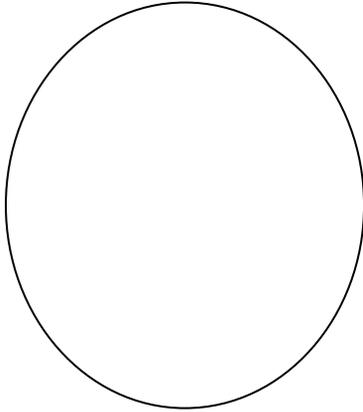
What is the measurement of each angle?

What types of angles are created?

Explain how you know your answer is correct.



**Measuring
Angles
Angle Worksheet**



Measurement of each angle: _____

Type of angles: _____

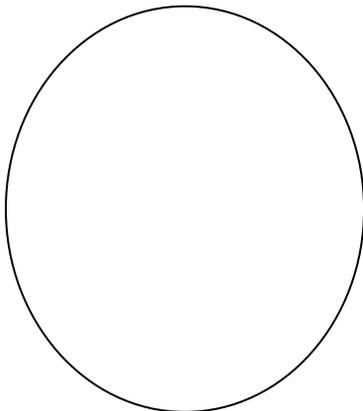
Explain: _____

3. Divide another pizza into six slices with the center as the vertex.

What is the measurement of each angle?

What types of angles are created?

Explain how you know your answer is correct.



Measurement of each angle: _____

Type of angles: _____

Explain: _____

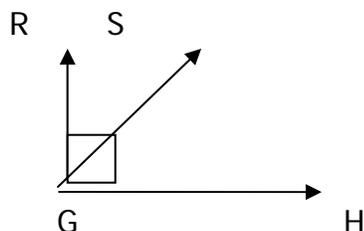
Measuring Angles

Angle Worksheet Key

Part I

1. Measurement: **30°** Type of Angle: **acute**
2. Measurement: **12°** Type of Angle: **acute**
3. Measurement: **135°** Type of Angle: **obtuse**
4. Measurement: **90°** Type of Angle: **right**
5. Measurement: **92°** Type of Angle: **obtuse**

Part II



Measurement of $\angle RGS$: **45**

Measurement of $\angle SGH$: **45**

Explain: **The sum of angles RGS and SGH totals 90° with the exact measurement of a right angle.**

Part III

1. Accept all reasonable drawings
2. Measurement of each angle is 90°
Type of angles is right angles
Explain: The sum of the angles 4 slices \times 90° is equal to 360°
3. Measurement of each angle: 60 degrees
Type of angles: acute angles
Explain: The sum of the angles 6 slices \times 60° is equal to 360°

Use the following summary to assess a student's abilities and performance throughout the lesson. Share this assessment with students at the start of the lesson so that students will understand how they will be assessed prior to beginning the Exploring and Learning section. The tool can be used as a basis for providing feedback to students. Use the scale below to score each of the following items:

Making Connections:

_____ Student participates in discussion by offering answers to one or more of the questions asked by the teacher.

Exploring and Learning

_____ Student works with partner to identify and list examples of angles found inside and outside the school.

_____ Student participates in discussion sharing angle examples.

_____ Student participates in discussion identifying some major features of a protractor.

_____ Student works with partner using a protractor to measure and identify angles as right, acute, and obtuse angles in problem #1 of the worksheet.

_____ Student solves additional angle problems and understands concepts regarding angle measurements in problems #2-5 of the worksheet.

_____ Student creates angles using toothpicks to build two-dimensional models representing right, acute, and obtuse angles.

SCALE

4 – Excellent

Student completes the activity, task or assignment with no errors and demonstrates mastery of concepts and/or lesson objectives.

3 – Good

Student completes the activity, task, or assignment with few major errors and demonstrates an understanding of the concepts and/or lesson objectives.

2 – Fair

Student completes the activity, task, or assignment with some major errors and demonstrates difficulty with the concepts and lesson objectives.

1 – Poor

Student does not complete the activity, task, or assignment and demonstrates no understanding of the concepts and/or lesson objectives.