



## THE ANGLE OF VISION

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**Subject Matter: Mathematics – Geometry**

**Grade Levels: 8-12**

**Time Allotment: Three 50-minute class sessions**

**Master Teacher: Sharon Porter**

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### Overview

In this lesson, students will learn the definitions of ray and angle and then the classification of angles based on the degrees they represent. Using digital cameras, students will photograph objects or scenes representing the angles and produce a poster of the photographs. The photographs will be labeled with the degrees and the correct characteristics of each angle.

### Learning Objectives

Students will be able to:

- Identify and define a ray and an angle with these classifications: obtuse, acute, right, straight, congruent, interior and exterior.
- Measure angles, label them and identify their classifications.
- Identify and label angles in everyday life using common objects and landscapes.
- Produce a poster of digital photos with correct labeling of the angles found.

### Oregon Standards Available at:

<http://www.ode.state.or.us/cifs>

### Mathematics – Geometry

Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.

#### Properties and Relationships

- Determine defining properties that characterize classes of triangles including side and angle measurements and their component parts (e.g., angle bisectors, altitudes, medians).
- Determine the measures of corresponding angles, sides and corresponding parts, congruent and similar figures.



## Media Components

### Video

Check the link at <http://www.opb.org/edmedia/trs/> to find access to the video(s) from unitedstreaming™ referenced in this lesson plan.

- “History in Focus: 1960-1969 (57:11)
  - **Clip:** “Sports and Games” (01:32)
- “Many-Sided World of Geometry, The, Program 1: Geometry Basics” (26:00)
  - **Clip:** “Part Two: Angles - Section A - Angles Defined” (05:50)
- “Many-Sided World of Geometry, The, Program 2: Angles 101” (26:00)
  - **Clip:** “Review: Geometry Basics” (04:12)

### Web

- **Exploring Angles (Glencoe textbook)**  
Review of angle definition and characteristics (for teacher use).  
<http://www.e-zgeometry.com/class/class1/1.6/1.6.htm>
- **StudyWorks Online! Folding Tape**  
An interactive site that helps predict the angle when you fold a piece of tape.  
[http://www.studyworksonline.com/cda/content/applet/0.,NAV2-21\\_SAP561.00.shtml](http://www.studyworksonline.com/cda/content/applet/0.,NAV2-21_SAP561.00.shtml)
- **Types of Angles**  
This interactive site allows students to check their understanding of the definitions of obtuse, acute, corresponding, adjacent, and interior and exterior angles.  
<http://www.utc.edu/~cpmawata/geom/geom1.htm>
- **Introduction to Angles: Concentration Game**  
This interactive Web site allows students to play *Concentration* with the characteristics of angles and their definitions.  
<http://www.quia.com/cc/65822.html>
- **Angles, Angles Everywhere Activity Sheet #3**  
An activity sheet that helps students identify and measure angles.  
<http://www.scetv.org/ntti/lessons/1998lessons/activities/anglesanglesA3.html>
- **Geometry**  
A handout for practice in measuring angles.  
<http://members.aol.com/tts009/downloads/Geometry2.html>

- **Poster Scoring Guide**  
A rubric for assessing poster presentations.  
[http://www.bcpl.net/%7Esullivan/modules/tips/rubrics\\_sec/poster.html](http://www.bcpl.net/%7Esullivan/modules/tips/rubrics_sec/poster.html)
- **Range of Motion for Athletes**  
Exercises for measuring range of motion in athletes.  
<http://www.orthop.washington.edu/arthritis/living/exercise/03>

## Materials

### Per Student:

- Blank paper
- Pencil
- Protractor
- Handout: What's Your Angle? Definitions (located at end of lesson plan)
- (if necessary) Handout: Activity Sheet #3: Angles, Angles Everywhere found at <http://www.sctv.org/ntti/lessons/1998lessons/activities/anglesanglesA3.html>
- Handout: Geometry found at <http://members.aol.com/tts009/downloads/Geometry2.html>
- Computer with Internet connectivity (doubling up would also work)
- Handout: Review of Angles and Their Definitions/Photo Shoot Storyboard (located at end of lesson plan)

### Per Class and/or Group:

- Digital camera with floppy or storage card
- Poster board
- Scissors and paste
- Access to a color printer (Black and white will work, though.)
- Computer with network connectivity for downloading images from the camera
- Camera drivers (if necessary) on computers
- Protractors and pencils
- Markers and drawing materials
- Poster scoring guide found at: [http://www.bcpl.net/%7Esullivan/modules/tips/rubrics\\_sec/poster.html](http://www.bcpl.net/%7Esullivan/modules/tips/rubrics_sec/poster.html)

## Prep for Teachers

When using media, provide students with a **Focus for Media Interaction**, a specific task to complete and/or information to identify during or after viewing of video, Web sites or other multimedia elements.

Make a copy of the Review of Angles and Their Definitions/Photo Shoot Storyboard handout for each student.

**Session 1:** Bookmark all Web sites and download video clips. Preview them for specific points you will use to teach students about the types of angles and their vocabulary. Schedule the computer lab or mobile lab and allow one computer per group. Check for the availability of printers for those computers. Check to see if the proper Windows Media Player is installed on the demonstration computer you will use for instruction. Make sure that this computer can be connected to a projector or a large-screen monitor for large-group instruction. Depending on the readiness of the students, you may need to review/instruct them on how to measure angles with protractors. A protractor made for overhead projectors or an opaque overhead projector like an Elmo projector can aid in this instruction.

**Session 2:** Make sure drivers for the digital cameras are installed on the corresponding computers. Charge all cameras. If handhelds are used, make sure docking cables are available at each computer station for downloading pictures.

If possible, ask another adult to help manage students during the photo shoot as the student groups will finish at different times. Some groups will move back into the computer lab/classroom/library (the scene of instruction for Session 2) to download photos to the computer for printing while other groups are finishing up outside.

**Session 3:** Depending on the ease of the use of the cameras and their software, and the computer savvy of the students involved, Session 3 may be necessary to finish up the poster project. In this session, you will also need the computer lab or enough computers for every two students. Bookmark the interactive Web site:

<http://www.quia.com/cc/65822.html>

## Introductory Activity

**Step 1:** Start out the lesson by sharing this quotation from Ralph Waldo Emerson: “What is life but the angle of vision? A man is measured by the angle at which he looks at objects. What is life but what a man is thinking of all day? This is his fate and his employer. Knowing is the measure of the man. By how much we know, so much we are.”

Ask students, “What is Emerson talking about?” (Answers may vary, but look for a way to progress to angles in a physical visual sense – not the metaphysical sense.) “What other kind of way can we look at angles?” Ask the students if any of them have played pool or putt-putted. When they respond, ask them if they can name a skill that may help them improve in those two activities. (Answers will vary. Look for a response that can lead to determining the path of the ball, such as using angles of the pool table or the lay of the rough.) Then say, “Let’s look at the part angles play in professional sports.” **View** the clip, “Sports and Games” (01:32), from the video, “History in Focus, 1960-1969”

(57:11). As a **Focus for Media Interaction**, have the students sketch the different angles related to baseball, football, hockey, basketball and golf that they observe in the video clip.

**Step 2:** After viewing the video clip, have students share answers. (Possible answers are: In baseball, angles are to be taken into account for pitching (ball and strikes), foul balls and throwing to bases. In golf, putting depends on angles. To score a goal in hockey, angles put the puck into the goal. Successfully rebounding a basketball depends on the angle the basketball leaves the hoop. In football, the angle of a throw determines the trajectory.)

**Step 3:** Continue the discussion by applying angles to occupations and activities. What jobs use angles? (Planing timber, sewing, lighting technicians for theaters, etc.) (15 minutes total)

## Learning Activities

### Session 1

**Step 1:** To familiarize the students with the vocabulary and provide a **Focus for Media Interaction**, distribute the What's Your Angle? Definitions handout and direct the students to fill in the definitions as they hear them on the video clip with sketches or words that will help them remember the angles' characteristics.

**Step 2:** **Play** the video clip, "Part Two: Angles - Section A - Angles Defined" (05:50), from the video, "The Many-Sided World of Geometry, Program 1: Geometry Basics" (26:00). **Play** it through once in its entirety. Then **play it again** and **pause** after each definition so students can take notes and make sketches on their handouts.

**Step 3:** (if necessary) Instruct students in how to measure angles using a protractor. Use the Activity Sheet #3: Angles, Angles Everywhere handout found at <http://www.sctv.org/ntti/lessons/1998lessons/activities/anglesanglesA3.html>.

**Step 4:** If instruction is not necessary in measuring angles, have students practice naming angles as obtuse, acute and right angles using the Geometry handout found at <http://members.aol.com/tts009/downloads/Geometry2.html>.

**Step 5:** As a **Focus for Media Interaction**, have the students practice identifying angles by going to the Web site, "Types of Angles," found at <http://www.utc.edu/~cpmawata/geom/geom1.htm>. It is best if there is at least a two-to-one ratio of students to computers for this activity. Review with the students the first half of the page. This site demonstrates the point at which an acute angle becomes an obtuse angle. Stop the applet on the Web page at 89 degrees and ask the students, "What happens when the measurement becomes 90 degrees? What about 91 degrees? What

about 180 degrees?” Have the students then explore the following applet and identify 10 other angles as obtuse, right, straight or acute. Have them note the angle measurements and their answers on the Gathering Sheet handout located at the end of this lesson plan. Return as a whole group to the Web site for an applet demonstration of complementary and supplementary angles. Have the students return to their Gathering Sheet handouts and draw complementary and supplementary angles.

**Step 6:** For the last five minutes of class, have students go to the interactive Web site, “Folding Tape,” found at [http://www.studyworksonline.com/cda/content/applet/0,,NAV2-21\\_SAP561,00.shtml](http://www.studyworksonline.com/cda/content/applet/0,,NAV2-21_SAP561,00.shtml). Using the java applet, have students demonstrate right, obtuse and acute angles in that order. The “open” button will open the tape to a flat plane. Hints 1 and 2 label the angles and the “init” button allows you to manipulate the vertex of the folding tape.

## Session 2

**Step 1:** It is now time for students to review the terms and definitions before applying this information to real-life situations. As a **Focus for Media Interaction**, have the students use the Review of Angles and Their Definitions/Photo Shoot Storyboard handout and match the terms to the definitions as they view the video clip, “Review: Geometry Basics” (04:12), from the video, “Many-Sided World of Geometry, The, Program 2: Angles 101” (26:00). **Cue** the clip starting halfway through to the part about angles (a blonde girl is speaking). **Play** the video clip. Share answers, especially the terms not covered in the clip: obtuse, acute, straight and right angles.

**Step 2:** Ask the students to see if they can detect angles around the classroom. (Answers will vary. Ask for the correct terms. Example: “Yes. There is a right angle where the desk meets the legs under the desk.” “The flag comes from the wall in two supplementary angles — one above the flag pole and one below.”) Tell the students that they will be divided into groups of four and that their job is to go out in the Commons or outside area (one that can be monitored) to snap five pictures of angles. The shots can be landscapes and close-ups. Each group should find a variety of angles with no two angles alike. Share the scoring guide you will use for the group poster that will result from the photo shoot. It is found at: [http://www.bcpl.net/%7Esullivan/modules/tips/rubrics\\_sec/poster.html](http://www.bcpl.net/%7Esullivan/modules/tips/rubrics_sec/poster.html).

**Step 3:** Have each student in the group select a job. Each group should have a spotter who defines the shot used from suggestions by the group, a cameraperson, a recorder of the shots and a person who docks and downloads the shots from the camera to the computer.

**Step 4:** When the group returns to the instruction area, the spotter can retrieve the photos from the printer, the recorder can do the cutting and pasting of the printed photos to the poster board and all group members can measure and label the angles on their poster.

**Note:** It is helpful to have another adult remain behind in the photo shoot area to manage

students while the teacher returns to the classroom when a majority of students are ready to download their photos.

**Step 5:** Each group should turn in a completed poster with the scoring guide attached. The members of the team will sign their poster for assessment.

### Session 3

**Step 1:** If necessary, groups should finish the posters they began the day before. When students finish their posters, direct them to visit <http://www.quia.com/cc/65822.html> to play a Concentration Game based on angles and their definitions. Instruct the students in how to click on the images to reveal the terms and definitions. As a **Focus for Media Interaction**, while playing the game students will record their scores and times of their matching activity. Instruct students to play at least twice to see if they can “best” their score.

**Step 2:** Move on to the Culminating Activity when all groups have completed their posters.

### Culminating Activity

Have each group present their poster to the class and ask the class to try to identify other angles in each photo. Refer back to Emerson’s quotation: “What is life but the angle of vision? A man is measured by the angle at which he looks at objects.” The posters may be rotated to see a different angle. Ask the students if rotating a view produces a complementary or supplementary angle. Students will display their group posters in the Commons area or in a hallway to provide an informative piece to share with others in the learning community.

### Cross-Curricular Extensions

#### Health and Physical Education

- When studying angles, students can determine the role of range of motion in athletics and physical health. Students could measure angles of these motions by using the exercises found at this Web site:  
<http://www.orthop.washington.edu/arthritis/living/exercise/03>
- A dance instructor can demonstrate the angles by teaching an Irish dance.

**History and Social Studies**

- The students can investigate the angles used in strategic battle plans and how angles were used in building famous structures.

**English and Language Arts**

- Using Emerson's quotation for inspiration, students can write a narrative piece on an incident from two observers' vantage points.
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**Community Connections**

- Guest speakers can be invited to speak to the students about the use of angles in their work. Physical therapists may talk about range of motion, builders about angles in construction, lighting technicians in placing illuminations for plays, clothing designers about angles in clothing construction and manufacturing, bicycle technicians on the strength of angles in various designs of bicycles or landscapers in laying out gardening designs.

Your Name \_\_\_\_\_ Today's Date \_\_\_\_\_

## What's Your Angle? Definitions

**Angle**

**Ray**

**Vertex**

**Interior point**

**Exterior point**

**Naming angles**

**Congruent angles**

**Acute**

**Right**

**Obtuse**

**Straight**

\_\_\_\_\_

**Adjacent angles**

**Complementary angles**

**Supplementary angles**

\_\_\_\_\_

**Vertical angles**



Your Name \_\_\_\_\_ Date \_\_\_\_\_

**Gathering Sheet for “Types of Angles” Interactive Web Site**found at <http://www.utc.edu/~cpmawata/geom/geom1.htm>

Click on the “Go” and then “Stop” buttons in the first applet on this Web page to see examples of acute angles and obtuse angles. After reviewing those angles, go to the next gray box below that on the Web page and record the degrees you see in the white box by the number 1 below. Decide if it is an obtuse or acute angle and record your answer on this sheet. Check your answer against the answer on the Web page. Do this four more times for this section of the paper. Circle the type of angles that you correctly identified the first time. No erasers allowed!

	Measurement	Type of Angle
1.		
2.		
3.		
4.		
5.		

*Draw a complementary angle diagram. Remember to label the measures of the angles.*

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*Draw a supplementary angle diagram. Remember to label the measures of the angles.*

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## Matching Exercise – Review of Angles and Their Definitions

### Adjacent

two angles whose sum is  $90^\circ$

### Complementary

two angles that have the same measure

### Supplementary

an angle whose measure is EXACTLY 180 DEGREES

### Vertical

an angle whose measure is GREATER THAN 90 AND LESS THAN 180 DEGREES

### Congruent

two angles whose sum equals 180 degrees

### Acute

formed by two rays which begin at the same point

### Right

an angle whose measure is LESS THAN 90 DEGREES

### Straight

an angle whose measure is EXACTLY 90 DEGREES

### Obtuse

are side by side and have a common vertex and ray

### Photo Shoot “Storyboard”

Shot number	Location/Object
1.	
2.	
3.	
4.	
5.	

Your Name/Group: \_\_\_\_\_

Camera used: \_\_\_\_\_

Computer station used: \_\_\_\_\_