Title: Angling for Fitness

Brief Overview:

This learning unit integrates geometric problem solving with real-world application. This unit will involve the mathematical skills of investigating and measuring right, obtuse, acute, and straight angles. Students will use these skills to complete a performance-based project in which they will design a fitness trail that meets specific standards.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate the ability to solve problems by successfully designing a fitness trail. Students will be required to construct specific angles and identify polygons to complete their fitness trail.

- **Mathematics as Communication**
  Students will use oral, graphic, and written skills to communicate mathematical ideas.

- **Mathematics as Reasoning**
  Students will demonstrate the ability to reason mathematically. They will make choices within given parameters, use spatial sense to design the fitness course, and justify their responses.

- **Mathematical Connections**
  Students will make connections between the real world and the activities in this learning unit. Students will be able to integrate the areas of health, language arts, and art into this task.

- **Estimation**
  Students will demonstrate the ability to apply estimation strategies in measuring angles.

- **Geometry and Spatial Sense**
  Students will demonstrate their ability to use geometric concepts in relation to angles using appropriate mathematical tools. Students will visualize and represent geometric figures with attention to spatial sense. They also will solve this task using a geometric model which will develop an appreciation of geometry as a method of describing the physical world.

- **Measurement**
  Students will demonstrate their ability to apply concepts of measurement using appropriate mathematical tools to estimate and verify the measurements of their fitness trail. They will apply measurements to an interdisciplinary and real-world problem-solving situation.

Grade/Level:

Grades 4-6

Duration/ Length:

3 to 4 classroom sessions

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Recognition of polygons such as triangle, square, rectangle, hexagon, pentagon, octagon
- Measurement techniques
- Drawing to scale for extension activity
- Identification of vertices on polygons

Objectives:

Students will:

- identify, define, measure, and construct angles.
- select appropriate units and tools to measure to the degree of accuracy required in a given situation.
- work cooperatively with partners.

Materials/Resources/Printed Materials:

- Protractor
- Ruler
- Scissors
- Grid paper
- Butcher paper
- Markers
- Angles Are Easy As Pie, by Robert Froman
- Mini-chalkboards (optional)
- Construction paper (optional)

Development/Procedures:

Day 1

- Access students' prior knowledge of angles using the placemat strategy. (Teacher Resource 1)
- Discuss and display students' placemats. Elicit responses to develop a definition of an angle. (An angle is defined as two rays that meet at a vertex.)
- Read Angles Are Easy As Pie by Robert Froman, or any other appropriate text, that illustrates the real-world application of angles. Have students identify angles within the classroom.
- Distribute Student Resource 1. Have students cut the cards apart, then classify them according to the type of angle in the picture. Discuss and name the four types of angles: acute, right, obtuse, and straight. Label each angle accordingly.
- Assess students' knowledge of angles in one of the following ways: drawing each type of angle on a mini-chalkboard, using arm motions to form the angles, sitting on the floor using body motions to form the angles, tracing with shaving cream, or using sand in a shoe box.

Home Extension

- Have students find and label, at least, two of each type of angle around their home. Have students compile their data in either chart or table form.

Day 2

- Discuss and share previous night's homework.

- Demonstrate the proper use of a protractor. Refer to Teacher Resource 2 for an explanation on the rubber band technique of measuring angles.
- Provide time for students to experiment with protractor and rubber band.
- Assess students' ability to measure angles by distributing Student Resource 2. Students will complete the first portion of this resource.
- Have students share their findings on an overhead. Allow time for discussion and understanding of the concept.
- Demonstrate how to construct an angle using the overhead or chalkboard.
- Assess this ability to construct the angles by allowing students time to complete the second part of Student Resource 2.

Home Extension
- Distribute Student Resource 3.

Day 3
- Discuss and share previous night's homework.
- Project Student Resource 4. Have students identify the angles they see. Measure angles. (Note: Depending on the ability of the students, the teacher may choose to allow students time to discover how to measure the angles along the trail, or the teacher may choose to demonstrate the proper procedure in measuring the angles.) Using different color transparency markers is helpful.

Performance Assessment:

You have been learning how important it is to exercise regularly and to keep physically fit. Your PE teacher has asked you to design a fitness trail with exercise stations for the school so that students could use it during recess or after school. The PE teacher would like you to use these exercises in the trail: sit-ups, push-ups, jumping jacks, deep knee bends, touch toes, and arm circles. You think that this is a great idea to get the school involved in a physical fitness program.

TASK 1: Using grid paper, design a fitness trail that meets the following criteria:
- Include 2 right angles.
- Include at least 2 acute angles.
- Include at least 2 obtuse angles.
- Connect the above angles with as many straight angles as needed to complete the trail.

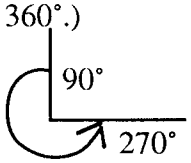
TASK 2: You realize that you will need signs for each exercise station. Place a different polygon sign at each angle's vertex to indicate a station. The polygon should state the specific exercise that will be done at that station. The number of vertices of the polygon will indicate the number of times each exercise will be performed.

Example:
Use a rectangle. This would be four sit-ups because there are four vertices in a rectangle.

TASK 3: Write a set of directions to explain how to use the fitness trail. Organize your thoughts using a sequence chain, then write a final copy in narrative form.

Extension/Follow Up:

- Make 3-D models using salt dough or sand.
- Make brochures advertising their fitness trail.
- Write a persuasive letter to the principal to get permission to make the trail
- Write persuasive letters to area businesses soliciting materials to make the trail.
- Use Microworld computer program to put the trail on the computer using LOGO.
- Use pattern blocks for additional practice with angles.
- If trail is built, graph personal growth or time individuals on the course.
- As a G/T component, include the measurement of a reflex angle. (A reflex angle is one that is greater than 180° and less than 360°.)



- Use the AIMS resource, Finding Your Bearings, pp.81-86, to incorporate orienteering which uses a 360° compass.
- Make the fitness trail 1320 feet long (one-quarter mile) to incorporate scale.

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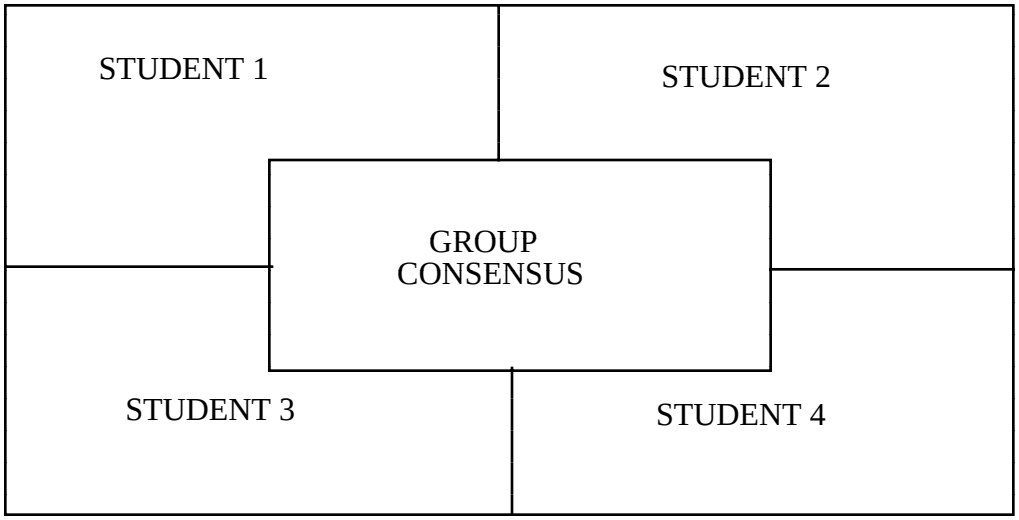
Essex Elementary School
Baltimore County, MD

PLACEMAT STRATEGY



The purpose of the placemat strategy and graphic organizer is to help students to work cooperatively, record their individual ideas, and come to a group consensus.

1. Place butcher paper on the desks and have markers available. Draw the diagram above, without the words.

2. Place students in cooperative groups of four. (Six may be used, but you will need to redesign the placemat.) Number students according to how many are in the group. Assign cooperative group roles to each number. (Example: Number 1-timer).

3. Pose a question or a problem for the students to think about. Have them record their individual ideas in their own "box". Allow sufficient time for this.

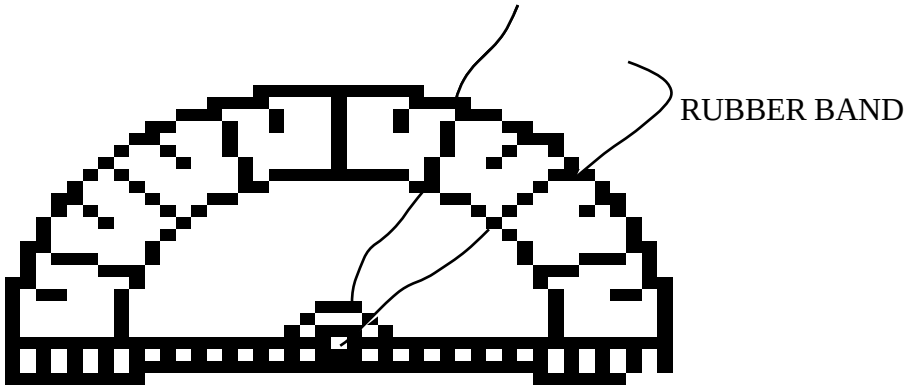
4. Students discuss their individual responses.

5. The group recorder writes the group's main ideas in the group consensus rectangle.

6. Share group responses. Discuss and draw conclusions.

Idea adapted from Pat Baltzley, Baltimore County Public Schools.

HOW TO BE A PROTRACTOR PRO!



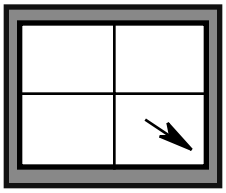
1. Make one cut in a rubber band.
2. Feed one end of the rubber band through the center hole on the protractor.
3. Tie the two ends of the rubber band together outside of the protractor.
4. Move rubber band along the degrees markings to indicate specific measurements.

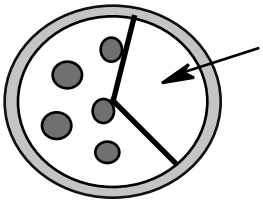
Idea adapted from Randi Blue, Howard County Public Schools.

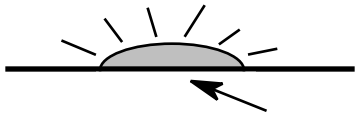
Student Resource 1

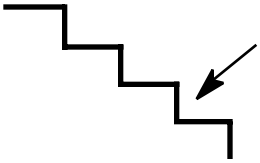
Angling for Fitness

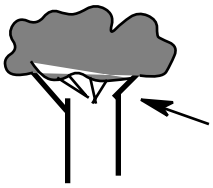
Directions: Cut along the lines. Sort into categories using the angle as the sorting factor. Arrows point to the angle to use for sorting.

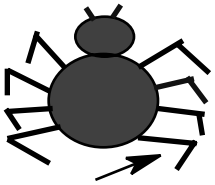

window

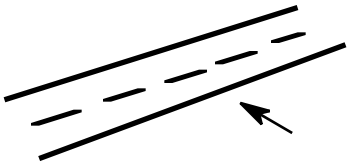

pizza

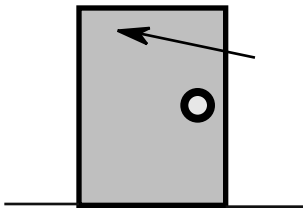

horizon

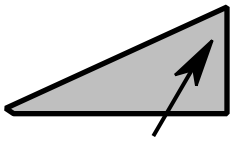

stair steps

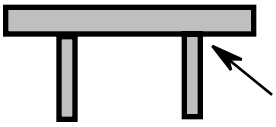

tree


spider's leg

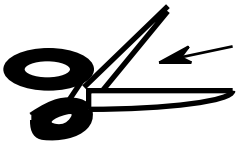

road line

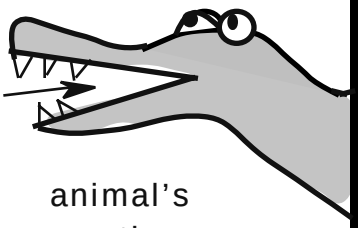

door


skateboard ramp



table


scissors


animal's mouth

Date_____

Dear Student,

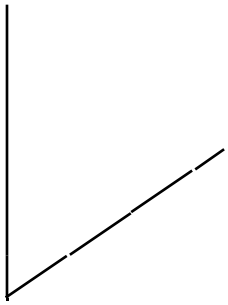
This week we worked with protractors. We have discovered that angles are all around us. As you start thinking about angles and looking for them, you will be amazed at how many you see.

Look around your home. Locate examples of the four different kinds of angles that we have been learning about in class. Create a table to record your data. Find at least two examples of each type of angle. Label your angles, telling what object you observed. Write a paragraph about the most common type of angle in your home. Tell why you think they are the most common.

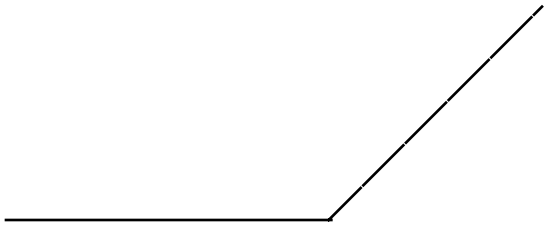
Have fun!

WHAT'S YOUR ANGLE?

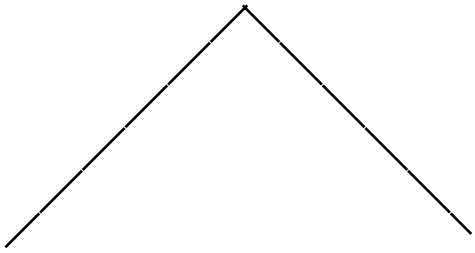
PART 1
DIRECTIONS: Identify and measure each angle.



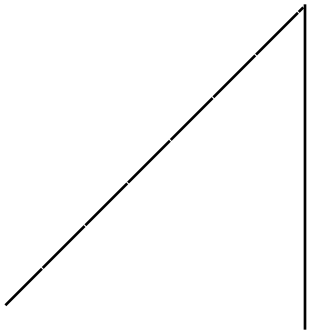
1. _____



2. _____



3. _____



4. _____

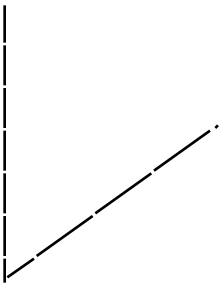
PART 2
DIRECTIONS: On the back of the paper, construct, measure, and label each of the following kinds of angles:

- acute
- obtuse
- right
- straight

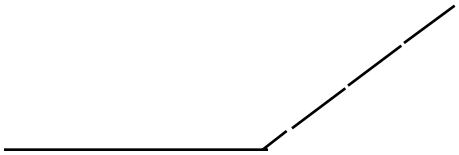
STUDENT RESOURCE 3
ANSWER KEY

WHAT'S YOUR ANGLE?

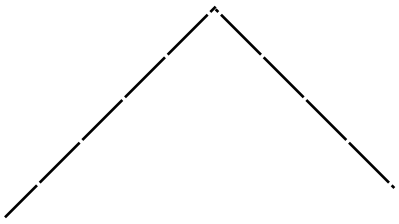
PART 1
DIRECTIONS: Identify and measure each angle.



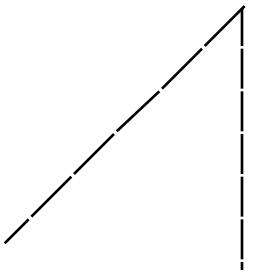
1. 60° Acute



2. 135° Obtuse



3. 90° Right

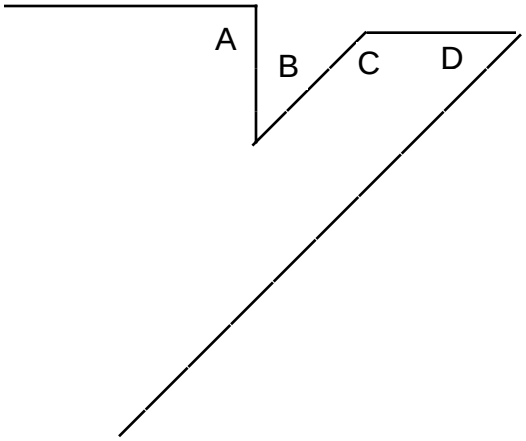


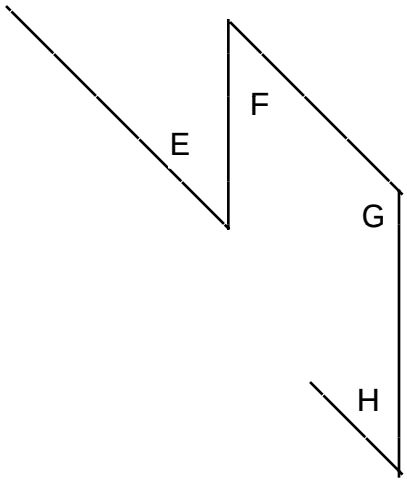
4. 45° Acute

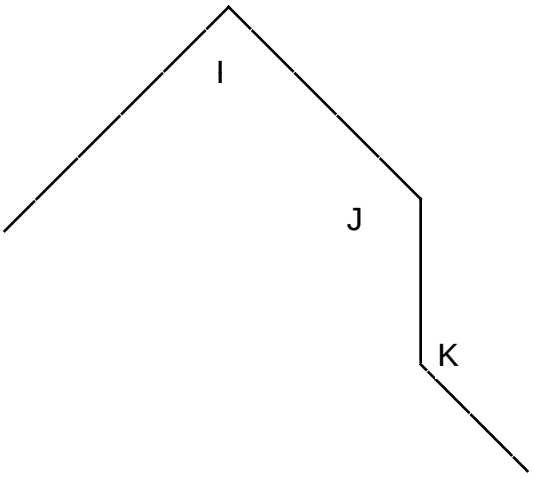
PART 2
DIRECTIONS: On the back of the paper, construct, measure, and label each of the following kinds of angles:

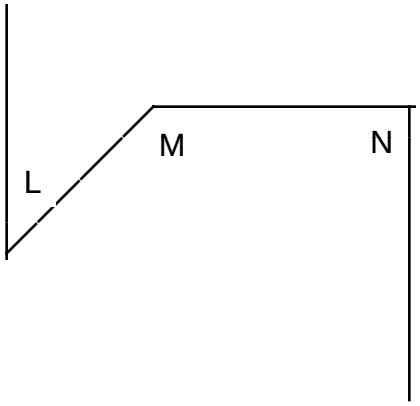
- acute
- obtuse
- right
- straight

Angling for Fitness



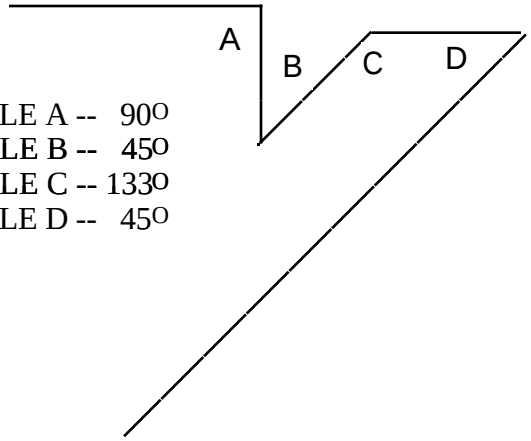




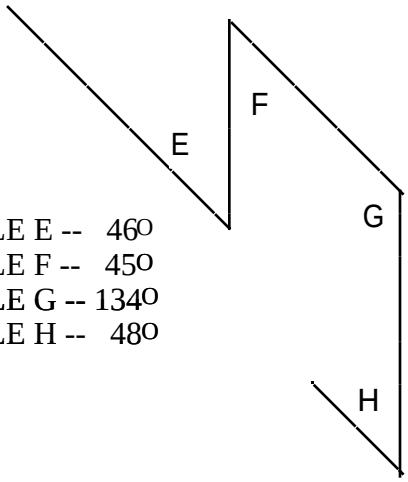


STUDENT RESOURCE 4
ANSWER KEY

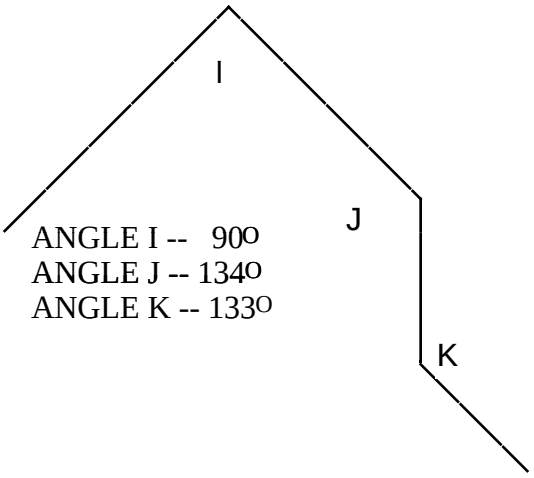
Angling for Fitness



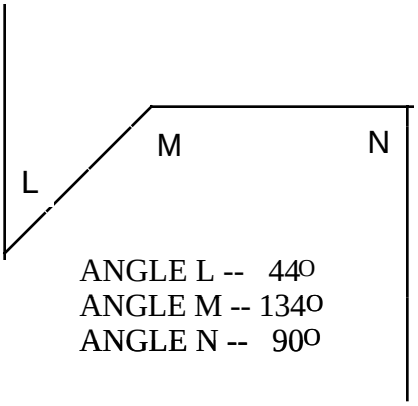
ANGLE A -- 90°
ANGLE B -- 45°
ANGLE C -- 133°
ANGLE D -- 45°



ANGLE E -- 46°
ANGLE F -- 45°
ANGLE G -- 134°
ANGLE H -- 48°



ANGLE I -- 90°
ANGLE J -- 134°
ANGLE K -- 133°



ANGLE L -- 44°
ANGLE M -- 134°
ANGLE N -- 90°

Angling for Fitness

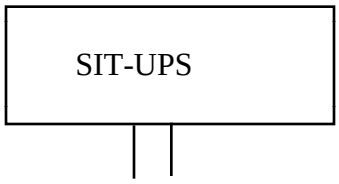
You have been learning how important it is to exercise regularly and to keep physically fit. Your physical education teacher has asked you to design a fitness trail with exercise stations for the school so that students could use it during recess or after school. The exercises that the physical education teacher wants you to use are: push-ups, sit-ups, jumping jacks, deep knee bends, touching toes, and arm circles. You think that this is a great idea to get the school involved in a physical fitness program.

TASK 1
Using grid paper, design a fitness trail that meets the following criteria:

- at least two right angles
- at least two acute angles
- at least two obtuse angles
- as many straight angles as needed
- label each angle

TASK 2
You realize that you will need signs for each exercise station. Place a different polygon sign at each station. The polygon should state the specific exercise that will be done at that station. The number of vertices of the polygon will indicate the number of times each exercise will be performed.

Example:



This sign would indicate four sit-ups because there are four vertices in the rectangle.

TASK 3
Write a set of directions to explain how to use the fitness trail. Using a sequence chain, organize your ideas. Then, write a final copy.