

Objective

Investigate conditions for building triangles.

Common Core State Standards

- **7.G.2** Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Geometry**Construct Triangles**

Triangles are polygons with three sides, and they are classified by their sides and angles. The sum of the angles of any triangle is 180° , and the sum of the lengths of any two sides in a triangle must be greater than the third side. When a figure does not meet all of these conditions, it is not a triangle. With an appropriate manipulative, students can effectively investigate conditions for building triangles. Students can determine whether a set of conditions defines one unique triangle, more than one triangle, or no triangle.

Try It! Perform the Try It! activity on the next page.

Talk About It

Discuss the Try It! activity.

- **Ask:** *Why was the green AngLegs® piece too short?* Elicit that the red piece was too long and/or the 45° angle was too large.
- **Say:** *Describe what happened with the yellow piece.* If necessary, explain that the yellow piece was just long enough to make a triangle.
- **Say:** *Describe what happened with the blue piece.* Elicit that the blue piece was long enough to swing through two points on the third side, so it was possible to form two triangles.
- Discuss the ways to define triangles. For example, explain that a triangle can be defined by its 3 sides, by 2 sides and the angle between them, by 1 side and its 2 adjacent angles, and so on.

Solve It

Reread the problem with students. Have students draw the triangles they made. Have them include the angle measures—($45^\circ, 45^\circ, 90^\circ$), ($10^\circ, 45^\circ, 125^\circ$), ($45^\circ, 55^\circ, 80^\circ$). Have students answer the question in the problem. Discuss.

More Ideas

For another way to teach about constructing triangles—

- Have students use a protractor and ruler to draw triangles given certain conditions. Include conditions that lead to one triangle, two triangles, and no triangle. With an emphasis on precise measurements, students will be able to make accurate determinations.

Formative Assessment

Have students try the following problem.

Miguel measures two sides of a sail: 15 feet and 8 feet. Which could be the measurement of the third side?

- A. 6 feet B. 10 feet C. 23 feet D. 30 feet

Try It! 25 minutes | Pairs

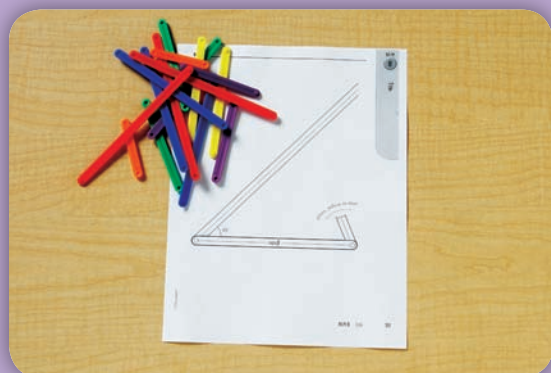
Here is a problem about constructing triangles.

Hannah is designing a triangular pen for her miniature play horses. She has some AngLegs to investigate different triangles. She is fixing one angle at 45° and she is fixing two of the side lengths by using a red AngLegs piece for the first side and blue, green, or yellow for the second side. Help Hannah investigate the triangles she can build. Which triangle is best?

Introduce the problem. Then have students do the activity to solve the problem. Distribute the materials.

Materials

- AngLegs® (3 of each color)
- BLM 8
- colored pencils
- straightedge



1. Have students study the BLM. Have them note the fixed angle of 45° . Have them identify where to place the red AngLegs piece and where they will be attaching the green, yellow, and blue pieces in subsequent steps. Note that the long gray side represents an unknown third side of the triangle that students will try to make.



2. Say: Put a red AngLegs piece in its place on the diagram. Now let's choose the second side. Attach a green piece to the right end of the red piece. Have students tell whether they are able to form a triangle. Elicit that they cannot, because the green piece is too short. **Ask:** How would you change the 45° angle or the red side to make a triangle?



3. Have students try a yellow piece in place of the green piece. **Ask:** Can you make a triangle? Is that the only triangle you can make? Elicit that it is. Suggest that an AngLegs piece will fit as the third side, and have students find that it is a yellow piece. Have them build the triangle and measure and record all the angles.



4. Have students try a blue piece in place of the yellow piece. **Ask:** Can you make a triangle? How many? Elicit that two different triangles can be made. **Ask:** What would you do to the 45° angle so that only one triangle could be made? So that no triangle could be made?

Use the AngLegs shown. Determine whether you can build a triangle.

1.



(Check students' work.)

Can you build a triangle? No

Using AngLegs, try to make at least one triangle. Draw the triangle(s) or write an explanation if no triangle can be made.

2. Angles: 30° , 60° , 90°

Possible; red-blue-purple
and yellow-green-orange

3. Sides: orange, orange, yellow

Not possible; sum of short
sides equals long side

4. Angles: 30° , 30° , 60°

Not possible; sum of
angles not 180°

5. Sides: blue, green; Angle between: 45°

Possible; blue-green-green

Use the AngLegs shown. Determine whether you can build a triangle.

1.



Can you build a triangle? _____

Using AngLegs, try to make at least one triangle. Draw the triangle(s) or write an explanation if no triangle can be made.

2. Angles: 30° , 60° , 90°

3. Sides: orange, orange, yellow

4. Angles: 30° , 30° , 60° 5. Sides: blue, green; Angle between: 45°

Name _____

