TITLE OF LESSON

Geometry Unit 1 Lesson 21 – Triangles, Part 1
Prove it! What's on the outside? What's on the inside? Of Geometry

TIME ESTIMATE FOR THIS LESSON

One class period

ALIGNMENT WITH STANDARDS

California – Geometry

Introductory lesson necessary for:
5.0 Students prove that triangles are congruent or similar, and they are able to use the concept of corresponding parts of congruent triangles.

MATERIALS

None

LESSON OBJECTIVES

- To begin to think about angle measurements in triangles
- To apply ratio to angle measurements in triangles

FOCUS AND MOTIVATE STUDENTS

1) Homework Check – Stamp/initial complete homework assignment. Pass back graded work and have students place in the appropriate sections of their binders.
2) Agenda – Have students copy the agenda.
3) Review Homework – (10 minutes) Review the homework from Lesson 18. Ask for a volunteer to draw the homework on the board and identify the line segments that start and end at a whole number that are of length 2. How many are there? Ask for a volunteer to repeat the problem for segments of length 3, 4, 5, and 6. How many are there? Now, for each different length, have students answer each of the following:
What is the midpoint of the line segment from 2 to 4?
What is the midpoint of the line segment from 3 to 5?
What is the midpoint of the line segment from 6 to 10?
What is the midpoint of the line segment from 6 to 8?

ACTIVITIES – INDIVIDUAL AND GROUP

1. Triangle Definitions – (10 minutes) Write the following definition on the board and have the students copy it into the Terms and Definitions section of their notebooks. *A Triangle is a 3-sided figure with three angles in the interior*. Ask for a volunteer to draw this on the board. Do not label the triangle at this point.

   Write the following on the board: *A triangle can be named by labeling the three corners. Each corner is known as a vertex. The plural of vertex is vertices. A triangle has three vertices*. Ask for a volunteer to label the three vertices of the triangle on the board. Ask the student to label the vertices A, B and C. You can also label the triangle with something other than letters. Ask someone to label the triangle's vertices with numbers, colors, or notes. Can anyone think of how we might label the triangle with movements?

   Ask for volunteers to form a triangle by standing in a configuration in the room. Is this not similar to the way that we created an angle? What is the difference? The angle used three people also. What does it mean that we might represent different figures with the same number of people? (Representations can be misleading sometimes. We need to state the meaning of the representation to make the representation complete, otherwise the representation can be ambiguous.)

2. Definitions/Discussion – (5 minutes) Write the following on the board: *The sum of the interior angles of a triangle is 180°.* Have the students copy this into their binders along with the definition of the triangle. (This is actually a theorem. You will prove it later when you introduce the Parallel Postulate. For now, treat it as simply a property of a triangle.

Ask a student to draw a triangle on the board. Have him label the vertices. Point out that each vertex label also identifies an angle. The vertex labeled A can also refer to angle a for instance, vertex B is associated with angle b and vertex C is associated with angle c. Ask students *If angle a measures 30° and angle b measures 70° what is the measure of angle c*? (80°) How do they know this? Ask someone to draw this particular triangle. Try to draw it so that the angles appear to be the right size. If angle a measures 40° and angle b measures 80° what is the measure of angle c? (60°) Ask someone to draw this particular triangle. If a triangle with a right angle has one of its angles that measures 30° what is the measure of the third angle? (60°) If one angle is obtuse what types of angles are the other two angles? (acute) If one of the angles is a right angle what types of angles are the other two angles? (acute) Is it possible to have two obtuse angles in a triangle? (No, because each obtuse angle measures more than 90° implying that these two angles total more that 180° so the three angles in the triangle would not be able to measure a total of 180°)

3. Types of Triangles – (15 minutes) Now you're moving on to a number of different types of triangles. Write the following on the board: *For one type of triangle, the measures of the three angles in the triangle are in the ratio 2:3:4*. Explain this by having students work with toothpicks and other things. How many remember well what ratio means? When you talk about the ration of teachers to students in the class, the ratio is probably 1 (or so) to 20 (or so), or 1:20. When you talk about the ratio 2:3:4, you're talking about three things, the first of which is smallest, the second is 1.5 times the size of the first, and the third is 2 times the first. The numbers 4, 6, 8 also have the ratio 2:3:4 since the second number is 1.5 times the first number and the third number is 2 times the first number. Because this is true for 2, 3, and 4, we say that any numbers that follow this pattern are in the ratio 2:3:4. Examples are 4, 6, 8 and 6, 9, 12 and 8, 12, 16 etc.

   But triangles don't have to have the ratio 2:3:4. The numbers 2:4:6 have the ratio 1:2:3 since dividing the numbers 2, 4, and 6 all by 2 returns 1,2,3. The numbers 5:10:15 have the ratio 1:2:3 since dividing the numbers 5,10, and 15 all by 5 also returns 1, 2, and 3. Again, demonstrate the concept with different groups of toothpicks or other objects that can be put together in ratios. Have someone demonstrate with steps.

4. Problems – Demonstrate the following type of problem, drawing on the board as you go. If the angles of a triangle are in the ratio 1:2:3, and because you know the total measure of the angles in a triangle is 180°, then you can determine the size of the angles for the triangle by solving the following problem for x (which is the angle measurement for the smallest angle, since the other two are measured in relation to the smallest) where the size of the 3 angles are 1x, 2x, and 3x respectively: $1x + 2x + 3x = 180° \rightarrow 6x = 180°$ so that $x = 30°$ and the size of the angles are 30°, 60°, and 90°.

   Repeat the problem for the ratio 2:3:4 $\rightarrow 2x + 3x + 4x = 180°$ so that $9x = 180°$ and $x = 20°$ so that the sizes of the angles are 40° (2x), 60° (3x), and 80° (4x). Repeat the problem for the ratio 2:4:6 (This gives the same answer as 1:2:3 but the value for x is 15). Repeat the problem for the ratio 3:4:5 (x = 15 and the angles are 45°, 60°, and 75°)

5. Group Work: Problem Solving – (7 minutes) Divide the class into small groups. Have students assign roles (see *Group Roles* below). Have each group work on the following problems:
   If the ratio of the angles in a triangle is 4:5:6, what are the sizes of the angles (48°, 60°, 72°)
   If the ratio of the angles in a triangle is 5:6:7, what are the sizes of the angles (50°, 60°, 70°)
   Have one group report the answer to the class for each of the problems. Have them write the answer on the board.

7. Homework – (3 minutes) Give students time to copy the homework assignment from the board as you write it.

HOMEWORK

Do the following problems:

- If the two of the angles in a triangle measure 20° and 30° what is the measure of the third angle?
- If the two of the angles in a triangle measure 50° and 30° what is the measure of the third angle?
- If the two of the angles in a triangle measure 50° and 50° what is the measure of the third angle?
- If the two of the angles in a triangle measure 20° and 40° what is the measure of the third angle?
- If one of the angles in a triangle is a right angle and the other two angles are equal what is the size of the other two angles?
- Is it possible for all the angles of a triangle to be acute?
- Is it possible for all the angles of a triangle to be obtuse?
- If the ratio of the angles of a triangle is 1:2:3 what are the sizes of the angles in the triangle?
- If the ratio of the angles of a triangle is 5:10:15 what are the sizes of the angles in the triangle?

- If the ratio of the angles of a triangle is 1:1:1 what are the sizes of the angles in the triangle?
- If the ratio of the angles of a triangle is 7:8:9 what are the sizes of the angles in the triangle?

GROUP ROLES

Facilitator – You are responsible for keeping all students focused on the assignment.

Recorder – You are must record the group's answer, though all students must record the notes in their binders.

Illustrator – You will draw the angles for the group and, when they present, on the board for the class.

DOCUMENTATION FOR PORTFOLIO

None