Which Triangles are Right?
Lesson Plan

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Teacher Mentor: Pamela Callahan
Grade/Class: 10th /Honors Geometry
KY Standards:
MA-HS-3.1.7 Students will solve real-world and mathematical problems by applying properties of triangles (Triangle Sum theorem)
MA-HS-3.4.1 Students will identify definitions, axioms and theorems, explain the necessity for them and give examples of them.

Objectives:
- Students will manipulate different squares to create right triangles.
- Students will deduce the triangle inequality by trying to manipulate lengths that do not go together to make a triangle.
- Students will define/discover what a Pythagorean triple is.
- Students will begin to understand the logic behind the Pythagorean Theorem.

Resources/Materials needed:
- Pre-cut squares of lengths 1", 2", 3", 4", 5", 6", 7", 8", 10"
  - Cardstock or Construction paper works best*
- Ruler
- Right Triangle Worksheet (attached)

Motivation

Students in Mrs. Callahan's class were going to begin a unit on triangles. There was a Thursday class, and a holiday on Friday, and Mrs. Callahan did not want to begin any new material. She wanted a day of discovery/review of the triangle information students should have remembered from Middle School. I came up with the two most important facts I could think of for triangles:
The Pythagorean Theorem, and the Triangle Inequality.

This activity promotes student self discovery of both of these ideas through manipulation of tangible squares.

Prior Knowledge

Students are assumed to have basic knowledge about triangles from Middle School. Students will be developing the Pythagorean Theorem and the Triangle Inequality on their own. Hopefully, they have already learned it, and after working with the manipulative for a short time, will be able to recall both of these relationships. This activity could very well be used in the Middle School classroom.

Outline of Lesson

I. This activity should be done in groups of one, two or three depending on the maturity level of the classroom.

II. Because the students are discovering triangles on their own, this activity does not need to follow any formal instruction. However, if the teacher does choose to lecture first, the students should be held responsible for the material without much assistance from the teacher.

III. Students should have one set per group of the 1", 2", 3", 4", 5", 6", 7", 8", 10" triangles.

IV. Students should be instructed verbally as follows (because these instructions are not written on the worksheet):

"You should try to match up the sides of three squares and create a right triangle. You have 9 different squares to try this with. Some combinations make right triangles, some do not, and some do not even make triangles." It would be appropriate to illustrate trying to make a triangle with the squares on the board by using tape. I made sure to do this with three squares that did not form a right triangle. I did not want to give the answers away.

As a personal choice I put each of the squares in a different color so that I could glance around the room to know which length the students were using. (For example, all the 8" triangles were in orange, all of the 10" triangles were white, etc.)

V. Students should gather their triangles and begin matching them, trying to create right triangles. Students should place a sheet of paper in the corner that should contain the right triangle to verify that it is, indeed, a right triangle.

VI. Students should work through the activity filling out the information as required.

VII. To wrap up, the teacher should be sure that everyone has the correct answer to questions 2, 4, 8, 9, 10, 11, 12, 13.
   a. The teacher should ask for several volunteers to share their answers to question 1**.
   b. The teacher should make sure that students did try to make a triangle with lengths 2, 3 and 8 as in #4 and explain what happened.
   c. The teacher should also make sure that students understand that when you add any two sides of a triangle it must be greater than or equal to the third side.
   d. The teacher should explain that 3,4,5, and 6,8,10 are Pythagorean Triples, and tell what this means. For consistency, use the definition in the textbook.
   e. The teacher should ask different students (3 or 4) what they learned from the activity.

Here are a few good points to stress:

"If two of the lengths of the sides of a triangle add up to be less than the length of the third side, then there is no such triangle."
"A Pythagorean Triple is a set of three integers {a, b, c} so that a^2+b^2=c^2."
"If you have any triangle with lengths {a, b, c} are such that a^2+b^2=c^2, then you have a right triangle."
"The hypotenuse of a right triangle is always the longest side, and the side across from the right angle."
Etc…

*Note: It is imperative that the squares be cut out at the **exact** measurements, otherwise the activity will not work as designed. If you plan to do this activity more than once, it may be a good idea to create sets and then laminate them.*

Note: It is important that the teacher realize that 3,4,5 and 6,8,10 are not the only correct answers to #1. They are the only Pythagorean Triples listed, but there are other combinations that are *very* close to satisfying the Pythagorean Theorem. When placing the squares edges into the shape of a triangle, they are almost right triangles. This is an excellent opportunity to go through the Pythagorean with these triangles which are very close and discuss why they are not exactly right triangles.

If there is time left over, I always keep origami instructions around. If you used squares which were not laminated, you could let the students create origami figures from the squares when they are finished.

Suggestion for follow up:
Create a bell-ringer for the next day's class by giving three sets of numbers and asking of these numbers were lengths, would they go together to make a triangle. If they do make a triangle, do they make a right triangle? Also, ask them to define Pythagorean Triple. Make sure they don't leave off that a Pythagorean Triple is a set of **integers**.

Lesson Source
I created this lesson entirely on my own.

Mode of Instruction
This activity is a discovery lesson. Students should be actively developing the triangle relationships on their own. Teacher should do a thorough wrap up by involving students to explain what they found. This will hold the students responsible for their work during the class, and allow the teacher to assess how they are learning.

Date of Implementation/ Estimated Time

Thursday, September 11, 2008/50 minutes

Date Submitted to Algebra^3

Tuesday, February 17, 2009

attachment: Right Triangles with Squares

Right Triangles with Squares

Names:_____

1. What were the lengths of the three right triangles you made? For example, if your lengths were 1, 6, and 7 units you should write (1,6,7)

   _____ _____ _____

2. What do you notice about the length of the side that was opposite your right angle?

3. Name one thing you notice about the relationship between the sides of your right triangle. Why do you think that happens?

4. Try to make a triangle with lengths 2, 3 and 8. What happens?

5. Fill in the blanks with either <, =, or >.

   2+3 __ 8 2+8 __ 3 3+8 __ 2

6. Try to make a triangle with sides 3, 5 and 6. What happens?

7. Fill in the blanks with either <, =, or >.

   3+5 __ 6 3+6 __ 5 5+6 __ 3

8. What do you notice from question 5. and 6. that you need to have to form a triangle?
(Fill in the blank)

9. If you add any two sides of a triangle, it must be __ the other side.

We will fill the rest out together.

10. What is a Pythagorean triple?

11. What type of angle does a triangle have to have to be a right triangle? How many degrees is that?

12. What is the longest side (the one across from the right angle) of a right triangle called?

13. What is the Pythagorean theorem for a right triangle?

14. Did you like this activity?

15. Do you have a suggestion for another activity? If so, write it here.