NCEA Math Lesson Plan

Grade: 9-12 **Subject:** Mathematics

Domain:
Geometry

Topic:
Similarity, Right Triangles, Pythagorean Theorem

Standard Number(s) and Description:
G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Vocabulary to be Highlighted:
Hypotenuse, right triangle, similar triangles, proportions, diagonal

Mathematical Practices (#):
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
6. Attend to precision.

Essential Question:
Given the two similar right triangles, how would you find the missing lengths of the sides?

Materials/Tools (include technology):
Whiteboard
Whiteboard markers
Smartboard/projector with internet access
iPads
Pythagorean Theorem worksheet (below)

Connections to Other Math Domains:

Connections to Other Subject Areas:
Construction
Community service

Catholic Identity Component:
Students will learn about Catholic social justice through Habitat for Humanity.

Resources (attachments):
Video about Habitat for Humanity (30 seconds): www.habitat.org

Step-by-step photos about carpenters measuring the openings for windows to determine if they are square: http://www.thisoldhouse.com/toh/how-to/step/0%2C%2C218006_150063%2C00.html

Activities/Timeline:
Lesson Description: Students will complete a three-question pre-assessment that serves to remind students how to find the lengths of legs or hypotenuses of right triangles using the Pythagorean Theorem. These pre-assessment questions should require the students to use both integers and radicals.

Provide students with a worksheet that guides students through the process of proving the Pythagorean Theorem, given two similar right triangles. Students should work on this in groups of two to four students. Check the progress of the groups by moving around the room.

Once the groups have finished the worksheet, provide whole-class instruction by discussing the students' results and findings. Encourage some students to show their proofs on the board so that students can discuss different approaches.

Show the 30-second Habitat for Humanity video. Take this time to see what students know about Habitat for Humanity and why it is important. Many churches have Habitat for Humanity teams and students may have direct experience with the organization.

Show the photo gallery that explains how homebuilders use the Pythagorean Theorem to prove that window openings are "square" before installing the windows. Engage students in a discussion about why the window opening may not be square and why it is necessary to make it square before installing the window.

Student will get back together in their groups to answer three application problems involving a hypothetical Habitat house. Each question will require students to apply what they have learned about similar right triangles, the Pythagorean Theorem and/or its converse.

Once groups have shown their work and answers for each question, each student should turn in their worksheet. Use this assessment for grading or as a means of checking for understanding.

Students will log on to the Sketchpad Explorer application via iPads, if available. Students will watch the Pythagorean Tree grow to see how the triangles change as the tree branches out.

As a closure activity, have students discuss their observations about the Pythagorean Tree on the Sketchpad Explorer and how it relates to today's lesson as a class.

Modifications/Differentiation:
You may wish to provide a Habitat for Humanity handout consisting of facts and local chapters.

Provide preferred seating for those with trouble hearing or seeing the video and photo gallery.

Pre-assign members of groups to ensure productive interaction.

If iPads and Sketchpad Explorer are not available, research a similar program for use on a laptop.

During the independent practice, provide higher-level students with problems that require proving the Pythagorean Theorem with variable labeled sides. Provide higher-level students with three more difficult application problems.

Formative Assessment (what to look for, how/when to look):

Summative Assessment:
Students will complete the front of the worksheet, on which they must derive the formula for the Pythagorean Theorem, and the back of the worksheet, which requires them to answer real-world application problems involving Habitat, the Pythagorean Theorem, and its converse. Give an additional assessment later in the unit, which combines students' understanding of the Pythagorean Theorem with other topics in the right triangle unit.

You have the ability to make the closing activity a formal assessment, if time allows. Instead of holding an informal discussion of the connections students have made between the Pythagorean Theorem and the Pythagorean Tree on the Sketchpad Explorer application, have the students write and turn in a paragraph about their observations.

Worksheet

Pythagorean Theorem

Name_____Date _____

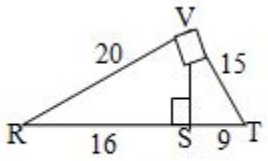


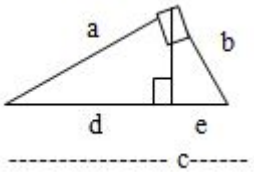
Fig. 1

1. Name three pairs of triangles that are similar in Figure 1.

2. Using these similar figures, write three true proportions using the letters to name the sides.

3. Fill in the numbers to make sure your proportions are correct.

4. Now derive the general case of the Pythagorean Theorem using the labeled side lengths.



(over)

Practice and Applications

1. When building a house for Habitat for Humanity, one of the requirements for construction is framing the window and ensuring that it is square. If the dimensions of the window are 5 feet by 3 feet, what must the length of the diagonal of the opening be to ensure that the window frame is square? Approximate your answer to the nearest eighth of an inch.

2. Several television cabinets were donated for the Habitat for Humanity project. If the length and width of the cabinet opening is 26 inches by 21 inches, find the largest size television that will fit in the cabinet. Television size is measured according to the diagonals of the screen.