Pythagorean Theorem

Strand: Measurement and Geometry

Topic: Working with the Pythagorean Theorem

Primary SOL: 8.9 The student will
a) verify the Pythagorean Theorem
b) apply the Pythagorean Theorem

Related SOL: 8.4

Materials

- Scissors
- One-Centimeter Grid activity sheet (attached)
- Triangle on One-Centimeter Grid activity sheet (attached)
- Applying the Pythagorean Theorem activity sheet (attached)

Vocabulary

distance, length, right angle, right triangle, square, square root, triangle (earlier grades)

diagonal, hypotenuse, legs, Pythagorean Theorem (8.9)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Give each student one copy of the One-Centimeter Grid activity sheet, one copy of the Triangle on One-Centimeter Grid activity sheet, and a pair of scissors. Have students cut out their triangles.
2. Direct students to draw three squares on the One-Centimeter Grid activity sheet, with each square having sides that are the same length as one of the sides of the triangle. Have them begin with side a by drawing on the grid paper a square whose sides are the same length as side a. Review how to find the area of the square, and direct them to label this square a^2. Instruct them to repeat these steps to create a square (labeled b^2) for side b and a square (labeled c^2) for side c.
3. Have students cut out the three squares and lay each square next to the corresponding side of the triangle.
4. Now display the equation $a^2 + b^2 = c^2$. Have students place square a^2 and square b^2 on top of square c^2, covering square c^2 completely. They will have to cut one of the smaller squares into pieces to get a perfect fit.
5. Discuss with students how they have just proved the Pythagorean Theorem: $a^2 + b^2 = c^2$. Ask students whether they think it will work for every right triangle. Ask whether it will work for every triangle. Discuss how to determine which sides are a, b, and c. Have students state the Pythagorean Theorem in words.
6. Distribute the Applying the Pythagorean Theorem activity sheet, and have students work in small groups to set up and solve each word problem.
7. When students have finished, lead a class discussion about how to set up and solve each problem.

Assessment

- **Questions**
  - Can a right triangle be formed with sides of length 8, 10, and 15? Why, or why not?
  - What happens if you double the length of one of the legs of a right triangle? If you double the length of the hypotenuse? If you double the length of both legs?
- **Journal/writing prompts (include a minimum of two)**
  - Explain a Pythagorean triple. Name and prove two different sets of Pythagorean triples.
  - Explain how you know which side of a right triangle is the hypotenuse.
- **Other Assessments (include informal assessment ideas)**
  - Provide the student with a right triangle of which the legs are labeled with values, and have them find the length of the hypotenuse.
  - Have the student create a right triangle and provide lengths for the legs of the triangle. They then should find the length of the hypotenuse.

Extensions and Connections (for all students)

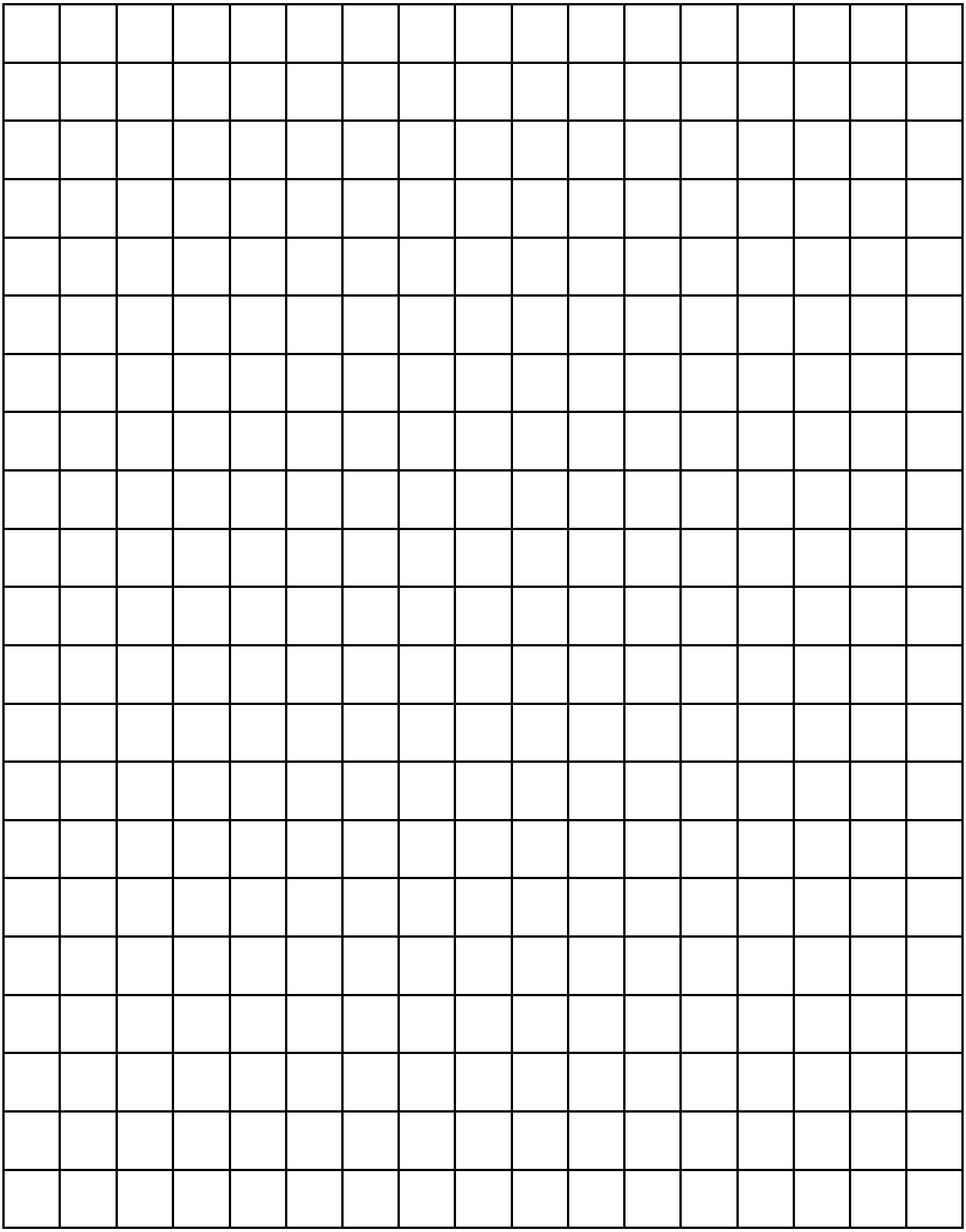
- Have students connect the use of the Pythagorean Theorem to practical applications such as constructing ramps, stairs, and roofs, using ladders to fight fires, laying out a football field, or using a map when travelling.
- Have students use interactive geometry software to model and create various right triangles.

Strategies for Differentiation

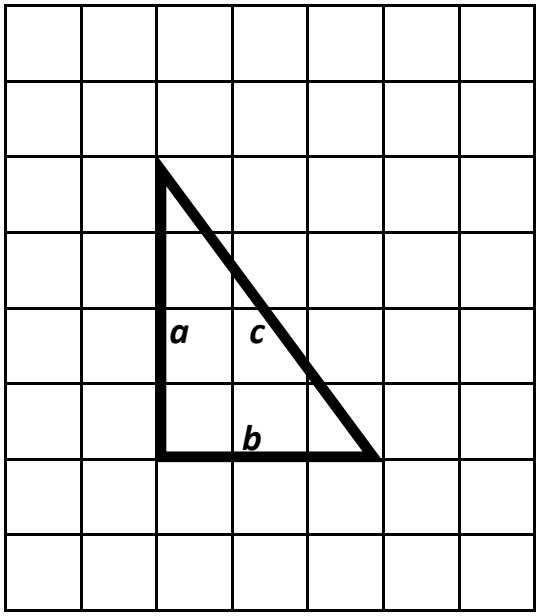
- Provide right triangles that are Pythagorean triples so students fully understand the relationship and how it works for every right triangle.
- Have students use a graphic organizer for problem solving.
- Highlight the legs of the right triangle one color and the hypotenuse a different color. Use the same colors for every problem.
- Provide a right triangle and a word bank (hypotenuse, leg, right angle), and have students label each part of the triangle.
- Make sure to present students with right triangles that are in many different orientations.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

One-Centimeter Grid



Triangle on One-Centimeter Grid



Applying the Pythagorean Theorem

Name _____ **Date** _____

Problem	Drawing	Work	Answer (with Label)
What is the length of a garden hose that is stretched diagonally, corner to corner, across a yard that measures 72 meters long and 60 meters wide? Round to the nearest meter.			
You are locked out of your house. The only open window is on the second floor, 25 feet above the ground. There are bushes along the edge of the house, so you will need to place the ladder 10 feet from the house. What length ladder do you need to reach the window?			
You have just picked up a ground ball at first base, and you see the other team's player running toward third base. How far do you have to throw the ball to get it from first base to third base, throwing the runner out? The distance between each base is 90 feet.			

The diagonal of a TV screen is 26 inches. The screen is 18.8 inches wide. How high is the screen?			