

Pythagorean Theorem

Reporting Category Geometry

Topic Working with the Pythagorean Theorem

Primary SOL 8.10 The student will
a) verify the Pythagorean Theorem; and
b) apply the Pythagorean Theorem.

Materials

- One-Centimeter Grid handout (attached)
- Triangle on One-Centimeter Grid handout (attached)
- Scissors
- Pythagorean Theorem Problems handout (attached)

Vocabulary

triangle, distance, length, right angle, right triangle, square, square root (earlier grades)
Pythagorean Theorem, diagonal, hypotenuse, legs (8.10)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Give each student a sheet of the attached One-Centimeter Grid handout, a copy of the Triangle on One-Centimeter Grid handout, and a pair of scissors. Have students cut out their triangles.
2. Direct students to draw three squares on the one-centimeter grid paper, 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 proven the Pythagorean Theorem: $a^2 + b^2 = c^2$. Ask them 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 copies of the Pythagorean Theorem Problems handout, and have students work in small groups to set up and solve each word problem.
7. When students are 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**

- 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.

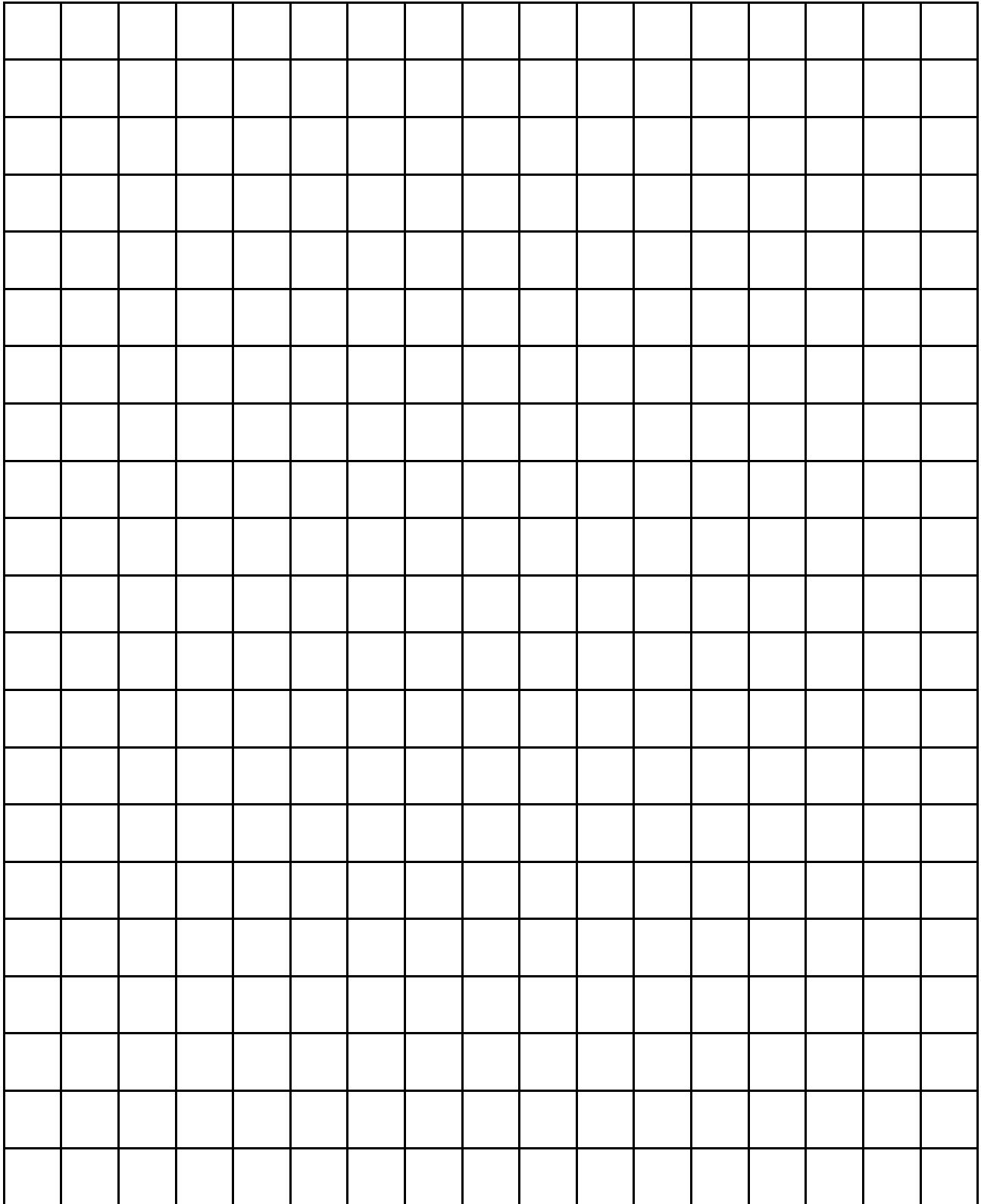
Extensions and Connections (for all students)

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

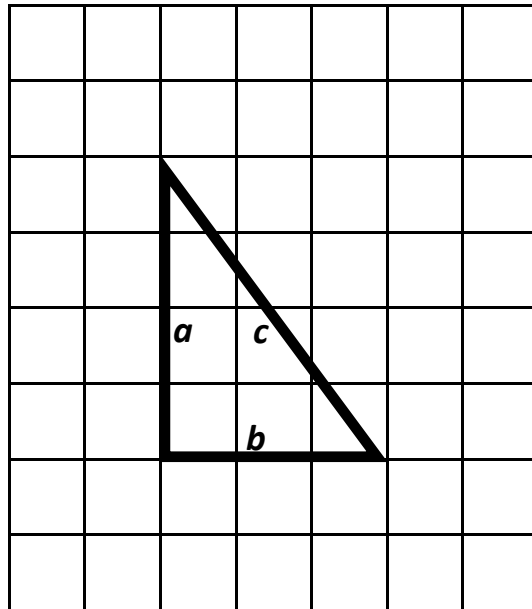
Strategies for Differentiation

- Provide more 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.
- Color code 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, and have students label each part of the triangle.
- Make sure to present students with right triangles that face in many different directions.

One-Centimeter Grid



Triangle on One-Centimeter Grid



Problems Using the Pythagorean Theorem

Name _____ Date _____

Problem	Drawing	Work	Answer (with Label)
<p>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.</p>			
<p>You're 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?</p>			
<p>You've 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 ft.</p>			
<p>The diagonal of a TV screen is 26 inches. The screen is 18.8 inches wide. How high is the screen?</p>			