

LessonTitle: Pythagorean Theorem**Geo 8.0****Utah State Core Standard and Indicators** Geometry Standards 2-4 Process Standards 1-5**Summary**

In this lesson, students build puzzles involving the Pythagorean Theorem, write their version of the theorem, compare their version to textbook versions, and use the theorem to solve problems.

Enduring Understanding

Pythagorean Theorem application is an important math context in which square numbers and roots are especially helpful for finding missing information.

Essential Questions

Why does the Pythagorean Theorem work? How do you prove it?

Skill Focus

- Solving equations using exponents and roots.
- Pythagorean Theorem application
- Using formulas

Vocabulary Focus**Assessment**

- All activities found below could be utilized as assessment.
- Use the Patio activity (taken from Utah Core Curriculum Performance Assessment Program, Elementary Algebra) to assess Pythagorean theorem application as well as ratio and proportion and area formulas.

Materials Computers if desired**Launch**

“Most high school students have very little knowledge of geometry. We defined a right triangle and labeled the legs and the hypotenuse. Using an overhead transparency, we explained how students must cut the pieces from the cutting sheet to use in the activity.”

“How do you find area? Remind students that the numbers on the puzzle are just the number piece not the length”

Explore

“Students worked in groups on the puzzles. When a puzzle was solved, the students glued the pieces on the worksheet with a glue stick. Puzzle # 3 seemed to be the most difficult. Some students glued the pieces on, but they really didn’t fit. There was some overlapping and holes in the square.”

“If you copy the cutting sheet in a different colored paper and number the pieces 1 for puzzle 1, 2 for puzzle 2, etc. it organizes the activity. Otherwise, some students who cut out all of the pieces at one time could mix them up or turn them over and the pieces wouldn’t fit.”

“Have students work with a partner. One cuts out the pieces, the other is the scribe. Tape the pieces on the back to create two squares from the large square. Teacher needs to observe and walk around giving hints on what the length of the sides of squares are.”

Summarize

“Students who were familiar with the Pythagorean theorem had little problem writing about the puzzles. Other students struggled. We labeled the triangle sides a, b and c, and talked about the area of the squares. Students were then able to write a theorem.”

“Have students present their findings and /or have students write a paragraph on how this activity relates to a right triangle. Show pictures”

“Having students write a paragraph would be a great WAC activity because they would have to explain why the theorem works.”

Apply

Directions:

1) Introduce the theorem by having students solve the puzzles below. Have them work in teams of four. Explain that they will be discovering one of the most famous mathematical theorems of all and writing their own theorem—then comparing it to the textbook. After they have solved the problem and written their theorem, have students give their theorem and explain it to the class. Then go to the textbook and compare their theorem with the way the textbook writes it. Then have the students individually explain in writing how the book theorem compares to theirs.

2) Access textbooks or other worksheets for Pythagorean Theorem Problems and other problems with equations involving squares and square roots.

3) Activities from the following sources give students valuable experience with the underlying concepts of used in the Pythagorean Theorem. You should pick and choose among them to allow students to experience the meaning of the theorem.

- Exploring Geometry with Geometer's Sketchpad pages 153-156, 157-158
- Navigating through Geometry page 28
- Patty Paper Geometry pages 217-235

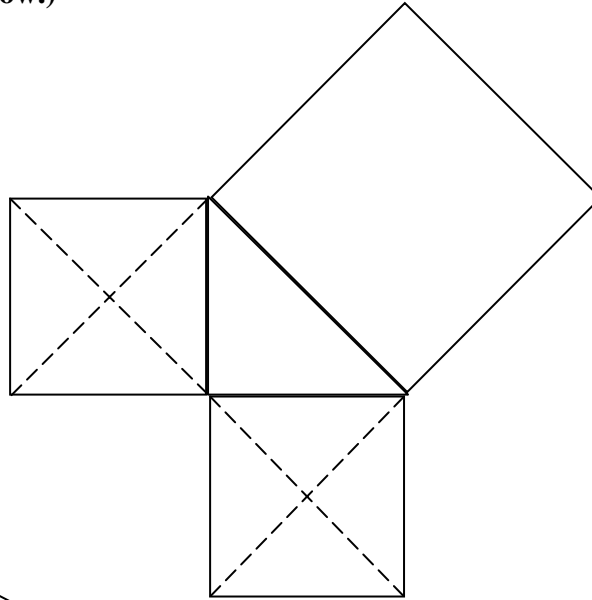
Geo 8.0 Discover and Write an Ancient Theorem

The following puzzles will help you prove an ancient geometry theorem. This theorem is the most famous theorem in all of geometry.

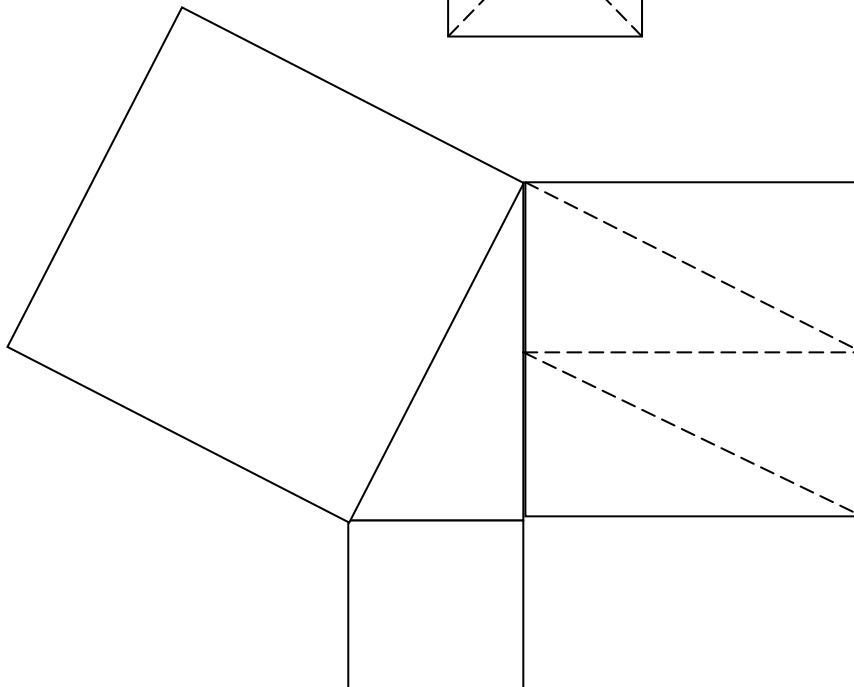
- Color in the triangles at the center of each drawing below.
- From the cutting sheet, cut the puzzle pieces for each problem below. You are cutting the two smaller squares formed off the two smaller sides of the triangle .
- Paste the puzzle pieces on the large square for each problem below

Write what you think the theorem is using your own words. Do not look in a geometry book. (See worksheet below.)

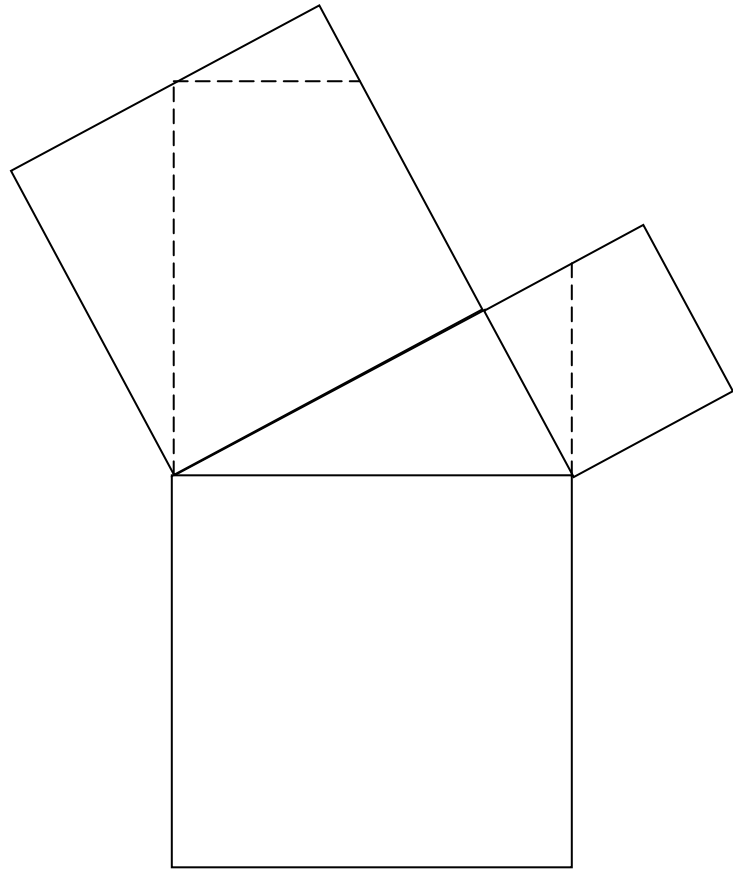
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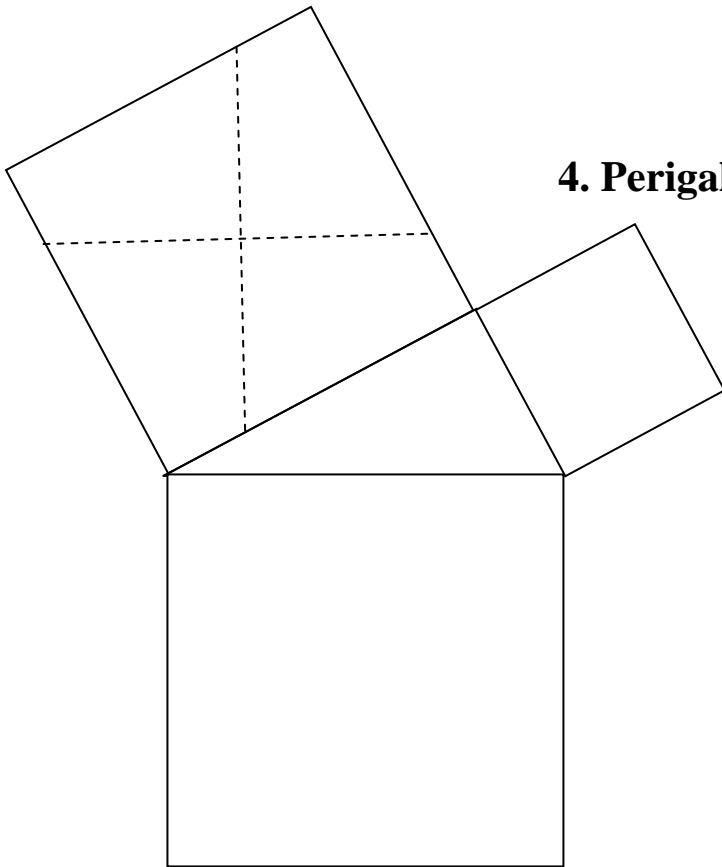
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3. Loomis' Proof

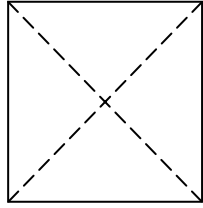
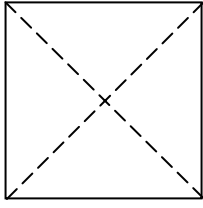


4. Perigal's Proof

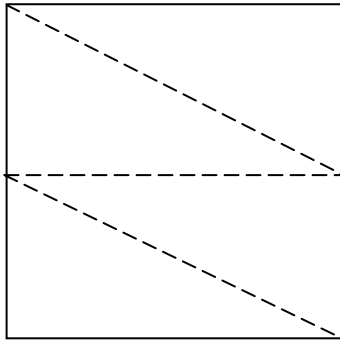
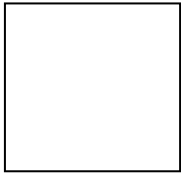


Pieces for Cutting

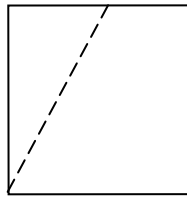
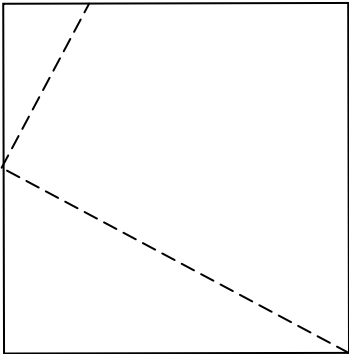
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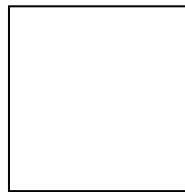
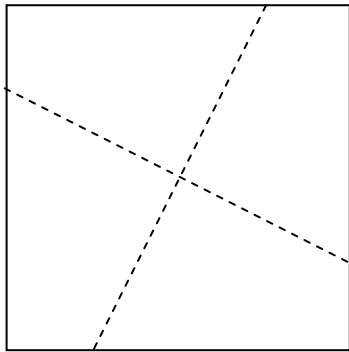
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3.



4.



Writing about the Pythagorean Puzzles

After fitting all the pieces onto the “hypotenuse square,” answer the questions below. Use your experience with the squares in your writing. *Hint:* If you feel it is difficult to answer a question, look at your cut ‘n’ paste and start describing what you see.

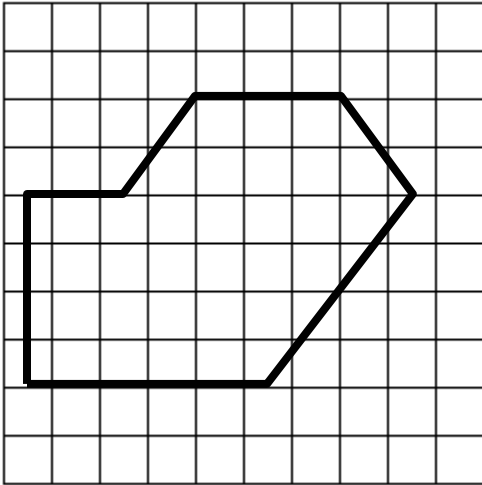
- 1) Explain what you found out by doing the Pythagorean puzzles. How are the three squares related?
- 2) Translate your writing from above into a mathematical equation. This would be your version of the Pythagorean Theorem. (Do NOT look in the book. If you need vocabulary to use in your writing, you may ask your teacher.)
- 3) Now look in your textbook. Compare your version of the theorem with the way the textbook wrote it. Write what you think.
- 4) How has this cutting activity helped you to understand the Pythagorean Theorem? Be specific.

Geo 8.1

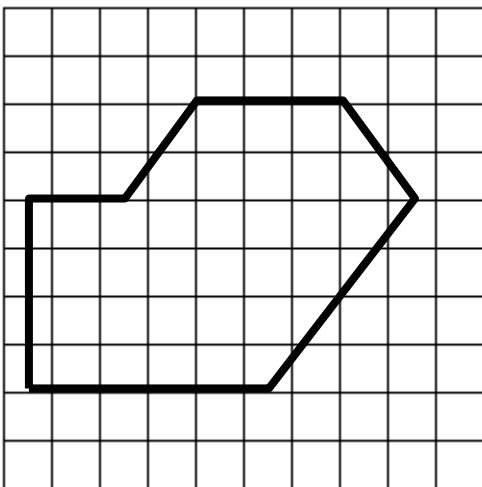
Patio Problem Assessment

Mr. Borg likes to make scale drawings before he builds anything. This is a scale drawing of a patio that he plans to build for his home.

- 1) Find the perimeter of the patio in the scale drawing. Show all thinking and work. Write all measurements used in computing the perimeter with a colored pen or pencil on the scale drawing.



- 2) Compute the area of the patio in the scale drawing by dividing the figure into regions. Explain how you found the area of each region listing each step and formula used. Write all measurements used in computing the areas on the scale drawing.



- 3) If the scale on the drawing above is 1 unit = 3 feet, what is the actual measure of the perimeter of the patio? The area? Show all work.

Geo 8.1b

Humongous Fungus

Apparently Utah is in the running for having the most humongous fungus. What is this humongous fungus? How big is it? Where is it? Who else is in the running?

In this activity you will research what is believed to be the world's largest living organisms, *Armillaria bulbosa* and *Armillaria ostoyae* fungus. Then you will examine their sizes and solve problems related to it.

1. Homework: Access the internet and search *Armillaria bulbosa* fungus (this search will probably also give you info about *Armillaria ostoyae*). Answer these questions: What is this humongous fungus? How big is it? Where is it? Who else is in the running? Each group will have 2 minutes to report their findings. Be prepared before class as you will have only a short time to get ready to present.

Summarize your presentation here.

2. If the humongous fungus in Michigan covers 154,000 square meters, what are some possible rectangle dimensions? (Remember the Garden Problem) Show all work.

If the fungus was in the shape of a square, what would the length of the side of this square be? Show your thinking.

How many football fields would fit on this humongous fungus? Show your thinking.

3. If the same humongous fungus is in the shape of a circle, how big would the radius of this circle be. (Hint: you will need to use the formula for the area of a circle) Write the equation you will use to solve this problem. Then solve it.

4. Compare Michigan's fungus with other places which have humongous fungus (Utah and Washington state) You may have to find out what a hectare is and consider depth and weight factors.

	Michigan	Utah	Washington state
Surface Area in meters ²			
Surface Area in hectares			
Square side length			
Circle radius			
Weight (if given)			

Which state has the

most Humongous fungus? Explain your thinking.

Are there any other factors we should consider? If so what?