

WAMC Lab Template

Math Concept(s): Right Triangles

Source / Text: Student Worksheet

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Attach the following documents:

Lab Instructions

Student Handout(s)

Rubric and/or Assessment Tool

Indicate “SPECIFIC” relationship to Science, Technology, or Engineering

Pythagorean Theorem is used in civil engineering, architecture, etc.

Short Description (Be sure to include where in your instruction this lab takes place):

In the classroom students will use manipulative blocks to develop a right triangle and derive the Pythagorean Theorem. They will determine why the Pythagorean Theorem works through their manipulations.

Lab Plan

Lab Title: Pythagorean Theorem Discovery

Prerequisite skills: Understanding of a right triangle

Lab objective:

Students will prove the Pythagorean Theorem using manipulatives.

Standards:

Mathematics K–12 Learning Standards:

- [CCSS.MATH.CONTENT.HSG.SRT.B.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.*

Standards for Mathematical Practice:

- 1. Make sense of problems and persevere in solving them.

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- [CCSS.ELA-LITERACY.W.6.1.A](#)

Introduce claim(s) and organize the reasons and evidence clearly.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

- | | | |
|---|---|---|
| <input type="checkbox"/> Global Awareness | <input type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy | <input type="checkbox"/> Civic Literacy |
| <input type="checkbox"/> Health/Safety Literacy | <input type="checkbox"/> Environmental Literacy | |

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION <u>Creativity and Innovation</u> <input type="checkbox"/> Think Creatively <input checked="" type="checkbox"/> Work Creatively with Others <input type="checkbox"/> Implement Innovations <u>Critical Thinking and Problem Solving</u> <input type="checkbox"/> Reason Effectively <input type="checkbox"/> Use Systems Thinking <input type="checkbox"/> Make Judgments and Decisions <input type="checkbox"/> Solve Problems <u>Communication and Collaboration</u> <input checked="" type="checkbox"/> Communicate Clearly <input checked="" type="checkbox"/> Collaborate with Others	INFORMATION, MEDIA & TECHNOLOGY SKILLS <u>Information Literacy</u> <input checked="" type="checkbox"/> Access and Evaluate Information <input type="checkbox"/> Use and manage Information <u>Media Literacy</u> <input type="checkbox"/> Analyze Media <input type="checkbox"/> Create Media Products <u>Information, Communications and Technology (ICT Literacy)</u> <input type="checkbox"/> Apply Technology Effectively	LIFE & CAREER SKILLS <u>Flexibility and Adaptability</u> <input type="checkbox"/> Adapt to Change <input type="checkbox"/> Be Flexible <u>Initiative and Self-Direction</u> <input type="checkbox"/> Manage Goals and Time <input type="checkbox"/> Work Independently <input type="checkbox"/> Be Self-Directed Learners <u>Social and Cross-Cultural</u> <input type="checkbox"/> Interact Effectively with Others <input type="checkbox"/> Work Effectively in Diverse Teams	Productivity and Accountability <input type="checkbox"/> Manage Projects <input type="checkbox"/> Produce Results Leadership and Responsibility <input type="checkbox"/> Guide and Lead Others <input type="checkbox"/> Be Responsible to Others
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Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Manipulative blocks
- Assignment worksheet
- Calculator

Set-Up Required:

- Have materials available to students
- Copies of student lab directions

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Creativity and Innovation
- Communication and Collaboration
- Information Literacy

Cooperative Learning:

- Students will work with partners to derive the Pythagorean Theorem and answer reflection questions.

Expectations:

- Students will complete all components of the lab with precision and communicate their findings effectively

Timeline:

- 50 minutes

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Students can apply the Pythagorean Theorem to sports
- Students can apply the Pythagorean Theorem to home projects

Career Applications

- Engineering, construction

Optional or Extension Activities

- Determine the other angles of the triangle
- Create a right triangle using the Pythagorean Theorem

Lab Instructions (teacher):

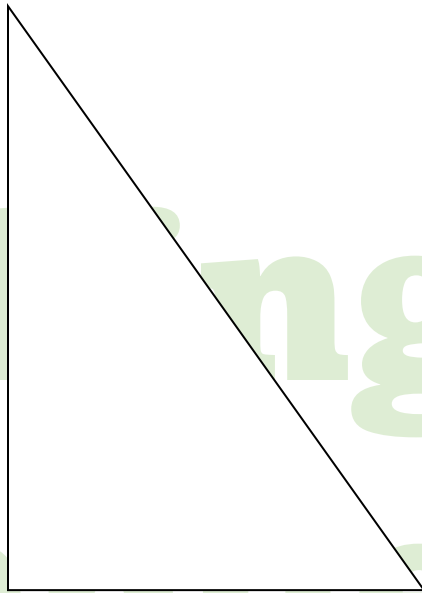
- Pass out supplies to students and student instructions
- Guide students through setting up the legs of a 3-4-5 triangle.
- Have students square each leg so that one side is a 3x3 square and one side is a 4x4 square.
- Ask students how they can relate the two legs to the hypotenuse.
- Give students time to work and manipulate their blocks until they conclude the hypotenuse can be the sum of the two legs in a 5x5 square
- Ask students if they can represent this relationship in a general way ($a^2+b^2=c^2$)
- Have students partner up and use both sets of manipulative blocks to test their conclusion with other triangles
- Give students exit task to complete
- Collect all materials

Rubric:

CATEGORY	4	3	2	1
Use of Manipulatives	Student always listens and follows directions and only uses manipulatives as instructed.	Student typically listens and follows directions and uses manipulatives as instructed most of the time.	Student sometimes listens and follows directions and uses manipulatives appropriately when reminded.	Student rarely listens and often "plays" with the manipulatives instead of using them as instructed.
Mathematical Concepts	Explanation shows complete understanding of the mathematical concepts used to solve the problem(s).	Explanation shows substantial understanding of the mathematical concepts used to solve the problem(s).	Explanation shows some understanding of the mathematical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Mathematical Reasoning	Uses complex and refined mathematical reasoning.	Uses effective mathematical reasoning	Some evidence of mathematical reasoning.	Little evidence of mathematical reasoning.

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Student Handout:



Washington Applied Math Council

Using the triangle above arrange your manipulatives so that each leg is lined with blocks. Create a solid square off of each leg. Explore the relationship between the blocks by the two legs and the hypotenuse. Develop an equation to represent the relationship between the two legs and the hypotenuse. Work with a partner to test your relationship with other sized triangles. Complete the exit task after this activity.

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Exit Task:

1. Record the equation you discovered for determining a third side of a right triangle given two side lengths.

2. How did you develop this equation?

3. What if I was given the hypotenuse and one leg, could you solve for the other leg? How?

Washington

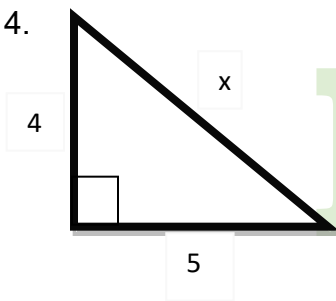
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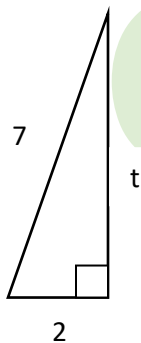
Council

Determine the missing side length for the following triangles.

4.



5.



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