

WAMC Lab Template

Math Concept(s): 3,4,5 rule explaining the Pythagorean theorem.

Source / Text:

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Attach the following documents:

- Lab Instructions
- Student Handout(s)
- Rubric and/or Assessment Tool

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

- This exercise will be completed in the classroom at the student's desk.
- Each student will create an evenly spaced knotted rope loop per the instructions and materials supplied to use as a tool to square up 2 pieces of material.

Lab Plan

Lab Title: 3,4,5 knotted rope.

Prerequisite skills: The student should understand basic geometric shapes and be able to tie knots on a rope.

Lab objective: In this lab the student will create an evenly spaced knotted rope loop to use to square up two pieces of material.

Standards: (Note *SPECIFIC relationship to Science, Technology, and/or Engineering*)

Mathematics K–12 Learning Standards

- **HSG-MG.A.1**
Use geometric shapes, their measures, and their properties to describe objects.
- **SG-MG.A.3**
Apply geometric methods to solve design problems.

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Look for and express regularity in repeated reasoning.
- Attend to precision.

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

- **11-12.3**
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Leadership/21st Century Skills:

<u>21st Century Interdisciplinary themes</u> (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		
<u>21st Century Skills</u> (Check those that students will demonstrate in the above activity.)			
LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
<u>Creativity and Innovation</u>	<u>Information Literacy</u>	<u>Flexibility and Adaptability</u>	<input type="checkbox"/> Manage Projects
x <input type="checkbox"/> Think Creatively	<input type="checkbox"/> Access and Evaluate Information	<input type="checkbox"/> Adapt to Change	x <input type="checkbox"/> Produce Results
<input type="checkbox"/> Work Creatively with Others	<input type="checkbox"/> Use and manage Information	x <input type="checkbox"/> Be Flexible	<u>Leadership and Responsibility</u>
<input type="checkbox"/> Implement Innovations	<u>Media Literacy</u>	<input type="checkbox"/> Manage Goals and Time	<input type="checkbox"/> Guide and Lead Others
<u>Critical Thinking and Problem Solving</u>	<input type="checkbox"/> Analyze Media	<input type="checkbox"/> Work Independently	<input type="checkbox"/> Be Responsible to Others
x <input type="checkbox"/> Reason Effectively	<input type="checkbox"/> Create Media Products	<input type="checkbox"/> Be Self-Directed Learners	
x <input type="checkbox"/> Use Systems Thinking	<u>Information, Communications and Technology (ICT Literacy)</u>	<u>Social and Cross-Cultural</u>	
<input type="checkbox"/> Make Judgments and Decisions	<input type="checkbox"/> Apply Technology Effectively	<input type="checkbox"/> Interact Effectively with Others	
x <input type="checkbox"/> Solve Problems		<input type="checkbox"/> Work Effectively in Diverse Teams	
<u>Communication and Collaboration</u>			
x <input type="checkbox"/> Communicate Clearly			
<input type="checkbox"/> Collaborate with Others			

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- 1@ 24" piece of string tan
- 1@ 24" piece of string white
- 2@ 2" x 12" pieces of cardboard
- Hot glue gun

Set-Up Required:

- To do this lab effectively the student will need a flat surface or desktop.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected): In this lesson the students will think creatively, use systems thinking and solve problems while constructing this project. The student will work independently and then will work with another student to assess their work.

Cooperative Learning: The student will work independently to build the project and then will work with other students to verify each other's project is 90 degrees.

Expectations: The expectation of this lab is to show the practical application of using Pythagorean theorem to square up any 2 pieces of material.

Timeline: This lab should take about 30 mins to complete.

<https://wa-appliedmath.org/>

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab.

- This process and method is used by multiple trades to layout projects accurately.

Career Applications

- This is used by Carpenters, Cement masons, Iron workers and multiple other trades and designers.

Optional or Extension Activities

- This is the introduction to accurate layout; we will continue using this method in our foundation unit and wall layout unit.

<https://wa-appliedmath.org/>

Washington

3,4,5 Knotted Rope Lab Instructions.

1. Glue or tie the ends of the 24" piece of string to form a loop.
2. Using the other white string, cut it into 12 @ 2" pieces.
3. Attach the 2" pieces of white string to the tan string loop 2" apart using a simple knot.
4. When complete layout the string per the image.
5. Glue the two pieces of cardboard together at 90 degrees using the knotted rope to make sure the corner is square.
6. Exchange your cardboard corner with your classmate and check their corner for square using your knotted rope loop and note if it is 90 degrees.

<https://wa-appliedmath.org/>

Building the Pyramids

The ancient Egyptians constructed right triangles out of knotted ropes, as shown alongside.

Since the 12 knots in the rope are evenly spaced, it makes a 3-4-5 triangle, and because of the Theorem of Pythagoras, we know the angle in the lower left **MUST** be a right angle.

Knotted ropes like this were used to ensure that the corners in the base of the pyramid **WERE** all right angles.

Modern-day builders still use the Pythagorean Theorem to ensure that their buildings are square.

