

WAMC Lab Template

Math Concept(s): Surface Area and Volume

Source / Text:

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Date: 06/25/2024

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):

- Given a scale drawing of a floorplan, put a roof on it.
- This lab should be done in the surface area and volume unit.

Lab Plan

Lab Title: Put a Roof on It

Prerequisite skills: Folding, cutting, measuring length, calculating area and volume.

Lab objective: Calculate surface area and volumes of different shapes created by roofs.

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

[Mathematics K–12 Learning Standards:](#)

- HS.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs. and data displays.
- HS.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.
- HS.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- HS.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- HS.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

[Standards for Mathematical Practice:](#)

- MP1 Make sense of problems and persevere in solving them.
- MP2 Reason abstractly and quantitatively.
- MP4 Model with mathematics.
- MP5 Use appropriate tools strategically.
- MP6 Attend to precision.
- MP7 Look for and make use of structure.

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

[K-12 Science Standards](#)

[Technology](#)

[Engineering](#)

- HS-ETS1-2. Design a solution to a complex real-world problem

[Leadership/21st Century Skills:](#)

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

- Global Awareness Financial/Economic/Business/Entrepreneurial Literacy Civic Literacy
 Health/Safety Literacy Environmental Literacy

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

LEARNING AND INNOVATION

Creativity and Innovation

- Think Creatively
 Work Creatively with Others
 Implement Innovations

Critical Thinking and Problem Solving

- Reason Effectively
 Use Systems Thinking
 Make Judgments and Decisions
 Solve Problems

Communication and Collaboration

- Communicate Clearly
 Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy

- Access and Evaluate Information
 Use and manage Information

Media Literacy

- Analyze Media
 Create Media Products

Information, Communications and Technology (ICT Literacy)

- Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability

- Adapt to Change
 Be Flexible

Initiative and Self-Direction

- Manage Goals and Time
 Work Independently
 Be Self-Directed Learners

Social and Cross-Cultural

- Interact Effectively with Others
 Work Effectively in Diverse Teams

Productivity and Accountability

- Manage Projects
 Produce Results

Leadership and Responsibility

- Guide and Lead Others
 Be Responsible to Others

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

Materials

- Cardboard
- Scissors
- Scale drawings of different floor plans

Set-Up Required:

- Handouts of different floor plans
- Cardboard acquired
- Scissors acquired

Lab Organization Strategies:

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

Leadership (Connect to 21st Century Skills selected):

- Groups design, create, measure, calculate, together

Cooperative Learning:

- Groups collaborate on design and work together to build

Expectations:

- Students will come up with different designs
- Students will determine how much surface area the roofs cover by measuring and by calculating (perhaps by estimating)
- Students will build roofs.
- Students will calculate volumes under the roofs

Timeline:

- Design of roofs - One period (50-80 minutes)
- Build roofs and measure (and calculate) surface area - one period (50-80 minutes)
- Calculate volume covered by roof. (30 minutes)

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- What are the different costs associated with different roof types (single slope, gabled, hip)?
- What are the different design and manufacturing problems associated with making a roof?

Career Applications

- Roofing
- Architecture
- Design
- Engineering

Optional or Extension Activities

- Does the slope of the roof matter? Why or why not?
- Does the material roofs are made of matter? Why or why not?
- Why do roofs have different slope? (Hint: Think of climate.)

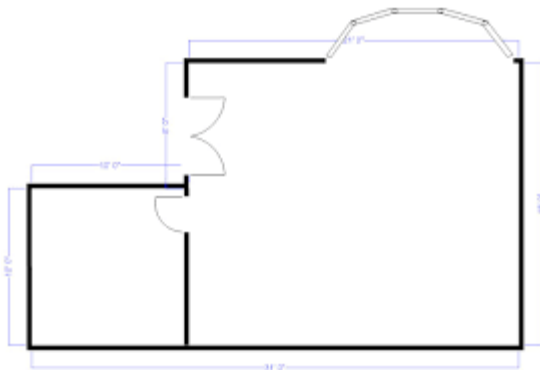
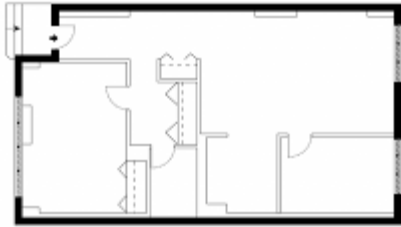
<https://wa-appliedmath.org/>

Washington

Roof Lab – Handout

A scale drawing of a simple floorplan would be given as a handout. Several different floorplans would be used so that students can try different plans.

The following would not work as is because they are not to scale, but are given only as examples.



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

Roof Lab – Rubric

	0	1	2	3	4
Follows instructions	Freestyles	Does some things	Completes the process following most instructions	Completes the process following all instructions	Completes the process following directions even to the point of making improvements
Creates roof according to plans	Roof does not match given plan	Roof design somewhat fits given plan or is a flat roof.	Roof mostly fits given floor plan and is not a flat roof.	Roof fits given floor plan with no overhang (no flat roof)	Roof fits given floorplan with a uniform overhang all around. (No flat roof.)
Calculates angle (2X)	No calculation	Has a formula. May or may not have correct answer	Uses correct formula, but some calculations are incorrect	Uses formula, most, if not all, calculations are correct	Correct formula used to calculate all the correct angles for all the data
Calculates distance (2X)	No calculation	Has a formula. May or may not have correct answer	Uses correct formula, but some calculations are incorrect	Uses formula, most, if not all, calculations are correct	Correct formula used to calculate all the correct angles for all the data