

WAMC Lab Template

Math Concept(s): Right Triangle Trigonometry

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 lab should be done after the lesson plan.

Lab Plan

Lab Title: Truss Design Plans

Prerequisite skills: Students should have some knowledge of right triangle trigonometry and measurements/scaling.

Lab objective: Students will be able to solve a real life problem using right triangle trigonometry!

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

Mathematics K–12 Learning Standards:

- HSG-SRT.C.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Standards for Mathematical Practice:

- 1 Make sense of problems & persevere in solving them
- 2 Reason abstractly & quantitatively
- 5 Use appropriate tools strategically
- 6 Attend to precision
- 7 Look for & make use of structure

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

- Speaking and listening. Comprehension and Collaboration.
- Work with peers to set rules for collegial discussions and decision making.
- Propel conversations by posing and responding to questions that relate to the current information.

Technology

- Computational Thinker. Students develop and employ strategies for understanding problems in ways that leverage the power of technology.
- Students collect data or identify relevant data, use digital tools to analyze them and represent data in various ways to facilitate problem solving and decision making.

Engineering

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- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost and reliability.

Leadership/21st Century Skills:

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

Math Council

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

Materials

- Chromebook
- Pencil
- Attached lab instruction and worksheet
- Protractor
- Ruler
- Calculator

Set-Up Required:

- None

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Work creatively with others
- Collaborate with group members
- Apply technology effectively
- Manage goals and time
- Manage products and produce results

Cooperative Learning:

- Each group of 4 will be assigned group member roles.
 - Project Manager (group speaker and leader)
 - Project Designer (in charge of design of truss)
 - Mathematician (in charge of calculations)
 - Review Manager (in charge of reviewing all information that group has)

Expectations:

- I expect all students to work on the entire project and participate in the creativity and math of everything. However, with the roles listed above, I expect those specific students to lead and be in charge of those specific parts.

Timeline:

- Students have 1 – 55 minute period to complete the lab.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Trusses are used everyday in the construction of buildings and houses.

Career Applications

- Construction – Architecture

Optional or Extension Activities

- Could have each group review other groups and double check the math.
- Could have each group present their design and math to the class
- Could have each group make a budget for the materials of a single truss and then figure out how many trusses you might need for the building.

Lab Instructions:

Your goal is to draw design plans for a single truss of a simple barn like roof. Then, we will use our resources to find out how much wood we need and how much it costs to build a single truss for your particular building.

First, be creative, come up with a team name and complete the worksheet below with your group. Include who the client is, what type of building is being constructed, why its being built, what kind of truss you are going to use, and the overall dimensions of your simple building. You and your group will get extra points for creativity!

Then, flip to the “blue print” design sheet and start marking out a truss by solving each and every triangle you see! Try your best to create a scaling factor and scale your truss to the best of your ability! i.e. 1cm = 1ft. Hint: Start with the base (bottom) of the truss and use your resources to find out typical dimensions of the type of building you are constructing.

In this part, you want to make sure you are hitting this check list:

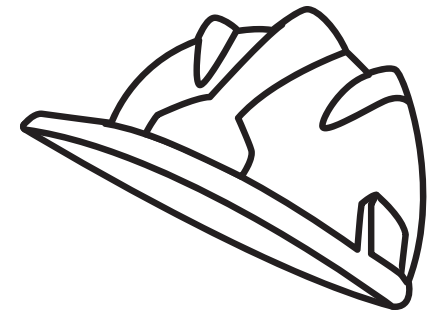
- Team is working well together in their assigned roles
- Everything looks professionally done
- Write your team name on the top left corner
- Mark your dimensions of your roof in the top right corner
- Draw out the truss that you will be using for your building
- Find the length of each and every side in the truss
- Find the measurement of each and every angle in the truss
- Don't forget your units!

Lastly, based on your math, calculate how much wood (2x4's) you need to build the truss and use your resources to do some research to find out how much it would cost to buy the wood for a single truss.

Potential other extensions include, but not limited to, switching designs with other groups and double checking the work, using a different truss for more right triangle trig practice, or have each group present their design to the class!

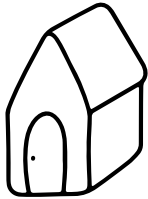
Lets get building!

You and your design team are in charge of designing the trusses for a new project. The deadline is at the end of the class. Follow the steps to decide what it is that you are building.

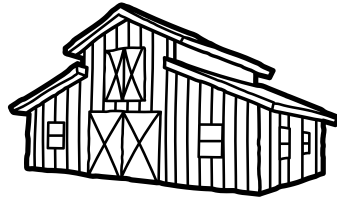


Step 1: Type of project your team has been assigned.

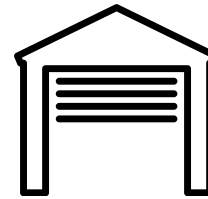
Tiny Home



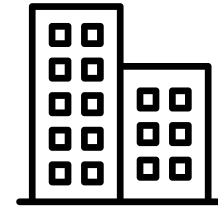
Barn



Garage



Other



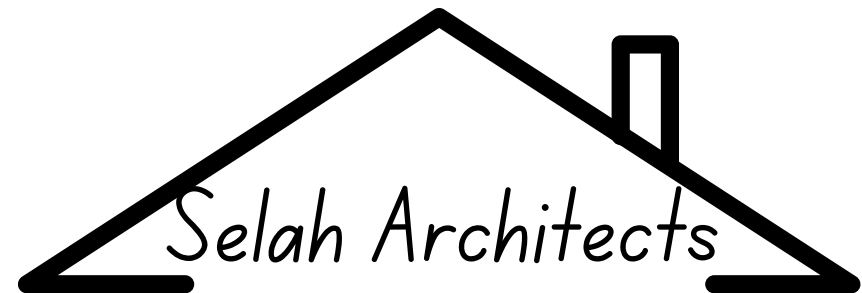
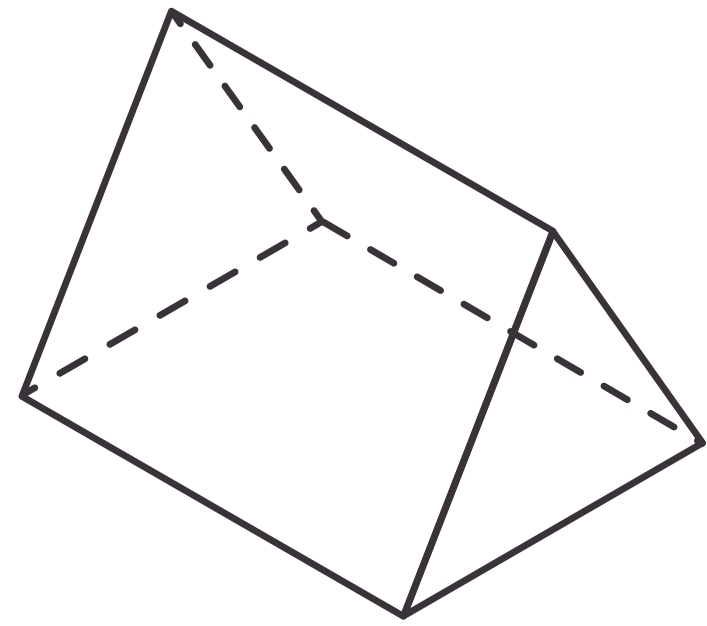
What project did you end up with?

Share location, who is it for, and anything else you can think of! Be creative!

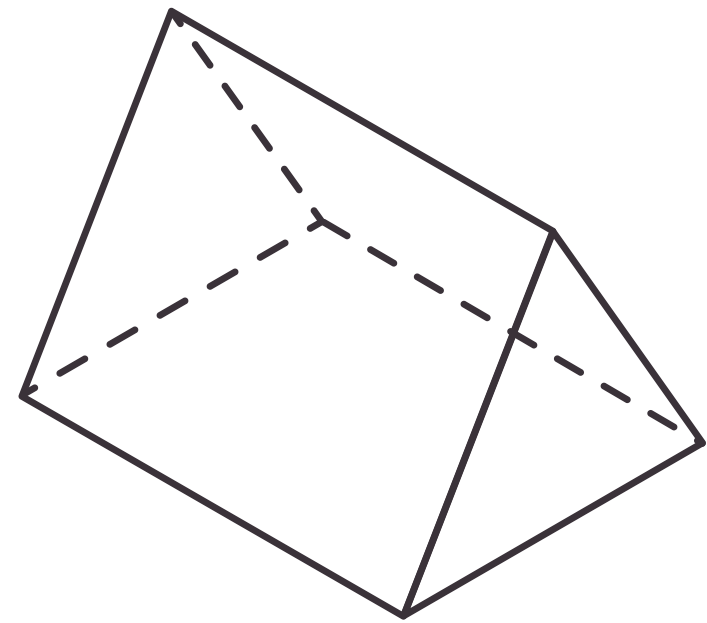
Step 2: Choose which truss you are using and draw it here.

Step 3: Sketch out and decide on your overall dimensions:

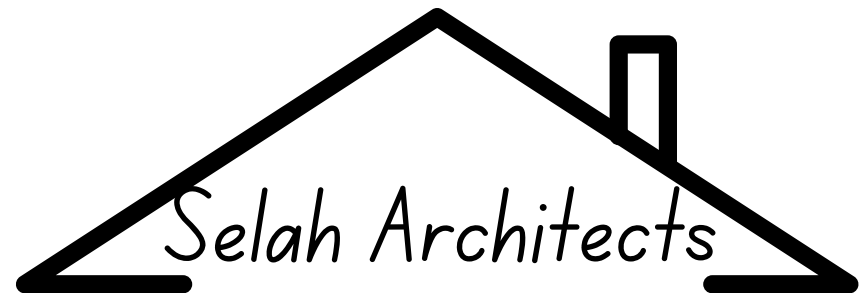
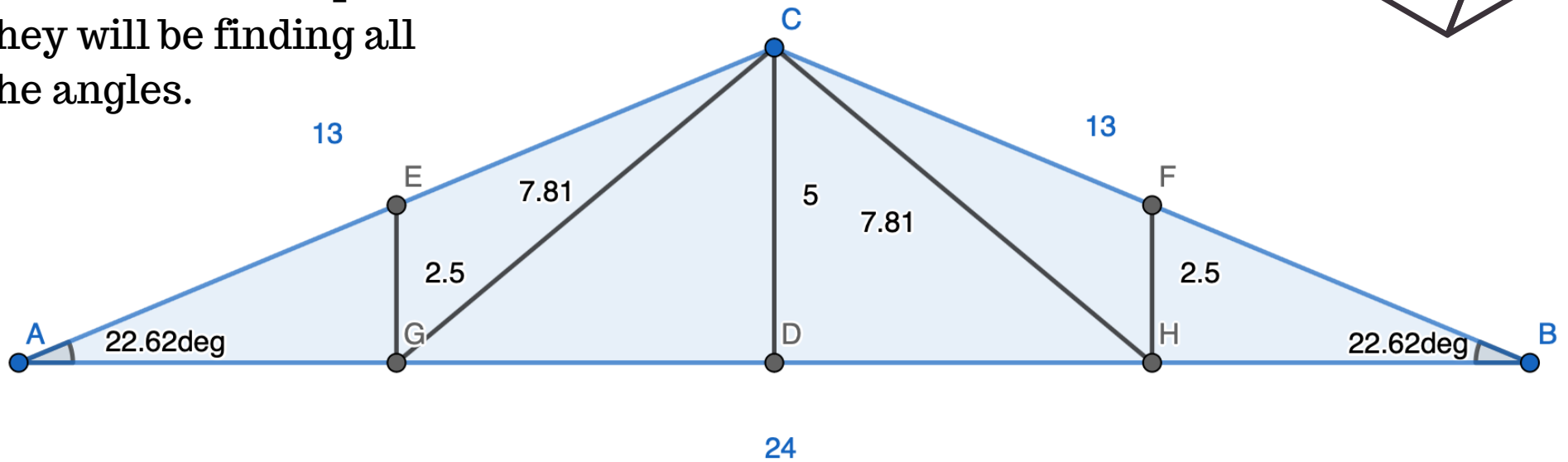
Step 4: Model your trusses here.



Step 4: Model your trusses here.



this is an example of what student work could be like, except they will be finding all the angles.



	Learning Target 1 SWBAT solve problems using trigonometric ratios	Learning Target 2 SWBAT identify trigonometric ratios of special right triangles	Learning Target 3 SWBAT build diagrams using the properties of right triangles and trigonometric ratios
Score 4.0 (More complex/extension)	<p>The student:</p> <ul style="list-style-type: none"> The student can connect the properties of sin, cos, tan to the unit circle. <p>No major errors or omissions regarding the score 4.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> The student can connect the properties of special right triangles to the unit circle. <p>No major errors or omissions regarding the score 4.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> Builds the diagram with key features of representation including angles, side lengths, and units All trigonometric ratios are shown All the calculations are correct <p>No major errors or omissions regarding the score 4.0 content</p>
Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 content		
Score 3.0 (Target)	<p>The student:</p> <ul style="list-style-type: none"> Identifies what side lengths are proportional using sin, cos, and tan. Can find the side lengths and angles of a triangle using sin, cos, tan. <p>No major errors or omissions regarding the score 3.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> Makes distinctions and shows patterns of the properties regarding special right triangles. Can find missing sides when given angles and vice versa <p>No major errors or omissions regarding the score 3.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> All trigonometric ratios are shown Most labels are on document. <p>No major errors or omissions regarding the score 3.0 content</p>
Score 2.5	No major errors or omissions regarding score 2.0 content, and partial success at score 3.0 content		
Score 2.0 (Simpler and/or pre-requisites)	<p>The student:</p> <ul style="list-style-type: none"> Identifies what side lengths are proportional but is unsure of how to use it in practice. <p>No major errors or omissions regarding the score 2.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> Notices patterns of the special right triangles however unable to operate with them <p>No major errors or omissions regarding the score 2.0 content</p>	<p>The student:</p> <ul style="list-style-type: none"> All trigonometric ratios are shown but answers may be off At least one label on diagram <p>No major errors or omissions regarding the score 2.0 content</p>
Score 1.5	Partial success at score 2.0 content, but major errors or omissions regarding score 3.0 content		
Score 1.0	With help, partial success at score 2.0 content and score 3.0 content		
Score 0.5	With help, partial success at score 2.0 content, but not at score 3.0 content		
Score 0.0	Even with help, no success		