

WAMC Lab

Math Concept(s): Engineering with a little Trig!

Source / n/a

Developed by: Aaron Smith

E-Mail: aasmith@royalsd.org

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Attach the following documents:

- Lab Instructions/Student Hand out

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

This lab is a short three part, in or outdoor project and discussion.

- Students will work in small groups to construct a tower built of 3 x 3in sticky notes within a set amount of time.
- After the competition/construction, a short discussion will take place about teamwork, use of material, and general construction.
- Students will calculate, using recent skills, the shadow cast from the top of the tower. Discussion will follow.

Lab Plan

Lab Title: Stick It Stack

Prerequisite skills:

- Using a Ruler, and other possible tools to measure distance.
- Convert units of measurement.
- Understanding of trig ratios and their inverse operations.
- Understanding of congruent triangles.
- Work as a contributing member of a group.

Lab objective:

Students will work together to develop a plan to construct a geometric tower using a determined material (3 x 3 in sticky notes). Students will discuss their strategies as a class community. Students will understand the uses of trig ratios and the facts of triangle congruence.

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

Mathematics K–12 Learning Standards:

- F-TF.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Use appropriate tools strategically.
- Attend to precision.

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

- RST.9-10.3 Follow precisely a complex multi step procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed verbally or mathematically into words.

Technology

- 1.2.1 Communicate and collaborate to learn with others.
- 2.2.1 Develop skills to use technology effectively.
- 2.4.1 Formulate and synthesize new knowledge.

Engineering

- HS-ETS1-2 Design a solution to a complex real-world problems by breaking it down into smaller, more manageable problems that can be solved through engineering.

Leadership/21st Century Skills:

21 st Century Skills
Check those that students will demonstrate in this course:

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

Materials:

- One Sheet of 8 x 11.5 paper
- Writing Utensil (Each Member)
- Sticky Notes
- Calculator
- Lab Sheet (Each Member)
- Timer

Set-Up Required:

- Gather materials for groups
- Locate a possible outside location if desired

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Each student is responsible to the other members in the groups to be attentive, communicate and contribute efficiently in a timely manner. All group members are encouraged to partake in class discussion and welcome the views and findings of others within and without the group.

Cooperative Learning:

- All members of the group will need to determine how to divide any group determined roles and responsibilities to construct, discuss, measure or any other group decided roles.

Expectations:

- Each member of the group is expected to contribute and participate in the construction, discussion and calculation of the lab. Each student is to complete a Lab Sheet.

Timeline:

- The Lab can be completed in the duration of a 45-50 min. Class period.
- It will be helpful to review the areas of trig ratios and their inverse operations in addition to congruent triangles.
- Only allow 10 min(or determined time) to construct.
- It will be helpful to allow discussion after the lab and trig measurement findings.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- What other materials can be used?
- How can the process be done faster, more efficiently, number of people need to change?
- Where can these principles be found or used?
- Collaborative work effectiveness.

Career Applications

- Construction, Engineering, Architecture, Design

Optional or Extension Activities

- Will other materials produce different results in construction or angle of the shadow from the sun?
- Will more time change anything.
- Finding height of structures.
- Introduction to Law of Sines and Cosines

Stick It Stack Lab Sheet

Name: _____

Part 1 Activity

Objective: Build the tallest self-supported tower from the provided stack of Sticky notes.

Materials:

- One 8 x 11.5 Sheet of Paper used as your flat base.
- 100 Sticky Notes
- Pencil for sketch only.

Plan: You will have 3 min to plan and sketch your ideas for your tower on your provided 8 x 11.5 sheet of paper.

Construct: You will have 10 min to complete your Stick It Stack.

Rules: You must use your 8 x 11.5 provided sheet of paper as a flat base to construct your tower and the provided Sticky notes.

Part 2 Discussion:

- Did you follow your plan?
- How well did you work together?
- What worked well?
- What shapes did you use for support?
- What did not work well?
- If you did it again, what did you do differently?
- If you had more sticky notes what would you do differently?

Part 3 Calculate

- Carefully take towers outside(if not already) and measure the height of the constructed towers and the shadow cast by the tower.
- Have students calculate the angle of the shadow from the top of the tower.
- Discuss the following questions as a class:
 - Ask what the different heights of the towers were.
 - Ask what the angle of the shadow that was cast.
 - Why are the results what they are?
 - Discuss similar triangles, congruence

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