WAMC Lab Template

Math Concept(s):

Source / Text: none

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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 lesson will take place in the sheet metal shop space at Opp Sky campus, Interagency Academy. Students will apply on paper learning about locating center of mass to sheet metal triangles. After marking centroid using various methods they will check for level by lifting triangle with a magnet.

Lab Plan

Lab Title: finding center of gravity in rigging

Prerequisite skills: names of shapes & types of triangles, ability to bisect angle & erect perpendiculars, knowledge of axis

Lab objective: Demonstrate degree of precision required for level rigging and the effects of moving pick points. Reinforce the efficiency of using correct formulas over trial & error. Connect concepts to career and technical skills used in trades where geometry is used.

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

Mathematics K–12 Learning Standards:

G-GDM 4: Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning

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

SL--Comprehension and Collaboration (Standards 1, 2)
SL--Presentation of Knowledge and Ideas (Standard 6)
L--Vocabulary Acquisition and Use (Standard 6)
RST--Integration of Knowledge and Ideas (Standards 7, 9)

K-12 Science Standards

INQC: Conclusions must be logical, based on evidence, and consistent with prior established knowledge.

INQF: Science is a human endeavor that involves logical reasoning and creativity and entails the testing, revision, and occasional discarding of theories as new evidence comes to light.

Technology

4.d. Exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.
6.a. Choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

Engineering

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, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

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

- Notes & drawings from prior lesson, sheet metal, aviation snips, markers, magnets, safety glasses, rulers, angle compass, dividers

Set-Up Required:

- 10”x10” sheet metal blanks cut, magnets selected with appropriate strength, (too strong or weak won’t work)

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Students will think critically, and problem solve both collaboratively and independently.

Cooperative Learning:

- Students will communicate and interact to share equipment and to advise one another on layout.

Expectations:

This lab is intended to build curiosity and reinforce base principals ahead of our rigging/ cable length unit.

Timeline:

- 45 minutes

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Students will compare methods of identifying center or gravity in terms of efficiency, reliability, and field application suitability. If a cube or round sign hangs from a single pick point what is the purpose of a cable harness & how many cables are optimal? What about a triangle like the one we used? Does larger scale mean more cables?

Career Applications

- Stage Rigging, exhibit industry, architectural rigging

Optional or Extension Activities

- Use your magnet to lift your triangle from further and further away from its center of gravity until it is no longer level. Use a marker to mark your margin of error if you had only the magnet with which to find the center of gravity.

Jay Connolly Lab 2 attachments

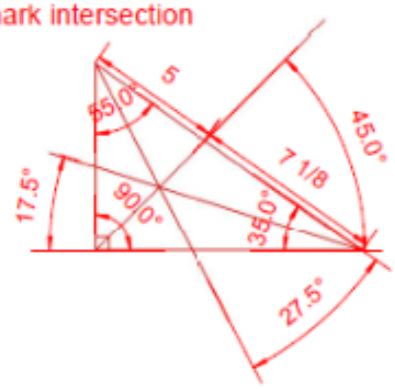
Lab Instructions:

1. Mark a right triangle where the perpendicular sides are 10” & 7”. Cut triangle on jump sheer.
2. Each set of students will attempt to find center of gravity using a different method. Methods are:
   -bisect angle & mark intersection
   -mark midpoint of edge to opposite vertex & mark intersection
   -erect perpendicular from midpoint & mark intersection
   -erect perpendiculars @ 1/3 edge lengths from 90-degree corner & mark intersection
   -mark midpoint longest side to 90-degree corner & measure length. Mark 1/3 from long side midpoint or 2/3 from 90-degree corner.
   -use only the magnet to find center of gravity. Mark the circle that you believe the center of gravity is in.
3. Test your mark using the magnet provided.
4. Group discussion. Did your method work? What steps could you have cut out, if any?

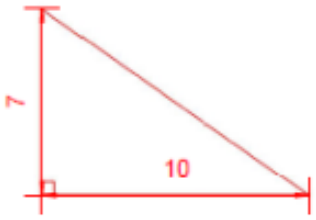
Student Handout: (produced by CAD student)

Right Triangle center of gravity

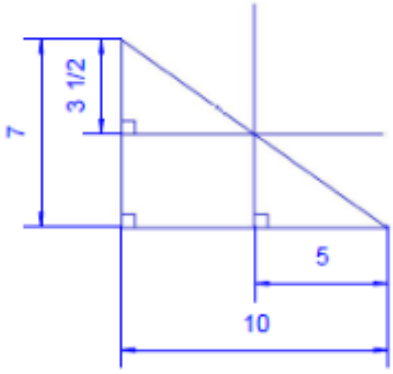
bisect angles
mark intersection



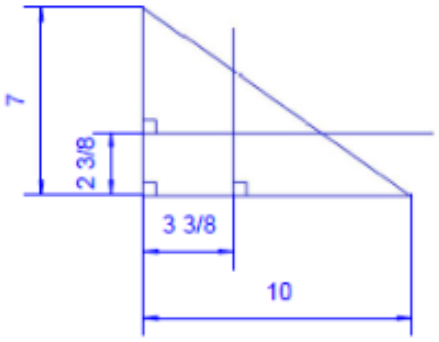
use only magnet to locate center of gravity
mark circle where it may be



erect perpendicular from midpoint
mark intersection

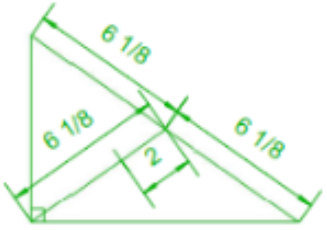


erect perpendicular on 90 degree side
@ 1/3 legnth from 90 degree corner



mark midpoint to opposite corner
mark intersection

mark midpoint long side to 90 degree corner
mark 1/3 length from long side



Project: pre rigging lab		# of units: 2 of each	Interagency Academy @ Opp Sky
Sheet #: 1	Date: 6.08.19	Status: for approval	CAD detailer: Ruqayyah Parker

Rubric:

This pre-rigging unit is worth 10 point. The completed sheet metal triangle can earn up to 5 points based on the following criterion:

1. Accuracy of triangle size/shape, mark out, and dimensioning:
   -above standard 3pnts.
   -at standard 2 pnts.
   -below standard 1 pnt.

2. Demonstrated production team skills. 1pnt.
3. Exit ticket & participation in group reflection. 1 pnt.