<u>WAMC Lab Template</u>
Math Concept(s): Systems of equations
Source / Text: Bridge to College mathematics
Developed by: Bridge to College mathematics
Adapted by: Janell Klovdahl and Eileen Harris
E-Mail: klovdahlj@svsd410.org harrise@svsd410.org
Date: Summer Conference 2023

<u>Attach the following documents:</u>
- Lab Instructions: (Attached)
- Student Handout(s): NA
- Rubric and/or Assessment Tool:

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

<u>Lab Plan</u>
Lab Title: Linear Landmines

Prerequisite skills: graphing lines in the coordinate plane

Lab objective: to discover the solutions to a linear system

<u>Standards:</u> *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*
Mathematics K–12 Learning Standards:
A-REI.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
A-REI.10: Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
A-REI.11: Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x)= g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential and logarithmic functions.
Standards for Mathematical Practice:
MP 1: Make sense of problems and persevere in solving them.
MP 3: Construct viable arguments and critique the reasoning of others.
MP 4: Model with mathematics.
MP 6: Attend to precision.
K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):
- Speaking and listening. Comprehensions and collaboration
- B Work with peers to set rules for collegial discussion and decision making
- Propel conversation by posing and responding to questions that relate to the current information
- Computational thinker. Students develop and employ strategies for understanding problems that leverage the power of technology.

Leadership/21st Century Skills:

Collaborate with Others 3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams - Students work together to find a pattern they see in a real world and collaborate on how they can represent the pattern mathematically

Use and Manage Information 4.B.1 Use information accurately and creatively for the issue or problem at hand - Students have to identify patterns to create equations

<table>
<tr><td colspan="4">

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.)

</td></tr>
<tr>
<td>

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

</td>
<td>

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

</td>
<td>

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

</td>
<td>

Productivity and Accountability

☐ Manage Projects

☐ Produce Results

Leadership and Responsibility

☐ Guide and Lead Others

☐ Be Responsible to Others

</td>
</tr>
</table>

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

Materials

- Poster paper
- Different colored string
- Markers
- Tape
- Measuring tools

Set-Up Required:

- Gather materials

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Reason Effectively 2.A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation - Students work together and share their ideas of how to figure out the enemy ship paths and how they could place the landmines

- Cooperative Learning:

Collaborate with Others 3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member - Students work in groups of 3-4 on Linear landmines lab and each student will have a specific role in the group

<u>Leadership roles within teams:</u>

Team leader and Speaker: will share their teams progress with the class

Records keeper: Will create table of all teams moves/and time

Time keeper: Keep team on track, and ensure all steps are completed

Team liaison will share and collect date from other teams, to compare to their team's own data.

Expectations: For students to gain an understanding of what a system of linear equations are, and what points represent a solutions

-

Timeline:

- One class period (45 min)

<u>Post Lab Follow-Up/Conclusions:</u>

Discuss real world application of learning from lab

Career Applications

estimating income over time, computing mileage rates, or predicting profit.

Optional or Extension Activities

- What strategies did your group use to solve the first task as a team? How effective was your strategy?
- What problem solving strategies did you use in this lesson?
- What did you struggle with in this lesson? How can you improve in the future?
- Reverse the activity with zombies, give them several linear equations that represent Zombies, and have then create a line that avoids the most zombies.
  - o Is that possible?
  - o Can we restrict the domain to make it possible?
  - o What would it need to be?

Create large coordinate grids on the floor of the classroom using masking tape or on large chart paper on the walls.

Assign the activity, providing students with materials such as different color string, masking tape, measuring tools, etc., along with small colored pieces of paper/post-it-notes to used as the "mines."

Avoid telling students how to use the materials, where to begin, etc.

Step back and observe as students discuss and solve the problem.

Pay attention to how students approach ideas of scale, orientation, precision and graphing.

Make note of appropriate vocabulary usage, whether or not students recognize the problem as a "system" and employ an algorithm to solve, or simply graph the lines using the slope, intercepts or table of values.

Collect the information to plan instruction.

During war games, it is your job to navigate one of our battleships.

Your course takes you over several enemy paths. As part of your duties, you must lay mines along the enemy's path. However, in order to plant the mines, you must know the points at which the paths cross and report those points to the Captain and to the Mine Crew.

You know of 3 different enemy paths, which are denoted by the following equations:

Enemy Path 1: $x - 3y = -15$

Enemy Path 2: $4x - y = 7$

Enemy Path 3: $2x + y = -1$
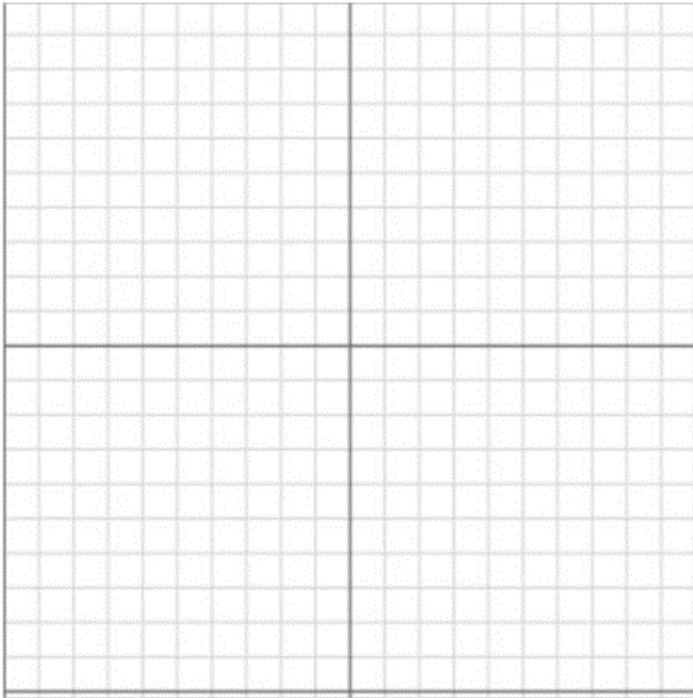
Your battleship's course is denoted by this equation:

Battleship: $x + y = -5$

Using graph paper and colored pencils, determine where you need to plant the mines

Solve the system by graphing , verify your answer

$$2x + y = 5$$

$$3x - 2y = 4$$
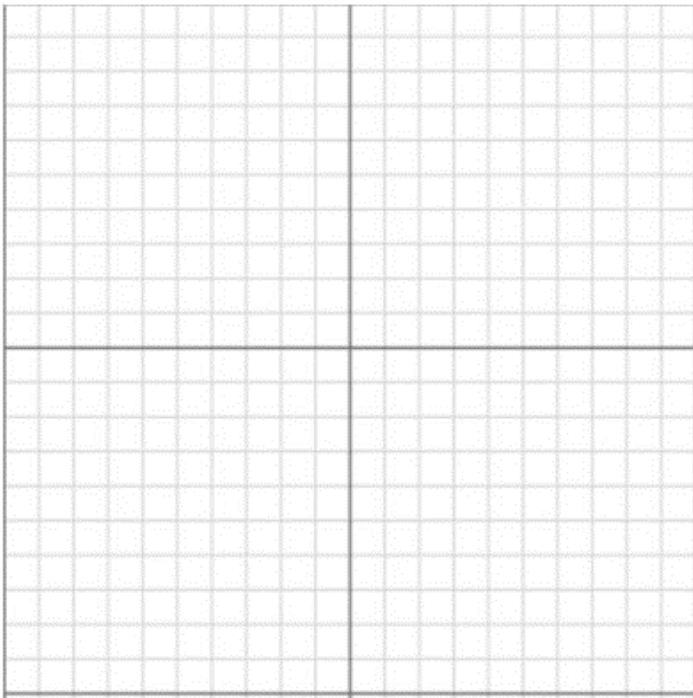
Solve the system by graphing , verify your answer

$$2x + y = 5$$

$$3x - 2y = 4$$

Washington Applied Math Council

https://wa-appliedmath.org/