

WAMC Lab Template

Math Concept(s): Systems of Equations

Source / Text:

Developed by:

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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):

Students will use systems of equations to determine where to place “bombs” to sink other people’s ships.

Lab Plan

Lab Title: You Sunk My Battleship!

Prerequisite skills: Writing coordinates, solving systems of equations

Lab objective: SWBAT solve systems of equations by playing a version of battleship.

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

Mathematics K–12 Learning Standards:

- CCSS.MATH.CONTENT.HSA.REI.C.6: Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

Standards for Mathematical Practice:

- CCSS.MATH.PRACTICE.MP1 Make sense of problems and persevere in solving them.
- CCSS.MATH.PRACTICE.MP4 Model with mathematics.
- CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically.
- CCSS.MATH.PRACTICE.MP6 Attend to precision.

Leadership/21st Century Skills:

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

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

Materials

- Graph paper
- Ruler
- Calculator (if needed)
- Practice Problems
- Large graph paper (optional)
- Masking Tape (optional)
- Yard Stick (optional)
- Marker (optional)

Set-Up Required:

- Basic: copies of the battleship problems. This can be as simple as placing them on the board.
- Advance: Set up large graph paper on the ground (this can be done on tile floors with masking tape for an even better game). Write problems on cards for each station so they have the problems on hand.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Creative Thinking to solve problems, and cooperative learning to work with others.Δ

Cooperative Learning:

- Students will work individually or in pairs, to graph the teacher's three ships paths. They will then graph their ship's path and determine the three intersections to determine what coordinates to place the bombs.

Expectations:

- Students will correctly place three "bombs" to sink the teacher's ships. They will show work and correctly graph four linear equations.
- For basic setup, students will do these on regular graph paper. They will need to correctly label each line.
- For advance setup, students will use masking tape to "draw" their lines and show their work on the large graph paper so they can share their lines with others in the class.

Timeline:

- This will work after the unit on systems of equations. This should take 1 class period.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Discuss why it is important to be precise.
- When would it be applicable to use systems problem solving in real life?

Career Applications

- Knowing what careers use slope (architect, construction, economist)

Optional or Extension Activities

- While not realistic on real life ships, this could be modified with non-linear equations.

You sunk my Battleship!

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

$$\text{Your ship: } 5x + 4y = 48$$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 5x + 4y = 48 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 5x + 4y = 48 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 5x + 4y = 48 \end{array}$$

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

Now, make a bomb for each of your intersections.

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Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

$$\text{Your ship: } x + y = 18$$

Intersections:

$$\begin{array}{l} x - y = -4 \\ x + y = 18 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ x + y = 18 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ x + y = 18 \end{array}$$

Now, make a bomb for each of your intersections.

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Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

$$\text{Your ship: } 3x + y = 10$$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 3x + y = 10 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 3x + y = 10 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 3x + y = 10 \end{array}$$

Now, make a bomb for each of your intersections.

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Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

$$\text{Your ship: } 15x - 200y = -1800$$

Intersections:

$$\begin{array}{ccc} x - y = -4 & 3x - y = 10 & x - 2y = -2 \\ 15x - 200y = -1800 & 15x - 200y = -1800 & 15x - 200y = -1800 \end{array}$$

Now, make a bomb for each of your intersections.

<https://www.appliedmath.org/>⁵
You sunk my Battleship!

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Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $9x + 5y = 180$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 9x + 5y = 180 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 9x + 5y = 180 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 9x + 5y = 180 \end{array}$$

Now, make a bomb for each of your intersections.

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $-x + 5y = 25$

Intersections:

$$\begin{array}{l} x - y = -4 \\ -x + 5y = 25 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ -x + 5y = 25 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ -x + 5y = 25 \end{array}$$

Now, make a bomb for each of your intersections.

<https://www.appliedmath.org/>⁷
You sunk my Battleship!

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $12x + 8y = 128$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 12x + 8y = 128 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 12x + 8y = 128 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 12x + 8y = 128 \end{array}$$

Now, make a bomb for each of your intersections.

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

$$\text{Your ship: } 100x + 400y = 5200$$

Intersections:

$$\begin{array}{ccc} x - y = -4 & 3x - y = 10 & x - 2y = -2 \\ 100x + 400y = 5200 & 100x + 400y = 5200 & 100x + 400y = 5200 \end{array}$$

Now, make a bomb for each of your intersections.

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $x + 2y = 14$

Intersections:

$$\begin{array}{l} x - y = -4 \\ x + 2y = 14 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ x + 2y = 14 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ x + 2y = 14 \end{array}$$

Now, make a bomb for each of your intersections.

You sunk my Battleship!

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $2x - y = 4$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 2x - y = 4 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 2x - y = 4 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 2x - y = 4 \end{array}$$

Now, make a bomb for each of your intersections.

You are navigating a battleship. Your course will take you across the straight path of your teacher's three ships. Your mission is to plant a bomb where your course will intersect with the teacher's ship. Try to blow up your teacher's battleship, if you can!

Your teacher's ships:

$$\text{Ship 1 : } x - y = -4$$

$$\text{Ship 2 : } 3x - y = 10$$

$$\text{Ship 3 : } x - 2y = -2$$

Your ship: $3x + y = 13$

Intersections:

$$\begin{array}{l} x - y = -4 \\ 3x + y = 13 \end{array}$$

$$\begin{array}{l} 3x - y = 10 \\ 3x + y = 13 \end{array}$$

$$\begin{array}{l} x - 2y = -2 \\ 3x + y = 13 \end{array}$$

Now, make a bomb for each of your intersections.

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