TOPIC: Writing equations of lines

GRADE LEVEL: 9th grade Pre-Algebra

FOCUS QUESTIONS: "How does collaboration and activated learning affect understanding of math concepts? How do I determine the equation of a line given different key pieces of information?"

EDUCATIONAL STANDARDS:

Non-arts Content TEK/S:
§111.39. Algebra I
(c) Knowledge and Skills
>   (1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
>>   C: Select tools, including real objects, manipulatives, and technology as appropriate, and techniques including mental math, estimation, and number sense as appropriate, to solve problems.
>>
>>   D: Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs and language as appropriate.
>>
>>   G: Display, explain and justify mathematical ideas and arguments using precise mathematical language in written or oral communication
>   (3) Linear functions, equations, and inequalities. The student applies the mathematical process standards when using graphs of linear functions, key features, and related transformations to represent in multiple ways and solve, with and without technology, equations, inequalities, and systems of equations. The student is expected to:
>>   C: Graph linear functions on the coordinate plane and identify key features, including x-intercept, y-intercept, ~~zeros~~, and slope, in mathematical ~~and real world~~ problems.

Theatre TEK/S:
§117.315. Theatre, Level I, Adopted 2013.
(c) Knowledge and skills.
>   (1) Foundations: inquiry and understanding. The student develops concepts about self, human relationships, and the environment using elements of drama and conventions of theatre. The student is expected to:
>>   A: understand the value and purpose of using listening, observation, concentration, cooperation, and emotional and sensory recall;

SEL GOAL I Secondary:
>   **Objective B**
>   Recognizes one's personal learning style ~~and finds ways to employ it~~

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MATERIALS NEEDED:
- Room with desks and chairs pushed out of the way
- Audio/visual capabilities
- Blue tape
- Permanent marker to write on the tape
- Gridded floor (or a gridded paper on the floor with at least 1' by 1' squares)
- String
- Twelve paper cutouts of battleships (three groups of four in different colors)
- Captain hats or captain's badges in colors of ships (*optional*)
- Envelope with "Classified" written on it
- See appendix for:
    - Map of battleships
    - Battleship clip
    - Classified mission
    - Battleship music
    - "Top Secret" Solution slip
    - Sound effects
    - Answer key
    - Exit tickets
    - "Reading the Map" poster

PREPARATION:
- Make a coordinate plane that goes +/- 8 units (8 tiles)
- Tape battleships on the coordinate plane
- Preset clip on the projector
- Preset music, torpedo and explosion effects on laptop
- Choose how to split students into three groups
- Tape up "Reading the Map"
- Give cooperating teachers captain's nametags

engage

1. PERSON IN A MESS:
Show battleship video.

"Captain Bugge and I have been sent from our superiors to ask for your help. This is a top secret operation, so we'll need your discretion."

Pull out "Classified" envelope. Read mission.

"To work as quickly and efficiently as possible, we will make three tactical teams. We can't do this alone; we need your help."

Have cooperating teachers break students into three groups.

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"Find a space in the room to work and in the next sixty seconds come up with a name for yourselves and choose a team captain."

Gather names from the groups and write them on the board.

2. HUMAN GRAPH BATTLESHIP
"Now that you have names, I'll give you your task. Each group has three battleships to destroy. The color of your captain's badge is the color of your battleships on the map. Each battleship goes through multiple coordinates. Using these coordinates, come up with the equation of a line that goes through all points on the battleship. This will be the trajectory for our torpedo. When your group thinks they have a torpedo trajectory, write the equation of the line on a "Top Secret" slip and flag down Captain Bugge or myself. We'll then all come together to verify the path."

Show the "Top Secret" slip and point out all of the information the groups need to write down. Read off the "Reading the Map" poster.

"Any questions?"

Give some time.

"Can someone repeat the directions back to me?"

"Good luck."

Turn on the music.

When a group thinks they've found the equation of the line that goes through a battleship, they fill out a slip and hand it Captain Bugge ro Captain Stephanie. Turn off the music and have the whole class focus their attention on that team. If this feels too disruptive, Captain can check the equations (answer key provided).

"Team -------------- thinks they have a torpedo trajectory to sink a battleship! What is the equation of your line? Can you put that line on the graph with the piece of string?"

Play torpedo sound effect.

"Let's check their work! Did the torpedo hit?"

Have the class check that the string on the graph matches the equation they have written <u>and</u> goes through all points on the battleship. If this is true, play explosion sound effect and remove the battleship from the field.

If no, encourage the group to continue working. Captain Bugge or Captain Stephanie can help them find their mistakes.

Turn the music back on and repeat. Depending on how the lesson is going, offer a goal for the class.

"Let's try to get one more ship in the next five minutes!"

If one team finishes, have them help another team.

If students finish too quickly add in: "A new ship has appeared through the coordinate ------ and parallel to the green ship 3! What would a torpedo trajectory be for this ship?"

reflection

3. REFLECTION ON THE LESSON:

With 10-15 minutes left in class, have the students stop the action and move their desks back into a circle to sit and reflect.

What did we do today? What terms did we use?

How was this activity different from the ways you've learned math before? Did any of those differences make learning easier? Harder?

How did we do working as a team?

"Before you leave for the day, I have an exit ticket for you to fill out. I want to be able to explain to other math teachers what we did and how you all felt about it. The more detail you can give me the better."

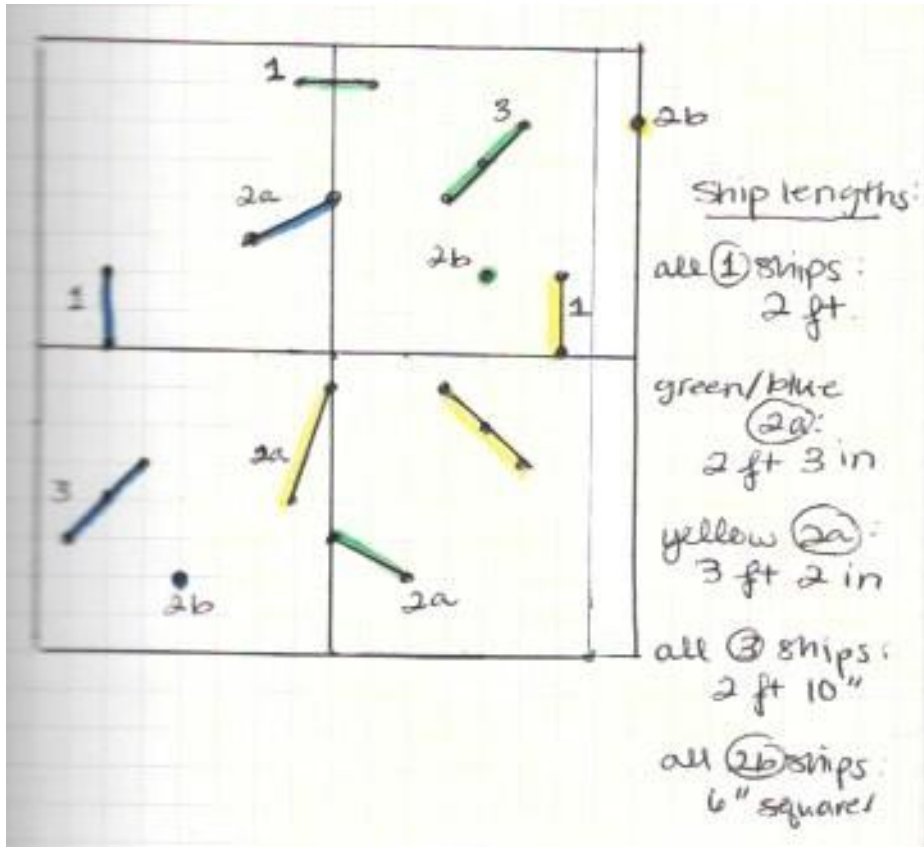Hand out exit tickets and have students fill them out.

"Thank you so much for working with me!"

APPENDICES:

Appendix A: Map of Battleships and Battleship lengths

Ship lengths and positions on the graph are provided. Put red dots on the ships anywhere you see a point on the diagram.

Note: You can make the ships worth the number of points delineated and then ask students to reach a certain number of points to get the enemy to turn around. You can also have the teams playing against one another; the first team to sink all of their ships wins.

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Ship lengths:

all ① ships: 2 ft.

green/blue ②ⓐ: 2 ft 3 in

yellow ②ⓐ: 3 ft 2 in

all ③ ships: 2 ft 10"

all ②ⓑ ships: 6" squares

Appendix B: Battleship clip (first 50 seconds):

https://www.youtube.com/watch?v=O8VYqhvBpL0

Appendix C: Classified Mission

CLASSIFIED

AT 08:00 hours, enemy battleships were discovered off the coast of California.

We need you, as mathematical experts, to help us destroy them.

We have enclosed a map of the battleships (the coordinates are encoded due to your clearance level).

We need you to give us the trajectories our torpedoes need to take to sink these battleships.

Appendix D: Music:
https://www.youtube.com/watch?v=UdzzCwzg8eM

Appendix E: "Top Secret" Solution slip:

Top Secret

Team Color/Name: _____

Boat Number: _____

Torpedo trajectory (Equation of Line):

_____

https://www.freesound.org/browse/tags/sound-effects/

Torpedo sound effect: Shoot off_Ringy5.wav

Explosion sound effect: Explosion_01.wav

Top secret: Torpedo trajectories

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Blue team:

1: x=-6

2a: y=1/2x+4

2B: x=-4 or y=-6 or any equation satisfied by (-4,-6)

3: y=x+2

Yellow team:

1: x=7

2A: y=3x-1

2B: x=8 or y=6 or any equation satisfied by (8,6)

3: y=-x+2

Green team:

1: y=7

2A: y=-1/2x-5

2B: x=4 or y=2 or any equation satisfied by (4,2)

3: y=x+1

1. Should this type of active learning be done in the math classroom (circle one)?

Always   Sometimes   Never

Why or why not?

_____

_____

_____

2. How could I describe this work to other math teachers?

_____

_____

_____

Appendix I: "Reading the Map" Poster

On a sheet of poster paper write:
- All floor tiles represent one unit
- The red dots on the ships show the coordinates the ship passes through
- All coordinates are whole numbers
- To sink a ship, your torpedo (equation of a line) must go through all red dots