

Coordinate Geometry Battleship

Teacher Lesson Plan

Coordinate Geometry Battleship is a multifaceted educational game. It is primarily designed to reinforce the concepts taught in a geometry class, but it falls under many of the types of math games that we discussed. It helps students learn the language of mathematics, use mathematical notation, develop skills, and devise strategy.

Target Grade: 7th, 8th and 9th grades

Learning Goals:

- To practice calculations related to coordinate geometry -distance, midpoint, slope/gradient.
- To help students learn to work in teams
- To allow students to strategize and tackle a complex problem

Materials:

- Graph Paper
- Pencils
- Ruler
- Students ☺

Preparations:

- Divide class into groups of two (or three depending on the size of class)
- Make a coordinate system on the graph paper, 10x10 scale for each quadrant
- Give each team a coordinate system and keep one as the master copy
- During each round, each team should choose a location to place their battleship and record the locations on the master copy

Variations:

- Students could be allowed to construct the coordinate system to allow more practice setting up the axes and labeling the positive and negative scales
- The scale of the coordinate system could be increased to allow more teams or a more challenging game
- The size of the teams can be manipulated to individual play or more teams
- Calculations could be modified, according to the grade level of students, to include concepts taught in vectors (dot product) or trigonometry (angles).

Answers to Questions on Student Activity Sheet:

1. The most strategic move would be to attack the origin on the first move. Depending upon what information the other team provides it can narrow down the location very well especially if provided with mathematical information. An example is if a team was to attack the origin and was given the distance it narrows down the possible positions to 8.
2. The first team has the advantage of attacking first and guessing the location before the other team if played strategically. There is a bit of luck in guessing the right position and also receiving the right piece of information necessary to infer upon the correct location.

3. You would just use the same strategies as used in the smaller grid. The larger grid just makes the numbers larger and more tedious to calculate. With more teams it makes it a bit more interesting because there are a variety of other teams to consider and you must pay attention to the other bits of gathered information. You must also think of a strategy to attack others while not being targeted by MANY teams.

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Student Activity Sheet

Game Objective: To sink all of your opponent's battleships.

Prepare to play

Choose a point on your coordinate system and record the location on your teacher's master copy.

How to Play:

Team A fires on Team B and vice versa by calling out a coordinate to fire upon.

When team A fires on team B, if A misses team B must give a bit of information of Team A's choosing.

This information can be one of the following:

- distance between B's location and A's shot
- gradient/slope between B's location and A's shot
- midpoint between B's location and A's shot
- answer to one yes/no question (eg. Is it in the first quadrant?)

A team can't give the same category of information twice in a row.

No team can shoot the same location twice.

The teacher will have all the teams' locations on the master copy and will be able to verify the student's calculations.

FORMULAS TO REMEMBER

Distance (d) Formula: $d = \sqrt{(\Delta x)^2 + (\Delta y)^2} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$

Slope (m) Formula: $m = \frac{y_2 - y_1}{x_2 - x_1}.$

Midpoint Formula: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Calculations (Feel free to use the back of the page as well):

Questions:

1. What is the most strategic move to make on your first move and why? On subsequent moves?
2. Which piece of information is most useful? Explain.
3. Does any team have the upper hand (advantage) by going first?
4. Would the game be easier or harder with a bigger grid? Or does it not make a difference? Explain?