



Game Over Gopher Teacher Guide

Game Over Gopher is available at mathsnacks.org

Game Over Gopher is an exciting tower defense game built around **the coordinate grid**.

To defend a prize carrot, players select various tools to “feed” the space gophers who are trying to eat the carrot. The first few levels of the game are intended to teach students the mechanics of the game play and are very simple. There are numerous visual clues that assist students in recognizing the coordinate plane and how to place points on the plane using the x-coordinate and the y-coordinate. For example, the x-axis and all other cues associated with x-coordinates are red. Everything associated with the y-axis is blue. As the levels progress, the number of tools available increases, the level of math vocabulary increases, the scale of the grid changes, and students are also asked to reflect points across axes. There are bonus levels where students use clues to identify the location of the hidden treasure. This game can be used to introduce the coordinate plane and does not require pre-teaching.

Time Required: Two gaming sessions: 40 minutes each; Bonus activity: 30 minutes

Learning Objectives:

By playing *Game Over Gopher* and engaging in at least one of the recommended bonus activities, students will be able to:

- Plot points on a coordinate plane when given a coordinate pair.
- Identify coordinate pairs on a coordinate plane.
- Identify the four quadrants, the x-axis, the y-axis, and the origin.
- Differentiate between x-coordinates and y-coordinates.
- Differentiate between negative and positive coordinates on the coordinate plane.
- Identify what happens when you increase or decrease the x-coordinate of a point.
- Identify what happens when you increase or decrease the y-coordinate of a point.
- Reflect points across the x-axis and the y-axis.

Vocabulary: Coordinate plane, quadrant I, quadrant II, quadrant III, quadrant IV, x-axis, y-axis, origin, point, positive number, negative number, coordinate pair, x-coordinate, y-coordinate, vertical line, horizontal line, increase, decrease, reflect.

Vocabulary in Spanish: Plano de coordenadas, cuadrante I, cuadrante II, cuadrante III, cuadrante IV, eje “x”, eje “y”, origen, punto, número positivo, número negativo, par de coordenadas, coordenada “x”, coordenada “y”, línea vertical, línea horizontal, aumentar, incrementar, disminuir, reducir, representar

Materials and Technology required: Access to computers and the Internet.

Common Core State Standards Covered

Standard	Standard Description
5.G.1	Graph points on the coordinate plane to solve real-world and mathematical problems. Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).

Common Core State Standards Covered (continued)

Standard	Standard Description
5.G.2	Graph points on the coordinate plane to solve real-world and mathematical problems. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
6.G.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
6.NS.6b	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
6.NS.6c	Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
6.NS.8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Preliminary Preparation

1. Please play the game so that you understand the game mechanics and how the math concepts are taught during gameplay. The games are intended to be a fun way for students to learn, and teachers find the game enjoyable as well.
2. Secure the proper number of computers for each student to play the game.
3. Make sure *Game Over Gopher* is open on all computers before taking the class to the computer lab. This will maximize game playing time in the lab.

Game Session 1 (40 minutes)

Note: There is no need to *teach* graphing before going to the computer lab. The intention is to have the kids experience the game first. It is also important to encourage students to talk and discuss while they are playing the game. Keep the sound at a manageable level, but do not have students mute the sound.

1. Allow students to play the game for 15–20 minutes.
2. Have students pause the game, and lead a discussion with the students about the gameplay. (We suggest limiting discussion to 10 minutes.)
 - What do you like about this game?
 - What are some things that make this game challenging?
 - Can anyone give classmates hints about how to play the game?
 - What math do you see in this game so far?
 - What is your favorite tool for feeding the gophers?
3. After the discussion, allow students to play the game for an additional 20 minutes.
4. After 20 minutes, if time allows, show one of the levels on the projector and ask students the following questions. (This can be done in the classroom.)
 - What do you notice about the x-axis and all of the x-coordinates? (Answer: Red)
 - What do you notice about the y-axis and all of the y-coordinates? (Answer: Blue)
 - What are some hints you can give other students about passing the bonus levels?

Encourage students to play *Game Over Gopher* at home.

Game Session 1 (40 minutes)



Game Over Gopher can be played at <http://MathSnacks.com>



On the level select screen, type the “shift” and the “c” key on the keyboard to open up levels. This is helpful for students at home; they can pick up where they left off in class.

Bonus Activity and Discussion Questions

Coordinate Grid Connect Four

Supplies:

1. A coordinate grid on a poster board, on the classroom floor, on the white board, on the smart board, in the hallway, or outside on the basketball court. The coordinate grid should be properly labeled and should go from -10 to 10 on the x-axis and -10 to 10 on the y-axis.
2. Depending on the coordinate grid, each team will need a different colored marker or “point.” This could be magnets, white board markers, sticky notes, or anything that can serve as a point on the grid.

Object of the Game:

The team that places four points in a row, either diagonally, vertically or horizontally, wins the game. It is basically “Connect Four” with coordinate points. The game can be played with multiple teams; however, more than five teams may be too many.

Rules of the Game:

1. Each team has three members: *Point Person*, *Runner* and *Placer*.
2. Team members cannot talk to each other.
3. The Point Person will write a coordinate point on a piece of paper and give it to the Runner.
4. The Runner will take the paper to the Placer.
5. The Placer will then place one of the team “markers” on the point given to him/her by the Runner.
6. If the Placer gets the coordinate wrong, it must stay in its place.
7. The team can block a run being made by another team if the Point Person chooses the appropriate point.
8. If Markers from one team surround a Marker from another team, they can replace that Marker with one of their own.
9. The team that gets four Markers in a row wins.
10. The game can be played over and over again, and team members should switch roles so that each has the opportunity to experience all jobs.

Discussion is encouraged after each round of the game to solidify the concept of choosing and placing points on the coordinate grid. Keep the markers on the grid and discuss alternate strategies for each of the teams. If a student or team is confused about the points or the strategy, this should be brought out in the discussion.

Bonus Activity and Discussion Questions (continued)

Alterations of the Game:

It would be a good idea to continue to play this game or a variation of this game with a different scale. For example, the scale could be from -5 to 5 on the x- and y-axes, but going up by halves. Another variation would be to double the scale on each axis and go from -20 to 20, counting up by twos.

Gaming Session 2 (40 minutes)

1. Allow students to play *Game Over Gopher* again. Allow students to use the CHEAT (shift + C on the level select screen) for the game during this second session so that they do not have to start from the beginning. Tell students to start at the level where they finished the last time they played.
2. Remind students about the visual clues, including color, for placing points.
3. Allow students to play for 15–20 minutes and then have students pause the game.
4. Ask the following questions: (Limit discussion to 10 minutes.)
 - How do the later levels in *Game Over Gopher* get more challenging?
 - What are some strategies you have used to get through different levels?
 - What is different about the scale for the x-axis and the y-axis in later levels?
5. Have students continue to play for as long as time allows.

The Bow (Tie it all together to bring out the main ideas)

1. Let's make a list of all of the math vocabulary you used in *Game Over Gopher*.

Have students give you different vocabulary words and state where they saw them in the game – encourage them to list as many as possible. Some examples (not a complete list):

Coordinate plane, quadrant I, quadrant II, quadrant III, quadrant IV, x-axis, y-axis, origin, point, positive number, negative number, coordinate pair, x- coordinate, y-coordinate, vertical line, horizontal line, increase, decrease, reflect, scale.

2. Draw a blank coordinate grid without any labels on the board and have students label it using the vocabulary words identified in question 1.
3. What difference does it make when you change the scale of the grid? (Hopefully students will understand that the grid could go up/down by ones, by halves, by twos, tens, hundreds or any scale that is most appropriate for the situation.)
4. Can you give some real world examples of where you might see coordinate grids? (Hopefully students will recognize that maps, blueprints, and streets use grids to identify locations using points.)

Encourage students to keep playing *Game Over Gopher* at home.

Encourage them to try to get through all levels of the game.