



Dinner Robot



Grade 5 Math Alignment

Domain: Geometry

Cluster: Graph points in the coordinate plane to solve real-world and mathematical problems.

Standard: 5.G.1: Use axes to define a coordinate system...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

Standard: 5.G.2: 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

Level 1B/2 CSTA Alignment

Concept: Variables

Standard: 1-AP-09: Create programs that use variables to store and modify data

Concept: Modularity

Standard: 2-AP-14 Create procedures with parameters to organize code and make it easier to reuse

Description

In this exploration students will “set” dinner tables by building and moving plates around using a **first-quadrant 2D coordinate system**. They will understand that **translations** from the origin define the x- and y-positions of a point in the plane. Students will create **modules** that allow them to quickly tell a “robot” where they would like a plate set so they can get out of doing the chore themselves!

Learning Objectives

- Students will practice describing position in the first quadrant of a 2D coordinate plane
- Students will recognize that a coordinate point represents how far along the x and y-axis a point has been moved from the origin
- Students will use a module with parameters to create customizable and replicable objects
- Students will manage a busy workspace by labeling, collapsing, and disabling blocks

Videos

- Working with Code: <https://www.youtube.com/watch?v=YBRaaPGuO2E>
- The Translate Block: https://www.youtube.com/watch?v=6ulQa_sO8ms&t=5s
- Modules: <https://www.youtube.com/watch?v=PKsFGq5dsos>
- Modules with Parameters: <https://www.youtube.com/watch?v=Us39lcENv4k>

Review/Prior Knowledge

Students should have some exposure to the coordinate plane, but this exploration serves as a good introduction to applying basic ideas about coordinates. Only the last challenge of this lesson asks students to think about negative coordinates of points not in Q1, but this is not an essential part of the lesson if students have not worked with the negative axes. This exploration does require some facility with managing the BlocksCAD workspace by collapsing and disabling blocks, but students do not need any prior experience to pick these skills up quickly.

Resources

- Student Handout: Dinner Robot → Student guide for activity
- Dinner Robot Student File.xml → BlocksCAD file for students to start with
- Dinner Robot Solutions.xml → Example solution code

Teacher Notes

General Introduction: Students should be refreshed on/introduced to the coordinate axes as appropriate. A suggested warm-up exercise is to create an imaginary first quadrant around the room with length 10 units in each direction. Have students place themselves somewhere and share what point they think they are at and why. You may

also have students follow instructions like “Move two units along the x-axis” to get them thinking about how translations and coordinates are related.

BlocksCAD Introduction/Refresher: When students open their Dinner Robot Student File.xml (Assign from your Classroom page or send them the .xml and do New Project → Project → Load Blocks from your computer) they will see lots of different blocks. Before they start working, students should be reminded about how to keep an organized workspace: Right-clicking on blocks will let them disable (keep blocks in workspace but not have object show up in render worksheet), delete, collapse, or add comments to their blocks. This exploration does not require any building experience, but these workspace management techniques will be important as students work through this activity in progressive sections. Encourage students to use the check boxes next to each instruction so that they can keep track of what they have completed.

Exploration: For **Part I**, students will first make a simple cylindrical plate with a color block and a cylinder block. They will choose an appropriate radius and height on their own ($r = 4$ and $h = 0.5$ are what were used for all the images). They will then enable the second “table” and should recognize that the current plate has a center of $(0, 0)$, but this table needs a plate centered at $(10, 10)$. They will use a translation block to move the plate where it needs to go. At this checkpoint the facilitator should confirm with individuals or groups that they understand how to make and move a plate before letting them move on to Part II.

Part II walks students through the steps required to make a module. This is likely a new concept for them, so Part II may best be completed as a group or at least with close guidance. Students can largely just follow the example blocks they see in their handout, but if they are not reading closely then may need extra explanations about the module inputs and why a module block on its own will not render anything. Once students have their module set up, however, they should be able to experiment on their own to see how they can simply put in x and y-numerical values and a plate will show up at that location. Once they show you that they’ve set the table with four plates using their module, they’ll be ready to work on Part III with less guidance.

Part III has two “challenge tables” in the students’ BlocksCAD file that they can set up by moving the appropriate number of tables to the appropriate places using the same methods they did in Part II. The second challenge introduces negative coordinates, so this could be a way to challenge faster-moving students to think about how they will move plates to locations not in the first quadrant. The last two picture challenges on the final page are just on the handout and are not in BlocksCAD. These can be used for

students who have worked through the activity quickly and are ready to think more about negative coordinates.

Reflection Questions and Activities

- 1) Coordinates like (2, 3) and (10, 15) describe positions in the XY plane. What could a coordinate with three spaces like (4, 12, 6) mean and why might it be useful?
- 2) Pick a room in your school or your house and pretend it sits in the first quadrant of a 2D plane. Describe the coordinates of some of the key features in the room, and see if a friend can sketch the layout of the room based on your coordinate descriptions.
- 3) Other BlocksCAD activities in the transformations progression: Bikini Bottom City Planning, Scale City, and Triangle Target Practice.