Lesson 1.5

Coordinate Drawing

Lesson Breakdown:
Coordinate Navigation Intro: 10 min.
Exploring Reset Navigation: 10 min.
Connect the Coordinates: 25 min.
Reflection: 10 min.

Overview

Use coordinates to create intricate "Connect the Dots" drawings with your robot.

Objectives

- I can use a coordinate grid to create intricate drawings with my robot.
- I can use reverse-engineering skills to re-create existing drawings with a coordinate grid.
- I can use the Reset Navigation Block to reset my robot's origin.

Preparation

If your students have not learned about coordinate grids, it may be helpful to allot some extra time to help them get comfortable with a grid system.

- Print out the worksheets at the end of this lesson (Make sure to print at 100% scale for measurements to be correct).
- Gather all materials listed in the Materials section.
- Charge robots and coding devices prior to class.

New Concepts

Reset Navigation Block
Coordinate Drawing
Plotting Machine

Materials:

iRobot® Coding App
Compatible Device
Root Coding Robot
Fold-Out Whiteboard Grid
Dry-Erase Marker

Standards:

CSTA 1A
1A-AP-10,
1A-AP-11,
1A-AP-12,
1A-AP-14

CSTA 1B
1B-AP-10,
1B-AP-11,
1B-AP-12,
1B-AP-15,
1B-AP-16,
1B-AP-17

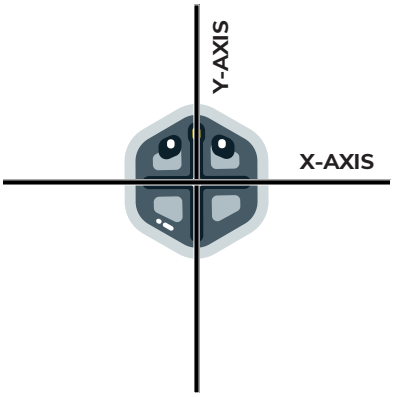
CSTA 2
2-DA-07 ,
2-AP-13

Step 1: Introduction

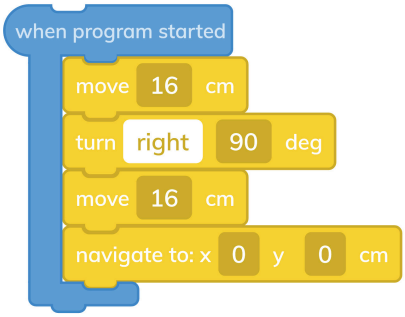
Welcome to coordinate drawing! In this activity, students will learn how to use the Reset Navigation Block and leverage the power of a coordinate grid to code their robots to trace existing drawings and create new artwork.

Ask if students can think of how the robot knows where the coordinates are as it drives. You can explain using the following:

- *"When the Play Button is pressed, the robot automatically decides that its starting position is the grid's origin (0, 0). The line extending straight from the robot's power button nose is the Y-AXIS. The line flat across the robot's middle is the X-AXIS."*
- *"As it drives using Move and Turn Blocks, the robot keeps track of its changes in direction and distance relative to its original starting point of (0, 0)."*
- *"This means you can usually tell the robot to return to its starting place by using a Navigate To (0, 0) Block. "*



Demonstrate the concept of returning to home by showing a robot executing the program on the right. Prompt students to notice that even though no other coordinate blocks are used anywhere in the project, the robot remembers where (0, 0) is.



Next, introduce the Reset Navigation Block.

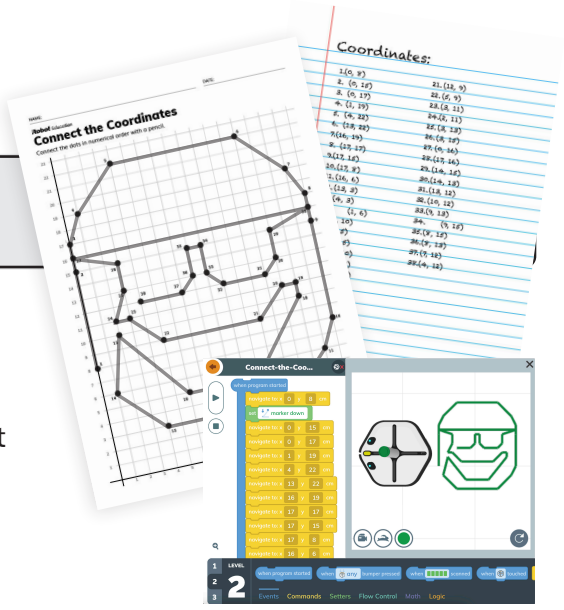
"Often, programmers are perfectly happy leaving the origin at the robot's original starting position. However, there are times where it can be more helpful to start a new grid mid-program by deciding a new origin location. This is where the Reset Navigation Block can be helpful!"

Step 2: Explore

Distribute coding devices and ask students to open the iRobot Coding App. Allow them experiment using the Reset Navigation Block and invite them to list at least three circumstances where this block might be useful.

Step 3: Skill Development:

Next, it's time for the Coordinate Drawing activity!



If students are unfamiliar with Connect-the-Dot puzzles, take time to explain them.

Divide class into groups or pairs and provide each team with a coding device, robot, marker, fold-out whiteboard grid, **Connect the Coordinates** worksheet and a blank coordinate grid worksheet.

Direct students' attention to the Connect the Coordinates worksheet and provide the following instructions:

1. Use a pencil to connect the dots on the page and discover the hidden artwork.
2. On scrap paper, write down the coordinate locations for each of the dots, in order.
3. Open the iRobot Coding App and connect to your robot.
4. Place the robot in the center of the fold-out whiteboard grid and insert its marker.
5. Code your robot to drive to each of the coordinate locations while drawing.
6. Your robot's drawing should match the Connect-the-Coordinates artwork.

Step 4: Reflection:

Discussion Questions:

- How do you feel about using your robot to draw pictures with the Navigate To Block instead of Move and Turn Blocks? Does one approach feel easier than the other? Why?
- Can you think of any other machines that use coordinate locations to create images?

Going Further

Create Your Own Connect-the-Coordinates

With remaining time, invite students to surprise each other with mystery coordinate artwork.

1. Students draw a Connect-the-Dot image on the blank coordinate paper provided. Make sure to keep the drawing a secret!
2. On a separate, blank piece of paper, list all of the drawing's coordinate locations in order.
3. Once all coordinate locations are listed, students exchange coordinate lists with a partner.
4. Take the new list and code your robot to draw a line connecting all the coordinate locations. What mystery artwork did your partner create?

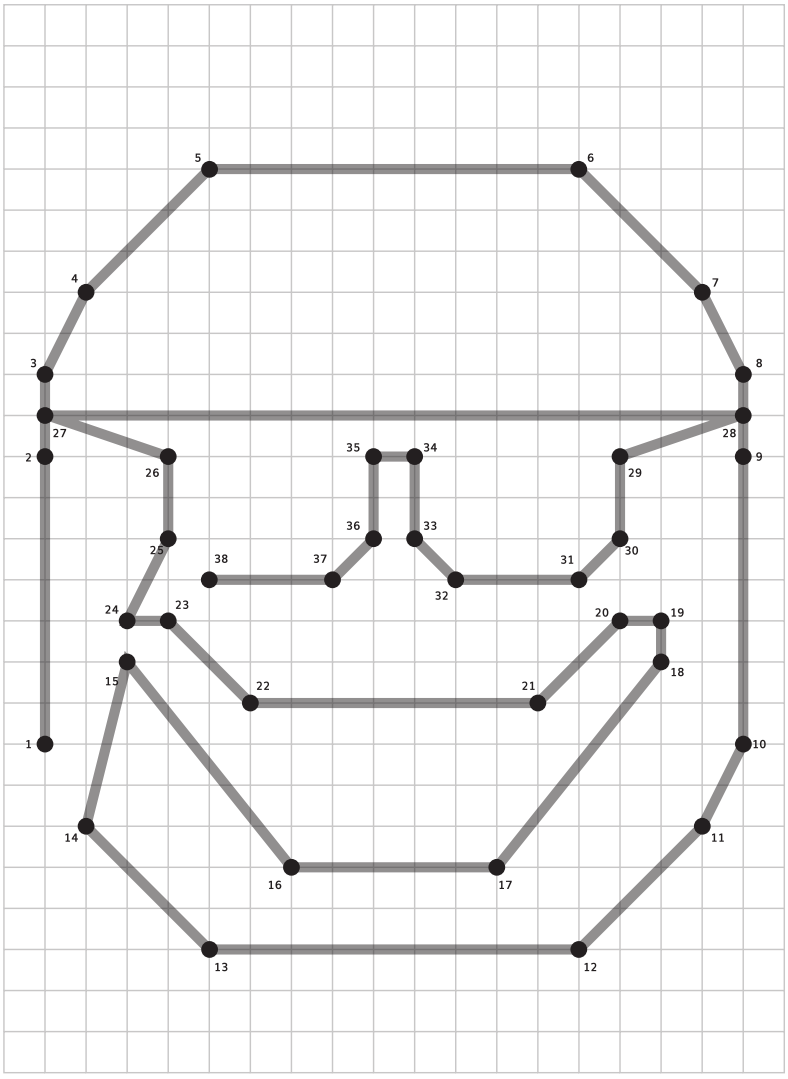
Python Extension

The Reset Navigation Block translates to Python as: **await robot.reset_navigation()**. Let's break the Python syntax down so we can better understand.

- "**await**" tells the program that the command may take a while to complete, and therefore other processes can run while waiting for this command to finish.
- "**robot**" clarifies which object the command is for. In this case, it's the robot!
- "**.reset_navigation()**" is a method that resets its object's grid. In this case, the new grid origin would be the robot's current location.

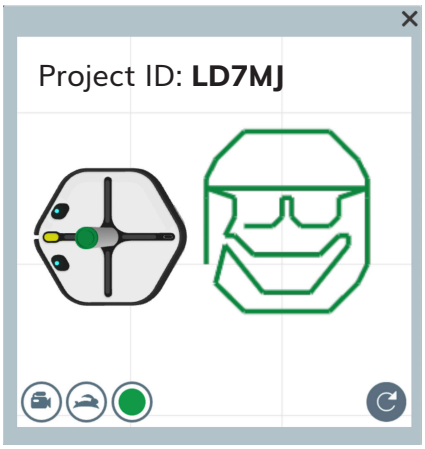
Connect-the-Coordinates

Answer Key



Coordinates:

1. (0, 8)
2. (0, 15)
3. (0, 17)
4. (1, 19)
5. (4, 22)
6. (13, 22)
7. (16, 19)
8. (17, 17)
9. (17, 15)
10. (17, 8)
11. (16, 6)
12. (13, 3)
13. (4, 3)
14. (1, 6)
15. (2, 10)
16. (6, 5)
17. (11, 5)
18. (15, 10)
19. (15, 11)
20. (14, 11)
21. (12, 9)
22. (5, 9)
23. (3, 11)
24. (2, 11)
25. (3, 13)
26. (3, 15)
27. (0, 16)
28. (17, 16)
29. (14, 15)
30. (14, 13)
31. (13, 12)
32. (10, 12)
33. (9, 13)
34. (9, 15)
35. (8, 15)
36. (8, 13)
37. (7, 12)
38. (4, 12)



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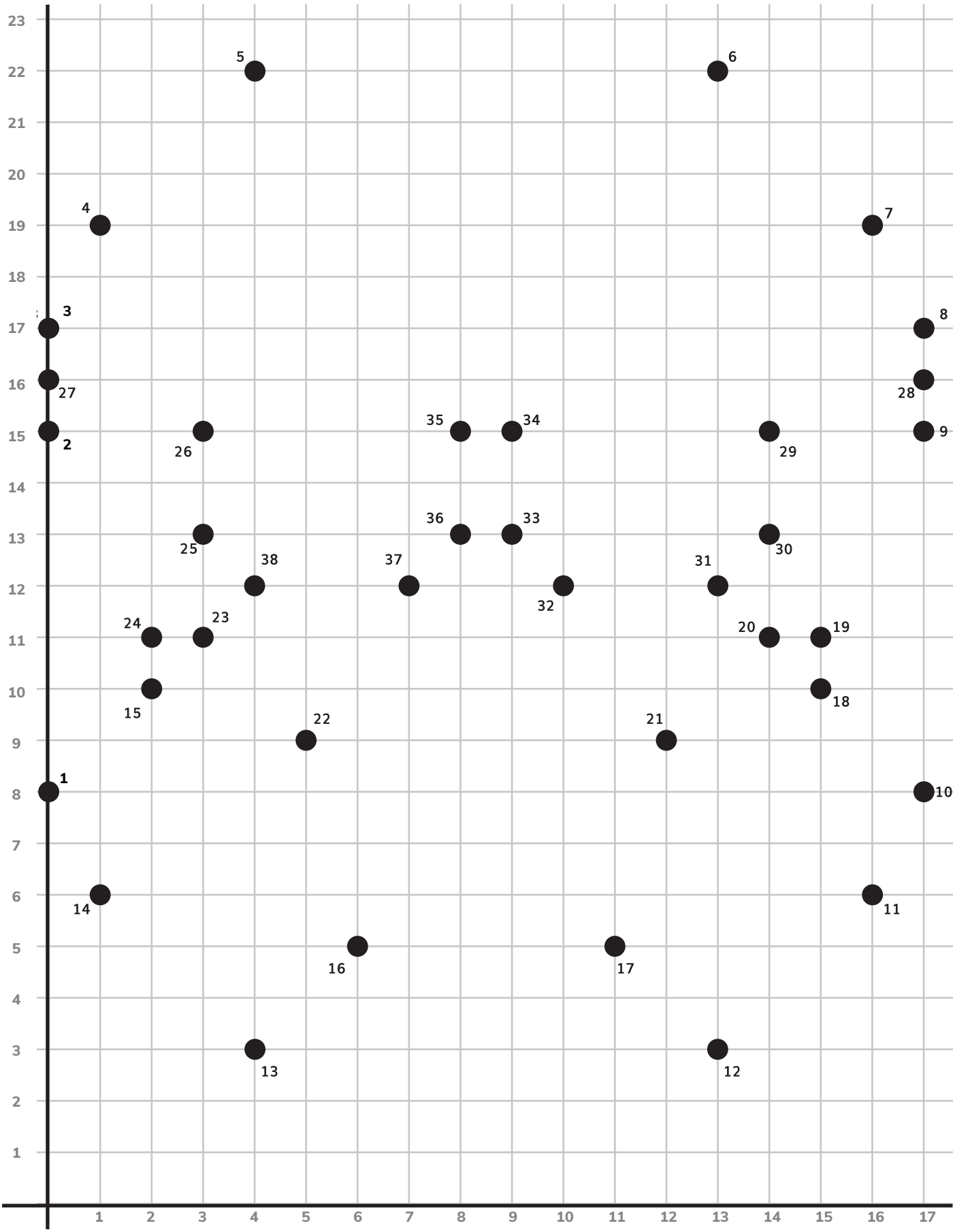
Connect the Coordinates

Connect the dots in numerical order with a pencil.



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