

## Week 3 - Overview

In this week's lesson we will use encoders for navigation and use the compare values block to control the motion of the robot using feedback from the encoders. We will start out the week by using the encoders to park our car and drive in a square. We will then use geometry and the encoder values to calculate the area of the circles on our parking lot. We will navigate to targets in the parking lot and learn to use the manual gamepad controls. We will wrap up the week by revisiting the lesson where we drive the perimeter. Recording the encoder values allows us to make distance calculations.

### Computer Science Skills

- Using Loops
- Using compare statements
- Using a spreadsheet for calculations

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### STEM Skills

- Using ratios
- Circle geometry and the use of PI
- How the rotary encoders work
- Average values
- Using order of operations to break complex arithmetic calculations into multiple steps
- Using a spreadsheet to keep track of encoder values
- Using a spreadsheet to make calculations
- Area and perimeter of a rectangle

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### CoderZ Techniques

- Until and While loops
- Encoder values
- Print to console block
- Comparing encoder values to ultrasonic and gyro values
- Using nested math blocks to make calculations
- Using the manual controls

## Implementation Thoughts

It is important to emphasize the differences between using time as a parameter to control the behavior of the robot versus using sensors such as the encoders. You will find that with actual robots (and our CoderZ simulation), using time can lead to wide variations in the robot's behavior. Encourage the students to find this out for themselves. Resetting the encoders is akin to resetting a stop watch when running laps and can be a powerful tool. Using the manual controls can be powerful on many levels. To start out, you can save steps in the coding process by creating a starting position for the robot to test the code. While the robot is moving with the gamepad, watching the encoder values can help your students plan their code. With a real LEGO robot, it is similar to pushing the robot with your hand.

### Lesson 1: Using Encoders to Park a Car

- Using Until and While Loops
- Using compare statements
- Resetting the encoders
- How do encoders work

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### Lesson 2: Encoders for Driving in A Square

- Reset the encoders
- Develop a relationship between distance travelled and the rotation of the wheels
- Develop a wheel to encoder turning ratio
- Use encoders to plan turns

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### Lesson 3: Geometry of a circle

- Making calculations
  - Using the manual controls
  - Coding the robot to make measurements
  - Coding the robot to drive in a circle
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#### **Lesson 4: Encoder Navigation**

- Using the manual controls and the HUD
- Using encoders to navigate
- Using spreadsheets to develop pseudo code

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#### **Lesson 5: Secure the Perimeter**

- Using the manual controls and the HUD
- Using encoders to navigate
- Using spreadsheets to make calculations