OzoBlockly Editor Challenge

Precision Placement – ORA Builds a Semicircle

Student Guide

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Introduction

Are you ready to bridge the gap between abstract mathematics and real-world engineering? In this challenge, your mission is to program ORA to arrange small square blocks into a perfect semicircle. To conquer this challenge, you will need to rely heavily on your math skills. You'll apply the Cartesian coordinate system to map out the physical workspace. Most importantly, you will unlock the power of trigonometry, using sine and cosine functions, to calculate the precise geometric drop-off points along the curved path.

Mastering these concepts does more than complete a school project. It builds a solid foundation for a career in robotics, automation, and advanced manufacturing. By translating mathematical equations into physical robotic motion, you are practicing the exact problem-solving techniques used by professional engineers today. Step up to the challenge, apply your math, and program your future!

The Challenge Setup

Figure 1 shows what the semicircle should like in front of ORA when the challenge is complete. The radius of the semicircle is 350 mm. Small square blocks are placed into the 3D-printed cube holder in the foreground one-by-one by a student as needed by ORA. The cube holder has been designed to hold the square blocks with very little wiggle room and is attached to the table by strong double-stick tape. It is important that each block be in precisely the same location when ORA moves over to pick it up and that there is no shifting of the cube's position when grasped by the vacuum gripper. The cube holder provides for this capability. Note that the square blocks used are actually from a *Travel Qwirkle™ Board Game*. With painted surfaces, these blocks form a tight vacuum when picked up by ORA's vacuum gripper.

In order to gain a better feeling for the result expected from this challenge, please view the 25-second time-lapse video that accompanies this challenge lesson.

Figure 1

Two <u>VERY IMPORTANT</u> Notes Regarding Safety

1. You should include the Ozobot Editor block shown in Figure 2 at the beginning of your program, perhaps right after the *Program start* block or in a function where you initialize a number of things required by your solution to the challenge. Why? When ORA is moving at a slower speed, say 20% or less, you have more time to prevent an impending collision with the table or squares that have already been placed by ORA. Of course, this also allows a person more time to move out of the way of ORA's moving arm! This is particularly important throughout the development process while creating your program, when you are more apt to make errors in coordinate values in *move to coordinates* blocks.

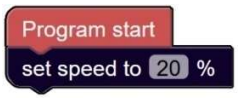

Figure 2

2. Make sure that the **Emergency Stop Button**, shown in Figure 3, is within easy reach. It might even be a good idea to have one student with his or her hand above the button when the program is started, in the event that it becomes necessary to instantly terminate all motion of ORA's arm and cancel any commands.

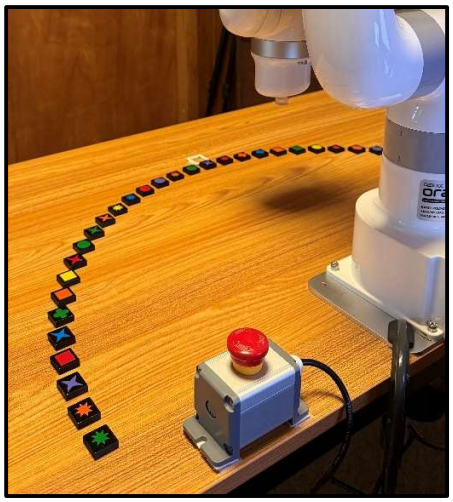

Figure 3

Take on this OzoBlockly Editor Challenge to program ORA in creating a perfect semicircle with square blocks! Enhance your math skills by applying trigonometry and the Cartesian coordinate system. This hands-on experience is your gateway to future careers in robotics and engineering. Join the fun!
