

Robots for Beginners

Project 4:A"maze"ing Turns

Sometimes the only way to get ahead is by going sideways

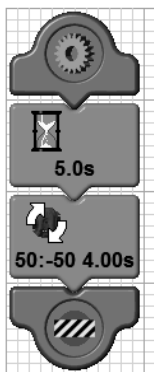
Now that you're a pro at going straight (and predicting how far you'll go) it's time to do some turning. Thankfully your S2 has a couple of cool design features we can exploit. The first is the fact that the two wheels are arranged such that if they rotate in opposite directions at an equal speed, the robot will simply spin on its axis. The second cool design feature is that there is a hole THROUGH the S2 precisely at that axis.

The combination of these features in concert with the fine control of motion that the encoders provide allow us to use the S2 as a sort of X-Y plotter (that's how "Scribbler" got its name). Just download your program, drop a pen through the hole, and start writing. Of course it's not quite that simple, but almost.

So let's start turning!

Please do the following in step-by-step fashion. When you have finished each step please check it off with a pencil ☒.

- 1.** Starting with a clear worksheet, find and add two blocks: a pause and an "Insert a move command" block.
- 2.** Set the starting pause to the usual 5 seconds to allow you time to get set.
- 3.** Set the velocity on the wheels to: Left = 50 , Right = -50 (yes that's a MINUS 50). Set the Time/Distance to 4 seconds. Upload to your S2. Your program should now look like this:

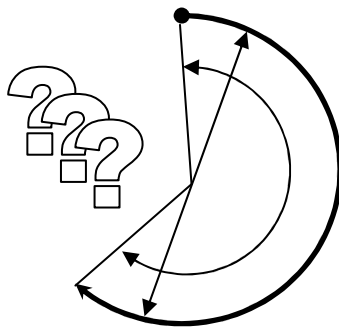
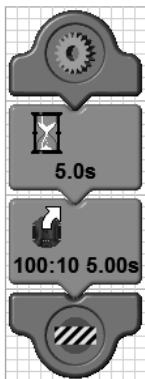


Caution – We're about to do some writing with your S2. If you are using an erasable white board, BE SURE TO ONLY USE DRY ERASE MARKERS!!!! Otherwise you can permanently damage the board. Also please cap the pen after each run, that saves it from drying out.

4. Get a pen and a sheet of paper (or dry marker and white board). With your S2 switched OFF place it on the paper or white board, remove the cap from your pen, insert the pen through the hole tip-down. Now without jostling the S2 turn the power on and let go. Once the program has finished, remove the pen first then lift your S2. Look at what was drawn.

If you entered the program correctly all you will see is a single dot, perhaps a very small circle or squiggle. OK, it's pretty dull but THIS IS GOOD NEWS, it means that your S2 is able to spin on its own center!

5. Now let's learn how to draw a circle. Change your program to have a velocity of 100 on the left and 10 (positive 10) on the right. Set the time to 5 seconds. Your program and drawing will look like this:



Upload to your S2, set up the pen and go again. You should now have an arc. What is the diameter of the arc in inches?

What portion of a circle was drawn (there are 360 degrees in a full circle)?

6. Now it's your turn. If your S2 is typical, you drew a little more than a half circle with the time set to the maximum, 5 seconds. Hmmmm... but we want a FULL circle, how do we get there? (Think about this BEFORE reading the next sentence!)

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Time to think...

If you're clever you realized that you can string multiple instances of the same move block, and thus add up the time!

So let's do it. Copy and paste the move block so you now have two identical blocks in a row, upload and run again.

What did it do?

Did it seem to move about twice as far as one single block?

Can you see discontinuity in the line where one block ends and the next one starts?

Did it come back and write (more or less) on top of the original line?

- 7.** Adjust the velocity values and times to produce as nearly a 8" diameter circle as possible, starting and stopping on the same spot. Use multiple move blocks if necessary.

Write down the final values here:

Left Velocity _____ Right Velocity _____ Total Time _____ (add up the blocks)

- 8.** Create a program that will draw a 6" straight line, spin 90 degrees in place to the right and then draw another 6" straight line. The result should be two straight lines joined at a sharp right angle turn.

Write down the values for the two move blocks:

Block 1: 6" Straight Line: Left Velocity _____ Right Velocity _____ Total Time _____

Block 2: Spin 90 degrees to right: Left Velocity _____ Right Velocity _____ Total Time _____

- 9.** *Let's put this to practice.*

Your instructor will show you the Maze, a white board with two lines that describe the boundaries of a pathway.

Program your robot to turn and move (with a pen) so that the line is always between the lines. You MUST travel the entire path up to the desired endpoint (one, two or three Einsteins). **Be prepared for many iterations if you decide to do the full run!**

Be sure to use a dry-erase marker and keep you pen capped between runs!

Hint: If you reach what looks like a dead-end in the path, that means you are to stop, turn 180 degrees, and continue. Or of course, you could always travel backwards...

Here's an approximate picture of the maze. You are urged to measure the actual maze so you know how far to move and turn.

