



**Larry Ottman
Calculator Robots Session
Teachers Teaching with Technology
International Conference
Washington, DC
March 18, 2005 2:30 pm**

Calculator Robots Basic Programming

All of the following information can be obtained from the spec sheet on the Smallrobot website at the following URL:

<http://www.smallrobot.com/Instructions.pdf>

Background Information

In order to make your robot function you only need two commands, Get and Send. Think of it as a conversation between the calculator and the robot. In order for the robot to execute a single movement you must **Send** an instruction to it from the calculator and the calculator must **Get** a reply.

The robot has two motors, one for each wheel. There are three basic commands you can **Send** to the motors; Timed movement, move until switch is hit, and timed movement *or* move until switch is hit. The logic board on the robot has been programmed to accept these commands as 1, 2, and 3 respectively. There are other commands that have been programmed for more advanced use.

Once you have defined the type of movement, you must next instruct each wheel how to rotate; backward, no motion, or forward. These have been programmed as 0,1, and 2.

Writing the Program

Choose **Program-New** and create a program called **AROBOT** (why A???)

Send Command

The first line of your program should be a **Send** command. Choose **Send**(from the **Program- I/O menu**. Insert a “curvy bracket” {
And complete the command so that it matches what you see below.

Send({122,500})

The first part appears to be the three digit number 122, but is actually a series of three commands being sent to the robot. The 1 is the command. 1 corresponds to the command for timed movement. The twos instruct each wheel, left first followed by right, to rotate forward.

Because the command is for timed movement, the number after the comma corresponds to the duration value. The manufacturer instructions define this number as being measured in “centiseconds” (which would be a good discussion for your class), however these time values will be relative to your individual robot and battery strength. In this case, the robot should move forward for approximately 5 seconds.

Get Command

Choose **Get(** from the **Program-I/O** menu and complete the command to read:

Get(R)

R, from what I can surmise, was an arbitrary choice of variables (I think it corresponds to the initials of the inventor), that allows the robot to communicate back to the calculator. It has been hardwired into the circuitry of the robot, so you can not substitute any letter you choose!!

Get to it!!

That’s all there is to it! In order to execute multiple movements, simply add another pair of **Send/Get** commands to the program. Each movement *must* have both a **Send** and a **Get**.

ROBOT EXERCISE

Group _____

Teach your robot to do the following things. When it has learned, bring it to the instructor to be approved.

<i>ACTIVITY</i>	CHECK
Move forward	
Move backward	
Go forward, come back	
Turn 180 degrees (using one wheel only)	
Turn 180 degrees (using both wheels)	
Go forward, turn around, come back	
A square	
An equilateral triangle	
Go forward until you touch a wall, then turn around and come back	



Calculator Robot Angle Turn Experiment



The directions for programming the robot claim that the duration values equate approximately to centiseconds. This can fluctuate due to environmental factors. We will complete an experiment to relate this number to angle turns in degrees.

PART I

1. Set your calculator down with the left wheel on the center of the circular grid and the right wheel on 0 degrees.
2. Modify a program to turn the robot by rotating the right wheel forward. Start with a duration value equal to 20. Run the program and observe the angle of rotation. Record this value in the chart.
3. Repeat this experiment increasing the duration value by intervals of 20. Try 3 trials at each value and use the average angle. Complete the chart.

Duration Value	Angle of rotation
0	
20	
40	
60	
80	
100	

4. Enter the data in two lists and create a scatterplot. Let's assume that your data is linear. Calculate the slope of your line. What does the slope represent?

5. Based on your calculation, predict the degree measure for a duration value of 250? Test your prediction.

6. Predict the duration value that would result in *two complete rotations*. Test your prediction.

PART II

1. Set the robot down on the grid so that the wheels are spaced evenly across the center and the right wheel on the zero mark. Modify your program to rotate the robot by turning both wheels, the right forward, and the left backwards.

2. What do you think will happen if we repeat the same experiment? Test your prediction by completing the chart.

Duration Value	Angle of rotation
0	
20	
40	
60	
80	
100	

4. Write the equation expressing angle rotation in terms of the duration value.

5. If you started in the initial position, rotating using both methods, what would be the first duration value for which both types of rotation would end facing the same direction?

Robot Wars

In this activity you will place your robot on the “field of play” on the tape mark facing the center. The goal is to reach the golf ball as fast as you can. If your robot reaches the ball before your opponent’s, you win. Oh, by the way, if your car touches the meter stick, you will be disqualified. You will not be allowed to practice on the playing field, but you will be allowed to take measurements from it and you may test your robot somewhere else. Be creative in designing an effective strategy!!

Choose a name for your robot.

Your Robot _____

