

# GEAR/TCEA Robotics

## Challenge 7: How Far, How Fast?



### Challenge 7: Estimating and Measuring Distance and Velocity

**THE OBJECT:** In this challenge, students will learn to use their robots to measure distance and velocity.

#### Estimating and Measuring Distance

Program your robot to go straight forward for one rotation.

1. How far (in centimeters) do you think your robot will move forward in one rotation?
2. How far did your robot actually move? Measure and record that number.

On the floor, create (with tape) or find 2 parallel lines.

3. Measure the distance between the two lines and record that number below.
4. Estimate how many rotations are needed to make the robot move from one line on the floor to the other? Record that number below.

5. Program your robot to go forward the determined number of rotations and test it. Did your robot move exactly from one line to the other? If not, what adjustments did you have to make to accomplish this task? Write down the actual number of rotations needed.
  
6. What do you expect to happen if the number of rotations stays constant, but you change the power level? Test your assumption using two different power levels (20% and 100%). What effect does power level have on rotations?

### Estimating and Measuring Velocity

We will once again use the two parallel lines on the floor to measure the time it takes for the robot to move from one line to the other at different power levels.

7. Program your robot to go at different power levels. It is the goal to determine the average velocity at which the robot travels for each of these power levels. How do you set up your experiment and what do you intend to measure?

8. Run your experiment three times each for power levels 10%, 30%, 50%, 70%, 90% and fill out the following table. Don't forget units.

	Trial 1		Trial 2		Trial 3	
Power Level	Time	Velocity	Time	Velocity	Time	Velocity
10%						
30%						
50%						
70%						
90%						

9. For each power level, determine mean, median, and range for the velocity.

Power Level	Mean Velocity	Median Velocity	Velocity Range
10%			
30%			
50%			
70%			
90%			

Now, instead of programming the robot to go straight a certain number of rotations, program it to go straight forward for 3 seconds and vary the power levels.

10. Graph the average velocity as a function of the power level. What is the relationship between power level and velocity?

11. Run your experiment three times each for power levels 10%, 30%, 50%, 70%, 90% and fill out the following table. Don't forget units.

	Trial 1		Trial 2		Trial 3	
Power Level	Distance	Velocity	Distance	Velocity	Distance	Velocity
10%						
30%						
50%						
70%						
90%						

12. For each power level, determine mean, median, and range for the velocity.

Power Level	Mean Velocity	Median Velocity	Velocity Range
10%			
30%			
50%			
70%			
90%			

13. How do your results in #11 and #12 (above) vary from the ones in #8 and #9?  
Why is this? What are your conclusions about varying power level and time?