Name:

Goal You will predict how far (in meters) it takes for a fan-car (accelerating from rest) to catch a buggy traveling at constant velocity.

Measurements

1. Using Logger Pro, create a position v. time graph of the **constant velocity buggy**. It should look like a diagonal line. Measure the slope of this line using the linear fit tool. Only highlight the clearest part of the line to take the slope. Repeat this process and complete the table.

Constant Velocity Buggy	Slope of position graph (a.k.a. velocity)
Trial 1	
Trial 2	
Trial 3	
Average of Trials	

2. Using Logger Pro, create a position v. time and a velocity v. time graph of the **accelerated motion fan car**. The position graph should look like a parabola, and the velocity graph should look like a diagonal line. Measure the slope of velocity line using the linear fit tool. Only highlight the clearest part of the line to take the slope. Repeat this process and complete the table.

Accelerated Motion Fan Car	Slope of velocity graph (a.k.a. acceleration)
Trial 1	
Trial 2	
Trial 3	
Average of Trials	

Identify and Define Variables

Make a list of variables (initial velocity, final velocity, acceleration, elapsed time, and displacement) for both the fan car and buggy. You should be able to write down a value for all of the variables except elapsed time, displacement, and final velocity for the fan car.

Buggy:

Fan Car:

Calculations

The elapsed time and displacement will be the same for the buggy and fan car, because they will start and end at the same position, and it will take them the same amount of time to travel this displacement. We can predict the displacement by solving two equations of motion simultaneously.

1. Begin with the equation below. Write one for the buggy and one for the fan car. Plug in the numbers for the accelerations and initial velocities.
   $\Delta\vec{x} = \vec{v_i}\Delta t + \frac{1}{2}\vec{a}(\Delta t)^2$
2. Since both of the displacements are the same, you can set the equations equal to each other (this is known as "eliminating" $\Delta\vec{x}$).
3. Now solve for Δt
4. Plug your answer for Δt into either the original equation for the fan car or the original equation for the buggy to get $\Delta\vec{x}$. It doesn't matter which one you choose.

Experiment

This experiment should be tested in the hallway.

1. Use the meter-sticks to measure the displacement you predicted in your calculations. Mark the start and end points. Someone should stand near the end point to mark where the fan car reaches the buggy.
2. Turn on the fan car and set it on the start point, but don't release it.
3. Another person will release the buggy some distance behind the fan car. Release the fan car when the front of the buggy reaches the front of the fan car. The idea is to release the fan car when it is in the same position as the buggy.
4. Mark where the cars intersect, and measure this displacement.

Actual Displacement: ____________________

Error Analysis

1. How close was the actual displacement to the predicted displacement?
2. What are possible reasons for this error. **+1 bonus point** for each plausible reason. **-100 points** for writing "human error" without elaboration.