

# Road Rage

NAME \_\_\_\_\_

This activity will explore how to predict where and when two cars will crash into each other based on data you will be collecting in your groups. To begin the activity, assign roles to all the members of your group:

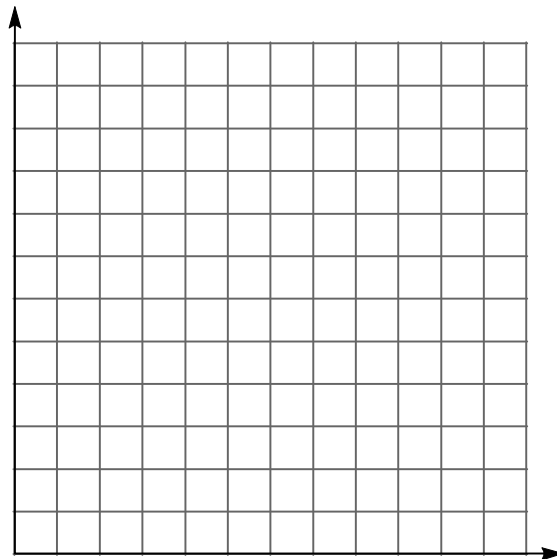
- Racer: Operates the remote-controlled car
- Timer: Runs the stopwatch
- Spotter: Measures the distance traveled
- Recorder: Logs data on the activity sheet



- Collect data to determine the velocity (or speed) in units/second for your remote-controlled car. Race your car for the lengths of time indicated in the table. After the given number of seconds has elapsed, measure and record the distance traveled in the second row of the table. Notice you will be racing for each time interval twice. This is to ensure an accurate calculation of velocity. In the final column, race the car for a set time greater than 15 seconds, and record your results.

TIME (SEC)	0	3	3	5	5	8	8	10	10	12	12	15	15	
POSITION	0													

- Create a scatter plot of the data you collected. Determine which axis represents time and which axis represents distance. Remember, the  $x$ -axis is the independent variable and the  $y$ -axis is the dependent variable. Your scatter plot should include an appropriate title and labeled axes.



- Your data should show an approximate linear relationship between time and distance. Draw a single line that passes through or near all the points on your graph. It may help to use a ruler. This line is called the “line of fit.” **Note:** This line may pass through some of the points, none of the points, or all of the points.

4. Select two points on the line of fit, and calculate the slope of the line, including units. The slope you found represents the speed of your car. Why?
5. a) Using a graphing calculator, determine the equation of the line of best fit, which is the line that most closely passes through or near the data points.
- b) Which number represents the speed? Why?
6. Is the speed the same for the line of fit you drew by hand in Question 4 and the line of best fit drawn by the calculator in Question 5? Why or why not?
7. a) Suppose your car starts at position 0 and increases its position as time increases. Given  $x = \text{time (sec)}$  and  $y = \text{position}$ , create an equation in slope-intercept form that predicts the position of your car.
- b) What do the slope and y-intercept represent?
8. a) Suppose your car starts at position 100 and moves in the opposite direction, which means it decreases its position as time increases. Given  $x = \text{time (sec)}$  and  $y = \text{position}$ , create an equation in slope-intercept form that predicts the position of your car.
- b) What do the slope and y-intercept represent?
- c) What is different in this equation? What do you think explains this difference?

9. Partner with another group for the next part of this activity. Record your roles below.

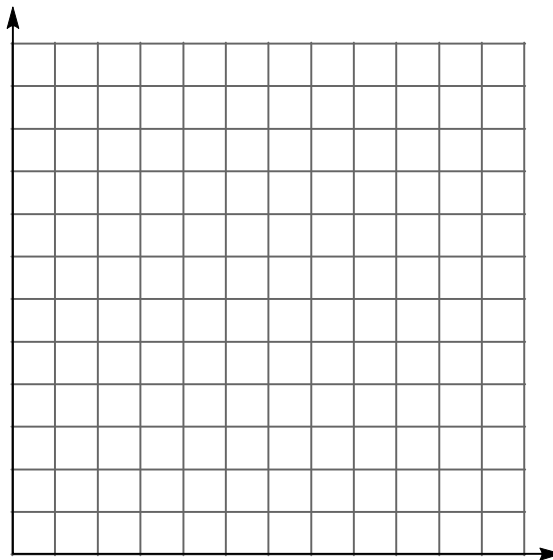
CAR	STARTING POSITION	EQUATION FOR CAR	GROUP MEMBERS
A	0		
B	100		

10. Create a function table for each car using your equations.

CAR A	
TIME ( $x$ )	POSITION ( $y$ )
0	
5	
10	
15	
20	
25	

CAR B	
TIME ( $x$ )	POSITION ( $y$ )
0	
5	
10	
15	
20	
25	

11. Graph the points from your function table and draw in the line. Label the lines “Car A” and “Car B,” and label the point of intersection “Crash.”



12. From your graph, find the time and position of the crash for both cars.

13. What do you notice about the solution for Car A and the solution for Car B? What do you think explains this result?

14. Solve the system of equations algebraically. Show your work.

15. Is there a relationship between the solution from the systems of equations and the graph? Explain this.

16. Now test your solutions by crashing your cars into each other. Assign roles to the group members as you did before, and collect data on 3 trial runs. In the last row, average the data from your 3 trials. **Note:** Cars may pass by each other instead of crashing. Record the time and position when the cars passed each other if this happens.

	TIME OF CRASH	POSITION OF CRASH
TRIAL 1		
TRIAL 2		
TRIAL 3		
AVERAGE RESULT		

17. What are some of the factors that may have caused your actual results to vary from the predicted result?

18. How could you redesign the data collection and the crash test to provide a closer result?

19. What does it mean to say that your predicted result is a solution of the system of equations?

20. Why are the values of time and position the same for both cars when they collide?