



Hitting Your Marks on the Drag Strip

STEM Lesson for TI-Nspire™ Technology

Objective: Collect data, analyze the data using graphs, and use the results to determine the best driver.

About the Lesson: As you'll see in this investigation, not all drivers are created equal. Using data, your objective is to figure out who is the best driver and what is the best possible drive time along the drag strip.

Materials: RC Car (optional)
 Straight-line drag strip that is 50-75 ft long
 3 stop watches (Number depends on the number of students in the group)
 Student worksheets

Procedure:

1. Record info about your car and driving conditions on the data sheet.
2. With a fully charged battery. Set the car at the start line and decide what the "GO" signal will be.
3. Make sure all time keepers are ready and have another student give the "GO" signal. Make sure all time keepers can see the start and finish line clearly.
4. Drive from the start line to the finish line. Time keepers measure the time it takes to drive the drag strip while the driver drives.
5. Record the trial number and measured drive time on your data sheet.
6. Repeat steps 2-5 for 10 trials.
7. Change drivers and repeat steps 2-6.

Analysis:

1. On your handheld, go to My Documents and open the file named *Hitting Your Marks_Drag Strip.tns*.
2. Use $\text{Ctrl} \rightarrow$ to move to page 1.2. Calculate the average drive time and average speed for each trial and driver. Record your calculations on your data sheet.

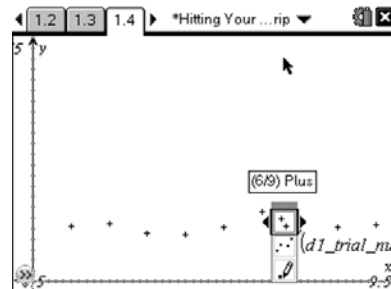
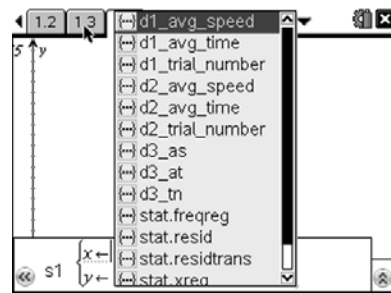
Trial	Time	Distance
1	2.58	19.3798
2	2.693	18.5667
3	2.24	22.3214

Trial	Driver	Time	Distance
1	1	2.58	19.38
2	2	2.693	18.567
3	3	2.24	22.3214
4	4	2.213	
5	5	2.53	

- Move to page 1.3 and enter the trial number, average drive time, and average speed into the table. Columns for 2 drivers (d1 for driver 1 and d2 for driver 2) are provided. If you have more than 2 drivers, enter the titles then enter the data.
- Move to page 1.4. You want to compare each driver’s drive time using a graph of average drive time vs. trial number. Which variable (average drive time or trial number) is the independent variable x ?

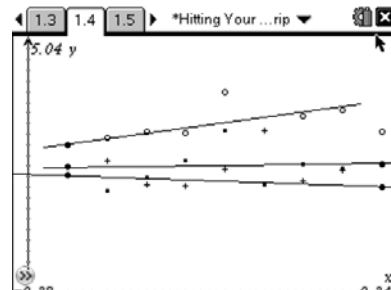
Which variable is the dependent variable y ?

- Graph the scatter plot of average drive time vs. trial number for driver 1. To do this first make sure the cursor is in the function bar. Then press **(var)** and choose the variable for driver 1. You can use the up and down arrows to go between the x and y . Press **(enter)** to see the graph. Move the arrow to one of the points and press **(ctrl)** then **(menu)** and select attributes to change the shape of the points.



- Create a line of best fit for the points by pressing **(menu)** then Points and Lines then Line. Click where you want to start the line then where you want it to end. Draw the line from left to right as close to the most points as possible. This line can be adjusted later by grabbing and dragging one of the points of the line.

- Press **(tab)** to bring the function bar back and repeat steps 5 and 6 for each driver. Give each driver a different shape so you can easily tell them apart. You can move or delete the labels as needed.



8. Move to page 1.5. Now we want to compare speed with drive time by graphing speed vs. average drive time. Which variable (average drive time or speed) is the independent variable x ?

Which variable is the dependent variable y ?

9. Repeat steps 5-7 to make a graph of speed vs. average drive time.
 10. Based on these graphs, who do you think is the best driver?

Why? _____

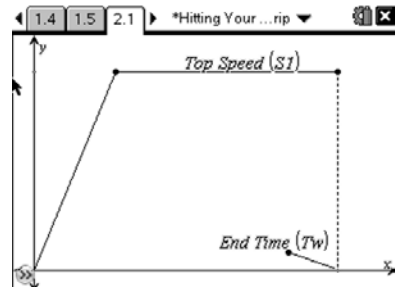
11. What was his or her best drive time? _____

EXTENSION

A vehicle traveling at a constant speed of $S1$ for a time of $t1$ travels a distance of d which is equal to $d = S1 * t1$. For example, driving at a speed of 34 mph for 2 hours gives a distance of 68 miles; or 34 feet/sec for a time of 1.5 seconds gives a distance of 51 feet.

Move to page 2.1.

This graph is the model of a car accelerating to a constant speed ($S1$) over a certain length of time (Tw). Move to page 2.2. Notice the model can be divided into a triangle and a rectangle. This splits the graph at the point the car stops accelerating and starts traveling at a constant speed. The heights of the rectangle and triangle are both $S1$. The base of the triangle is Ta and the width of the rectangle is $Tw-Ta$.



12. Using these variables, write equations for the area of the triangle and the area of the rectangle.

Triangle _____

Rectangle _____

13. Compare these equations to the formula $d = r*t$ or in this case $d = S*t$. What is similar? What is different? _____

14. Write an equation for the total distance of the car using the formulas for the areas.

15. If you ran a car on the 50 ft drag strip in 3 sec and calculated the car's top speed to be 30 ft/sec, how long did it take the car to accelerate to top speed?
