EXPLORATIONS

Activity 7

Stopping Distances

The distance required to stop a moving vehicle depends upon several factors including the driver's reaction time and the speed of the vehicle. The reaction time will affect the distance that the car will travel before the brake can be applied. Once the brake is applied, the distance required to stop is directly proportional to the square of the velocity.

In this activity, you will find a model for the total distance required to stop a moving vehicle.

Data Collection

1. Open a new TI InterActive! document. Title this page **Stopping Distances**. Add your name and the date to this document.
2. Click on the Web Browser icon to open TI InterActive!'s Internet Browser. Click on the Data Sites icon. Under the **Activity Book Links** category, click *TI InterActive! Math for High School*. Choose **Activity 7: Stopping Distances**.
3. Once the page has loaded in the browser, click on Select and then Extract to download the data into the list editor.
4. Double-click on the name of the list containing MPH data and change the name of this list to **Speed**. Click OK.
5. Double-click on the name of the list containing Braking Distance data and change the name of this list to **Braking**. Click OK.
6. Double-click on the name of the list containing Perception-Reaction Distance and change the name of this list to **Reaction**. Click OK.
7. Double-click on the name of the list containing Total Stopping Distance and change the name of this list to **Total**. Click OK. Click on Save To Document.

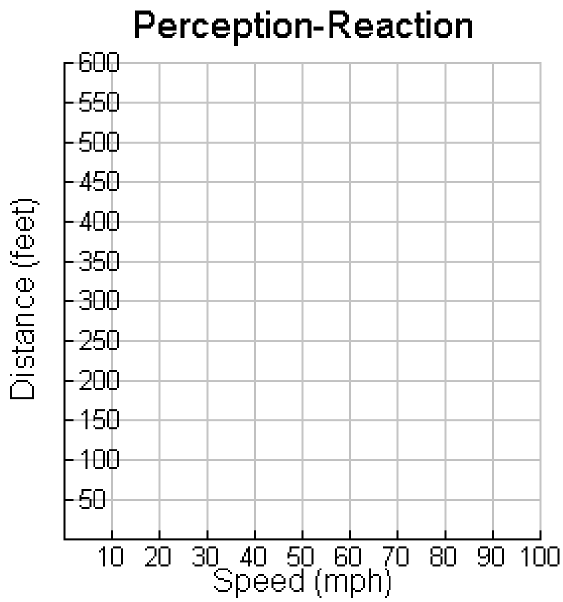
Perception-Reaction Distance Exploration

The perception-reaction distance is the distance the car travels while the driver is reacting to the situation.

1. Select Graph and click on the Stat Plots tab. Enter **Speed** in the first field and **Reaction** in the second field.

2. Click on Format . Set up the window with x: [0, 100], Xscale = 10, and y: [0, 600], Yscale = 50. Click on Apply.

3. Click on the Labels tab in the Format Window. Title this graph **Perception-Reaction**. Label the X-axis **Speed (mph)** and the Y-axis **Distance (feet)**.



4. Click on OK, and then Save to Document . Sketch the graph on the grid provided.

Perception-Reaction Distance Analysis

1. What type of equation will model this data?

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2. Select Stat Calculation Tool . Choose the Calculation Type as **Linear Regression (ax + b)**. Enter **Speed** into the X List and **Reaction** into the Y List. Change the name of the regression equation to **r(x)**.Click on **Calculate**. Title the equation **Perception-Reaction**. Click on Save Results to paste the results into your TI InterActive! document. Record the equation.

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3. Double-click on the graph. Define y1(x):= *your equation*. Click on Save. How well does your equation fit the data?

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4. What is the slope? Interpret the meaning of the slope including the units.

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5. What is the *y*-intercept? Interpret the meaning of the *y*-intercept including units.

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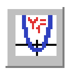
Braking Distance Exploration

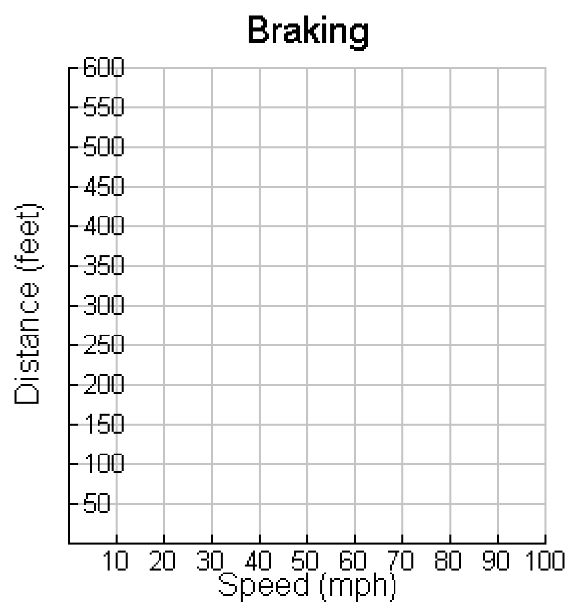
The braking distance is the distance that a car will travel from the time the brakes are applied until the car stops.

1. Select Graph  to open a new graph window. Click on the Stat Plots tab and enter **Speed** in the first field and **Braking** in the second field.

2. Click on 

. Set up the window with X: [0, 100], Xscale = 10, and Y: [0, 600], Yscale = 50. Click on Apply.

3. Click on the Labels tab in the Format dialog box. Title this graph **Braking**. Label the X axis **Speed (mph)** and the Y axis **Distance (feet).**



4. Click on OK, and then Save to Document . Sketch the graph on the grid provided.

Braking Distance Analysis

1. What type of equation will model this data?

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2. From physics, the braking distance of a car is directly proportional to the square of the velocity. Write this statement mathematically.

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3. Select Stat Calculation Tool . For the Calculation Type, select Quadratic Regression. Enter **Speed** into the X List and **Braking** into the Y List. Change the name of the regression equation to **b(x)**. Click on Calculate. Title the equation **Braking Equation**. Click on Save Results to paste the results into your TI InterActive! document. Record the equation.

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4. According to the theory from question 2, what should be the regression equation's values of b and c? Write the equation for the braking distance based upon the theory and the results from question 3.

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5. Double-click on the graph you created above. Define y1(x): = *your equation*. Click on Save. How well does your equation fit the data?

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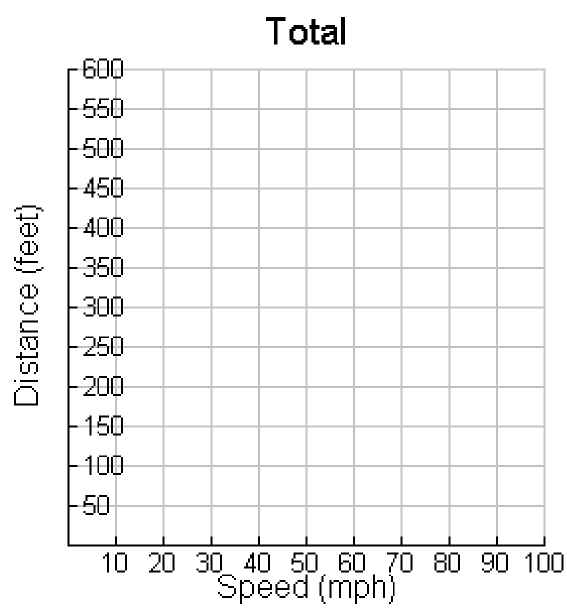
Total Stopping Distance Exploration

The total stopping distance is the sum of the perception-reaction distance and the braking distance.

1. Select Graph to open a new graph window. Click on the Stat Plots tab and enter **Speed** in the first field and **Total** in the second field.

2. Click on Format. Set up the window with X: [0, 100], Xscale = 10, and Y: [0, 600], Yscale = 50. Click on Apply.

3. Click on the Labels tab in the Format dialog box. Title this graph **Total**. Label the X-axis **Speed (mph)** and the Y-axis **Distance (feet).**



4. Click on OK, and then Save to Document . Sketch the graph on the grid provided.

Total Stopping Distance Analysis

1. What type of equation will model this data?

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2. Find an equation for the total stopping distance using the equations from *Perception-Reaction Distance Analysis* (question 2) and *Braking Distance Analysis* (question 4).

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3. Double-click on the graph you created in *Total Stopping Distance Exploration*. Define y1(x):= *your equation*. How well does your equation fit the data?

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4. Use your model to predict the stopping distance of a car traveling 55 mph. How does your prediction compare to the value given at the Data Site **Activity 7: Stopping Distances**?

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5. If it takes a car 280 feet to stop from the time an emergency is sighted, how fast was the car traveling?

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6. Save this document as **stopping.tii**. Print a copy of this document.