STOP!

ID: 12580

Time required
15 minutes

Activity Overview

In this activity, students will work with speeds in meters per second, and stopping distances in meters. An interactive page will evaluate problems for the student, and a spreadsheet will also perform the same calculations. With a collection of data values, the scatter plot reveals a relationship and a shape to the students. Finally, students are asked to perform the calculations and solve a radical equation themselves.

Topic: Radical Equations & Functions

- *Converting between units of speed*
- *Using formula with square roots*
- *Comparing table of values with a function*

Teacher Preparation and Notes

- *If CAS technology is not available, page 1.2 will not be "active." It contains a command that is not available in the numeric TI-Nspire technology.*
- *In the spreadsheet application, a conversion is provided so students may work with miles per hour rather than meters per second if that is preferred.*
- *Students must know how to double click on an expression or number and change it. They must also know how to answer a multiple choice question, and enter values into the spreadsheet cells.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "12580" in the keyword search box.***

Associated Materials

- *STOP_Student.doc*
- *STOP.tns*

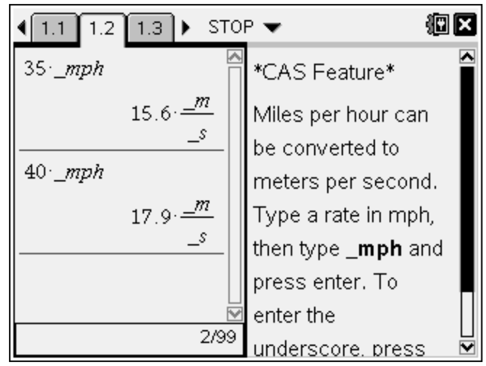
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Solve Square Root Equation (TI-84 Plus family Study Cards) — 1643*
- *Radical Transformations (TI-Nspire technology) — 11575*
- *Exploring Functions (TI-Nspire technology) — 8989*
- *Braking and Total Stopping Distances (TI-84 Plus family with TI-Navigator) — 5617*
- *Forensics Case 13, Life in the Fast Lane (TI-84 Plus family) — 6304*

Problem 1 – Conversions

Students in the United States are more familiar the customary units versus metric units. The first problem in the TI-Nspire document allows students to covert between miles per hour and meters per second, preparing them for making judgments in the second problem.



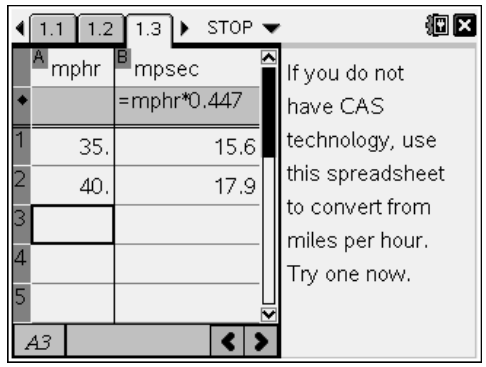
Two examples are shown pages 1.2 and 1.3, which can be used as a point of reference for students. 35 miles per hour and 40 miles per hour are relatively common speeds for local roads.

Page 1.2 – CAS users

- Enter the speed, then enter **_mph**. To enter the underscore press (ctrl) + [␣].

Page 1.3 – numeric users

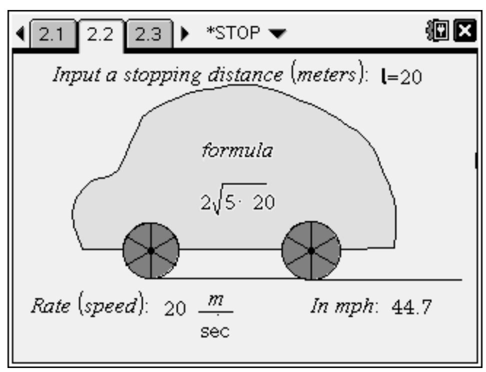
- Enter the speed in Column B.



Problem 2 – Stopping Distance and Speed

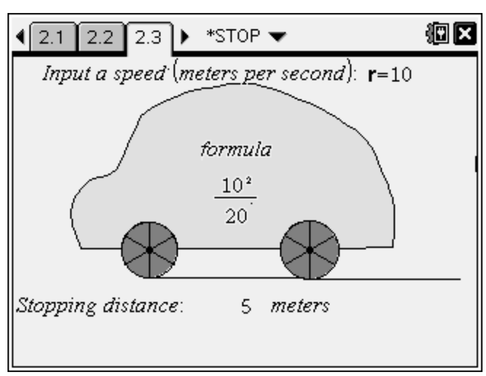
Students are given the formula for computing speed given the stopping distance on page 2.1. They are first asked to evaluate the formula when *l* = 20.

$r = 2\sqrt{5\cdot 20} = 2\sqrt{100} = 2\cdot 10 = 20$ m/sec



This first computation will help them estimate the stopping distance of a car that is driving through a school zone (i.e. a low speed). They may need to use a meter stick to help with their estimation.

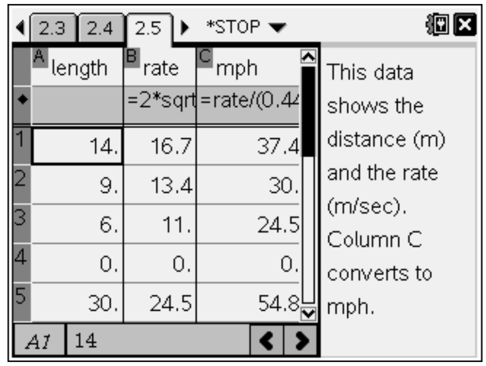
Students are to enter their distance on page 1.5 and view the speed given in both meters per second and miles per hour.



On page 1.6, students will enter the speed of a car on a highway to determine the stopping distance. They can use speed they found in Problem 1 if they are having trouble with m/s.

Discuss with students how both calculations were found using the same formula.

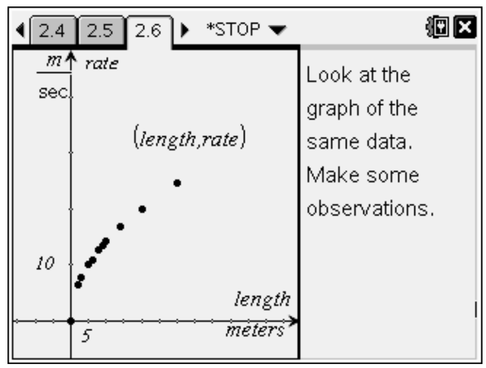
On page 2.5, a spreadsheet shows the stopping distance of several speeds. Students are to make observations, determining the general trend of the data and the relationship between the length and the rate. Help the students to find words that are descriptive and appropriate to the scenario such as increasing, directly proportional, not linear, etc.



One possible interpretation is "as the rate increases, so does the length, and vice versa." If students have trouble seeing this, have them use the **Sort** command to sort Column A in ascending order.

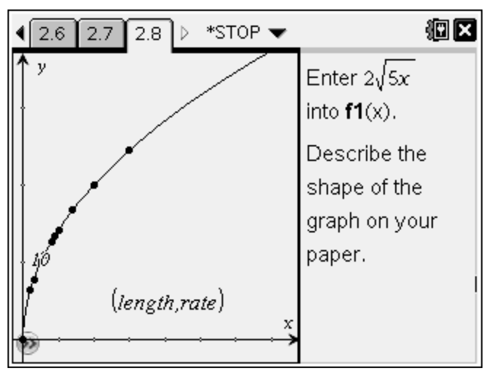
Students should understand that the pair (0, 0) represents a car that has a speed of zero (already stopped), which does not have a stopping distance.

Then, students are to look at the scatter plot and discuss the shape or relationship between the variables length and rate. Have students be as specific as they can. Compare their observations to previous functions studied (quadratic). Can they discuss domain or range of this relationship?



Students should respond to the self-check questions on page 2.7.

On page 2.8, students will enter the formula for rate in **f1**, replacing *l* with *x*, and press enter to view the graph. Students may need to revise the statements they made about the scatter plot describing the shape of the graph or the relationship between the variables. Discuss with students the properties of the graph (i.e. where it starts and the domain and range).



Some students may see half of a parabola, while others may have already seen a square root function.

At this time, you may wish to use the name *Square Root Function*, and compare its shape to that of a parabola. (only the right half of the parabola would be graphed due to restrictions on the domain). That function would be $l = \frac{r^2}{20}$, which is a very wide parabola, with only positive values for rate.

Homework Problem

Students are given a formula that contains a square root. They will calculate the value of the length or the area when given the value of the other variable. Students should show their work and they algebraically solved the problem. They should see that the length of the room is easier to calculate because the formula is already "solved" for that variable.

Extension

Students can graph the "inverse" function for stopping distance, which is $l = \frac{r^2}{20}$ by plotting ordered pairs (by hand on paper) from earlier tables in the document, or by setting up the scatter plot with the variables reversed. To do this on a *Graphs* page, press **MENU > Graph Type > Scatter Plot** and then select **rate** for ***x*** and **length** for ***y***.

Discuss the independent and dependent variables in each form of the equation. *Does stopping distance depend on the rate of the car, or does the rate of the car depend on the length of the stopping distance (skid mark)?* This is an interesting scenario to discuss! Make sure that the graphing window is set up to view only the first quadrant, as all other values are irrelevant to the problem.