Charlotte Chase Activity

STEM Lesson for TI-Nspire™ Technology

Objective: Students will create scatter plots given data in a table. Students will then create lines of best fit to analyze and interpret the data.

About the Lesson: Charlotte Motor Speedway is a 1.5 mile track banked at 24°. The October 2009 pole qualifying speed, posted by Jimmie Johnson, was 192.376 mph. The Charlotte October race (there is one in May also) can be heavily influenced by the weather and temperature change from afternoon into late evening. The average temperature change is more than 20°F. This temperature change makes a huge difference in the traction afforded by tires, but it can also affect engines. Cooler conditions deliver more air to the engines. Air going to a naturally aspirated engine at a given engine speed is a function of air density. Air density is inversely related to temperature provided that the air pressure remains the same. We will investigate these relationships just like the crew chiefs and engineers do.

Analysis:
The table below shows the temperature and pressure at 30 min intervals throughout the race.

TIME (P.M.)	TEMPERATURE (°F)	PRESSURE (psi)
6:45 (green flag)	67	29.95
7:15	63	29.98
7:45	63	29.98
8:15	59	30.01
8:45	59	30.01
9:15	59	30.03
9:45	59	30.03
10:15 (checkered flag)	55	30.05

Ten80 Student Racing Challenge: NASCAR STEM Initiative

### *Using TI-Nspire Technology*

1. Open the file named ***Charlotte_Chase_Activity.tns***.

2. Move to page **1.2**.

3. Input the data from the table into the appropriate columns. Use *time* = 0 for 6:45 P.M.

4. Move to page **1.3** to create a scatter plot of *temperature* vs. *time* for each driver.

5. What is the independent variable?

6. What is the dependent variable?

7. Move the cursor to the bottom of the screen where it says, "Click to add variable," and press [key].
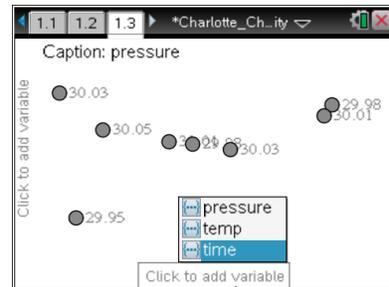
8. Choose the independent variable.

9. Move the cursor to the right side of the screen until a rectangle appears and press [key].

10. Choose the dependent variable.
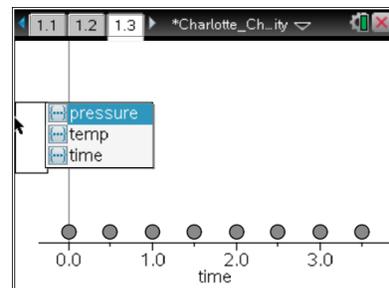
11. Press (menu) then choose **Analyze > Add Movable Line**. Grab the line at each end and move it until it best fits the points.
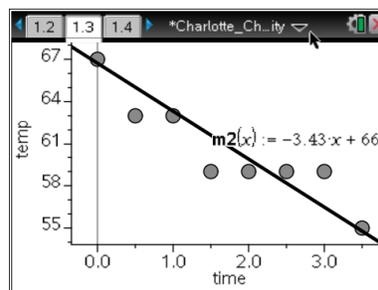

12. What is the total temperature change from green flag to checkered flag?

13. How fast is the temperature changing per hour?

14. What is the relationship between *time* and *temperature* direct or indirect?

15. Move to page **1.4** to create a scatter plot of *pressure* vs. *temperature* for each driver.

16. What is the independent variable?

17. What is the dependent variable?

18. Move the cursor to the bottom of the screen where it says, "Click to add variable," and press ⬚.

19. Choose the independent variable.

20. Move the cursor to the right side of the screen until a rectangle appears and press [🖱].

21. Choose the dependent variable.

22. Press (menu) then choose **Analyze > Add Movable Line**. Grab the line at each end and move it until it best fits the points.
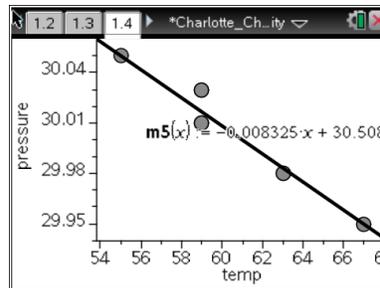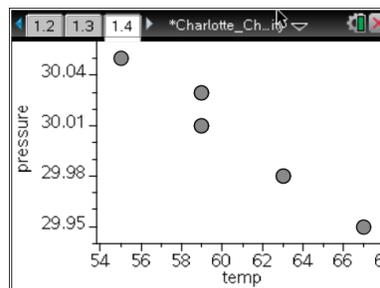
23. What is the total pressure change from green flag to checkered flag?

24. How fast is the pressure changing per degree?

25. What is the relationship between *pressure* and *temperature* direct or indirect?

Using spreadsheet software

1. Enter the data from the table into spreadsheet software. You will have to type the PM and format your cells to recognize time for the *time* column. Highlight the cells and right click. Choose **Format Cells > Number**. Choose the desired time format.

2. Use the chart wizard to create a scatter plot of *temperature* vs. *time*. Chart type will be XY(Scatter). Click **Next**.

3. What is the independent variable?

4. What is the dependent variable?

5. You will have to click on the **Series** tab to make sure the correct data is on the correct axis. If the wrong data is there, click in the box for the *x* values then highlight the data for the independent variable.

6. Repeat step **5** for the y values. Click **Next**.

7. Create titles for the chart and each axis. You can also click the other tabs to change the appearance of your graph. Click **Next**.

8. Decide if you want the graph to appear in the same window as your table or in a new window. Click **Next** and your graph should appear.

9. You may need to change your *time* range to better see the data. Double click the *time* axis and click the **Scale** tab. Type 6:30 as 18:30 into the minimum box and 23:59 as the maximum. You can change the major and minor unit as desired using the hour:minute format.

10. Create a line of best fit for your scatter plot by clicking **Insert > Picture > Auto Shapes**. Then choose **Lines** and then **Line Segment**. Draw a line that touches the most points.

Temp vs. Time
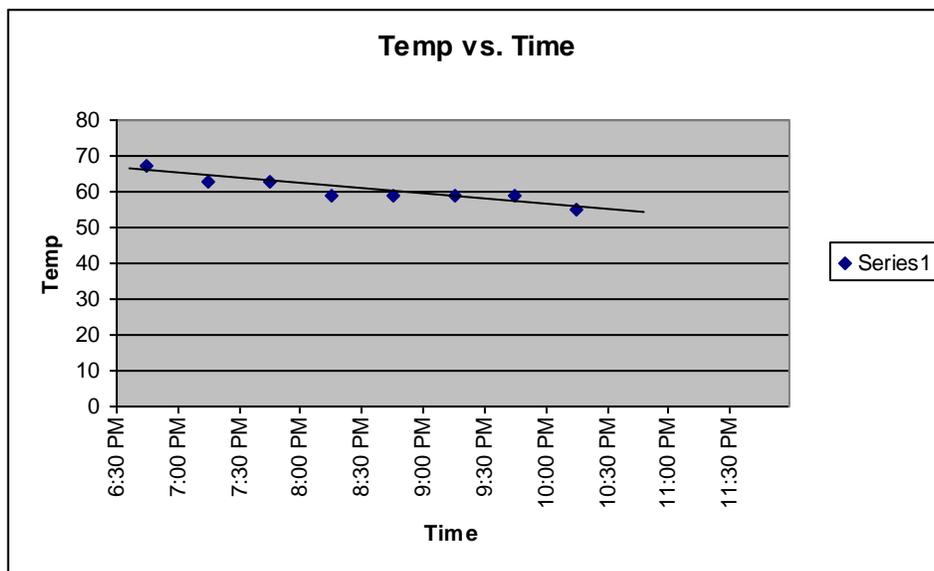
11. What is the total temperature change from green flag to checkered flag?

12. How fast is the temperature changing per hour?

13. What is the relationship between *time* and *temperature* direct or indirect?

14. Use the chart wizard to create a scatter plot of *pressure* vs. *temperature*. Chart type will be XY(Scatter). Click **Next**.

15. What is the independent variable?

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17. You will have to click on the **Series** tab to make sure the correct data is on the correct axis. If the wrong data is there, click in the box for the *x* values then highlight the data for the independent variable.

18. Repeat step **5** for the y values. Click **Next**.

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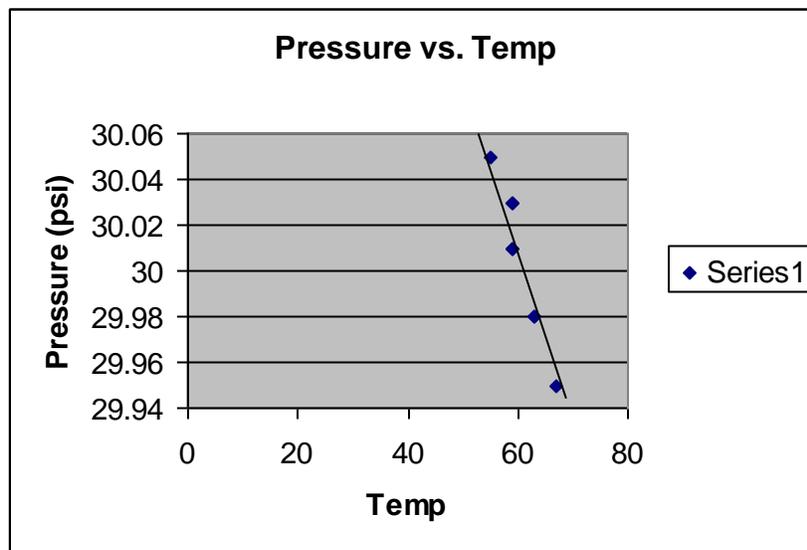
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