Do You See What I See?
Visual Literacy in Mathematics and Science

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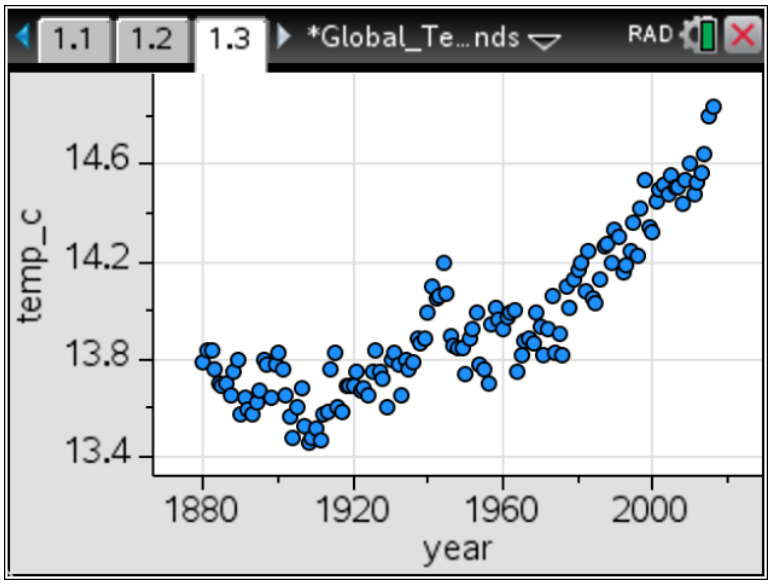

T³ International Conference

Dallas, TX

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Texas Instruments STEM and Coding Activities:

https://education.ti.com/en/activities

NASA STEM Engagement for Educators:

https://www.nasa.gov/stem/foreducators

Atmospheric CO2 concentrations (ppmv) derived from in situ air samples collected at Mauna Loa Observatory, Hawaii from 1958 to 2003:

http://cdiac.esd.ornl.gov/ftp/maunaloa-co2/maunaloa.co2

Graphing Global Temperature Trends:

https://www.jpl.nasa.gov/edu/teach/activity/graphing-global-temperature-trends/

Introductory Temperature Sensor Activity

Activity Overview

In this activity, you will collect and analyze data using the Vernier EasyTemp® temperature sensor.

Activity Materials

- TI-Nspire™ CX or TI-Nspire™ CX CAS handheld
- Vernier EasyTemp® USB temperature sensor

Step 1:

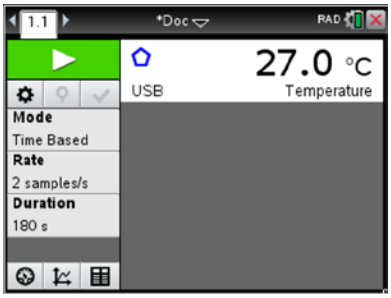
Turn on the TI-Nspire™ CX handheld and create a new document by selecting New Document from the Home page.

- If the message "Do you want to save 'Unsaved Document'?" appears, select "Yes" or "No" based upon whether you wish to save the current open document.

Step 2:

When the new document opens, connect the EasyTemp sensor into the mini-USB port at the top of the TI-Nspire handheld.

- The Vernier DataQuest™ application should launch automatically. If not, select **Add Vernier DataQuest™** from the Menu.
- A temperature reading should be displayed, indicating that the device is in Meter View.

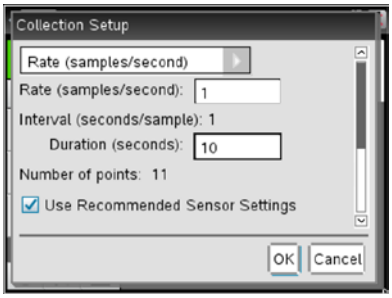


Note: To change the Measurement Units (e.g., from degrees Celsius to degrees Fahrenheit), double click in the region of the screen where the temperature is displayed. Select the desired unit.

Step 3:

To set up the data collection, press **Menu > Experiment > Collection Setup**.

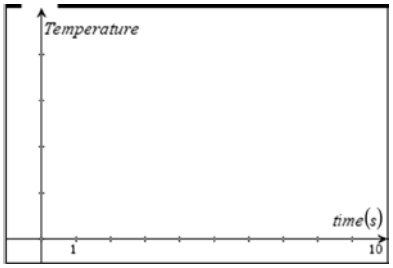
- Press [tab], and set the **Rate** to 1 sample/second.
- Press [tab], and set the Duration to 10 seconds.
- Press [enter], or click **OK**.



Step 4:

For the first trial, plan how you could make the temperature increase at a constant rate throughout the 10 seconds.

Predict the shape of your temperature versus time graph, and sketch a graph of your prediction on the graph at the right.



Introductory Temperature Sensor Activity

Step 5:

When ready to collect the data, click the Start button in the upper left corner of the screen. A graph will appear and will be scaled to the data when the data collection is complete.

Step 6:

Using only the graph, calculate the rate of change (slope).

Note: Click on the graph region of the screen. Then, use the right and left arrows on the Touchpad to trace on the graph. The coordinates of the points will be displayed on the left side of the screen.

Step 7:

Click the "check mark" icon near the top of the screen to **Store latest Data Set**. The data set will be stored as **run1**. Note how the screen has now changed.

Step 8:

For the next trial, design a plan to make the temperature decrease throughout the data collection. When ready, click the Start button. When the data collection is complete, calculate the rate of change.

Step 9:

Click on **run2** on the left side of the screen (immediately above the time display "10 s"). Select **All** to display both graphs.

Step 10:

To compute and display the rate of change for a run, press **Menu > Analyze > Curve Fit**. For the first trial, select **run1.Temperature**, and then select **Linear**. Arrow to the lower region of the Curve Fit dialog box, and make note of the rate of change (*m* in the linear model). Click **OK**.

Step 11:

Repeat Step 10 to compute the rate of change for the second trial, selecting **run2.Temperature**.

Step 12:

If time permits, design another data collection scenario, and then collect the data.

Discussion

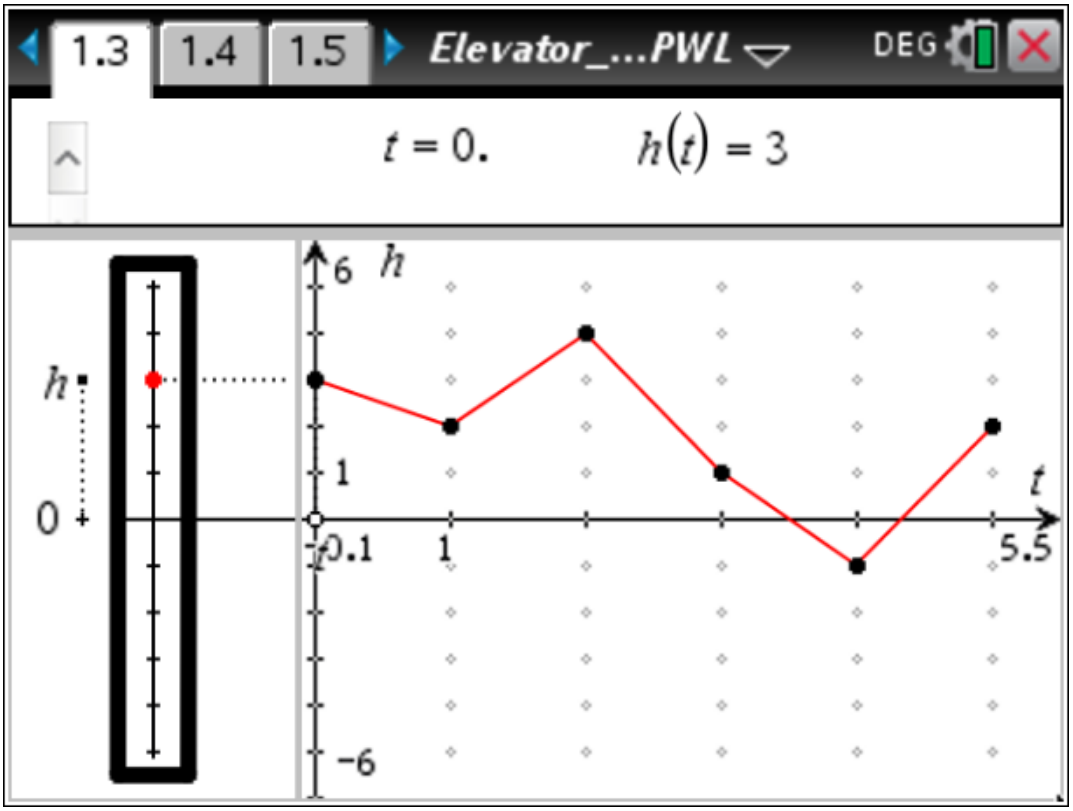
1. Describe the appearance of the graph from the first trial.
2. What is the significance of a positive rate of change?
3. Describe what the rate of change for the first trial indicates. Be sure to use units.
4. Describe the appearance of the graph from the second trial.
5. What is the significance of a negative rate of change?
6. Describe what the rate of change for the second trial indicates. Be sure to use units.
7. At approximately what time during the data collection were the temperatures the same for both trials? What was this temperature?
8. What does it mean, graphically, when the time and temperature were approximately the same for both trials? What does it mean algebraically?
9. How could this activity be used in a math classroom?
10. What are the advantages of using data that students collect?

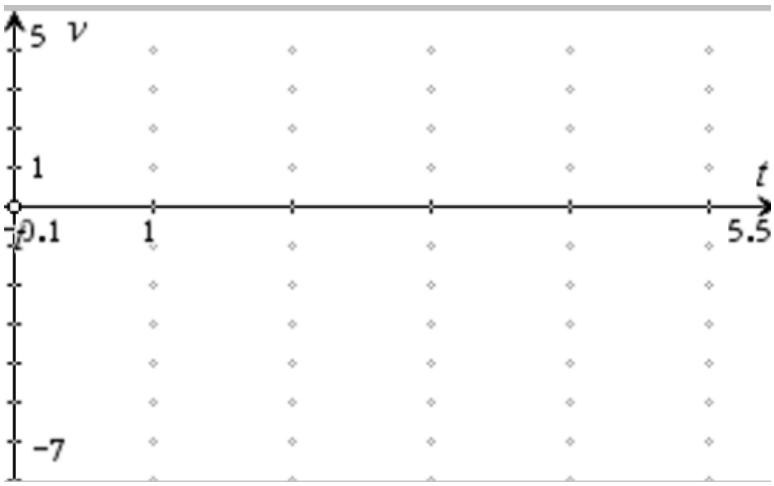
Function Elevator Activities

The graph below shows the height, *h*, of an elevator as a function of time, t.

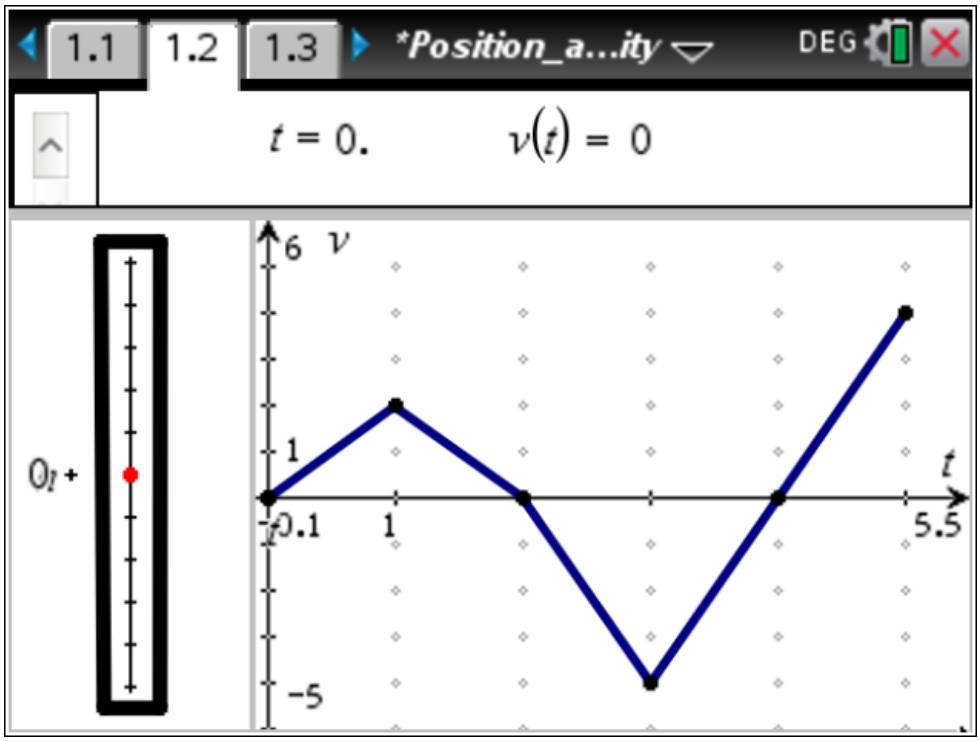
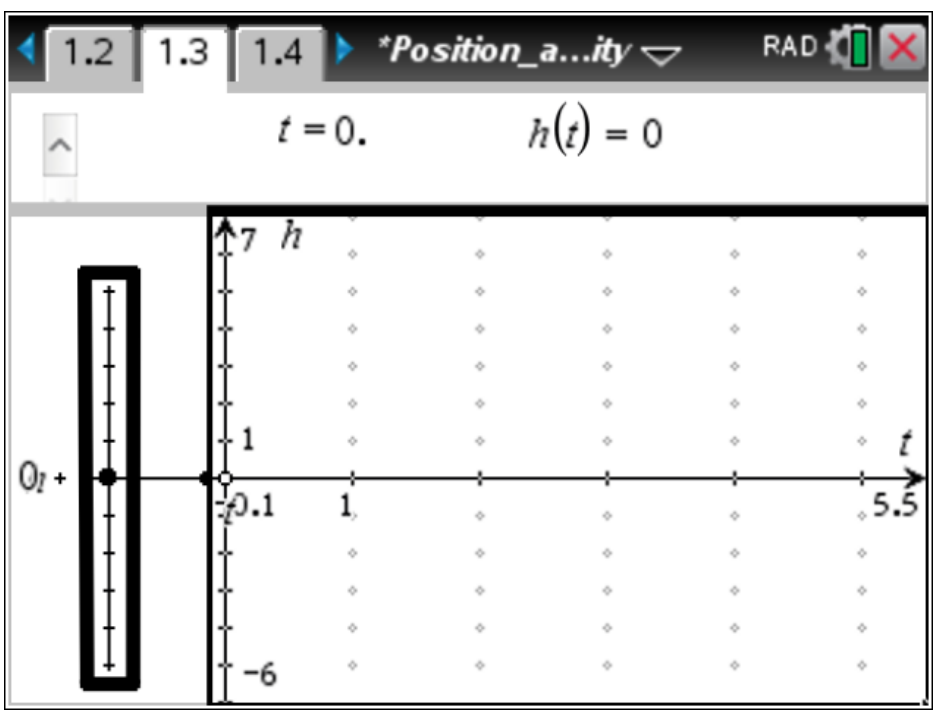
On the graph in the lower part of the page, sketch a graph of the velocity, *v*, of the elevator as a function of time, t.

Source: education.ti.com > Math Nspired > Calculus > Applications of the Derivative > Elevator: Height and Velocity





The graph below shows the velocity, v, of an elevator as a function of time, t.

On the graph in the lower part of the page, sketch a graph of the height, h, of the elevator as a function of time, t.

Source: education.ti.com > Math Nspired > Precalculus > Functions and Graphs > Position and Piecewise Velocity; also, see The Function Elevator activity.