Teachers Teaching with Technology™
Professional Development from Texas Instruments

Getting Started with TI-Nspire™ Middle Grades Science

Materials for Institute Participant*

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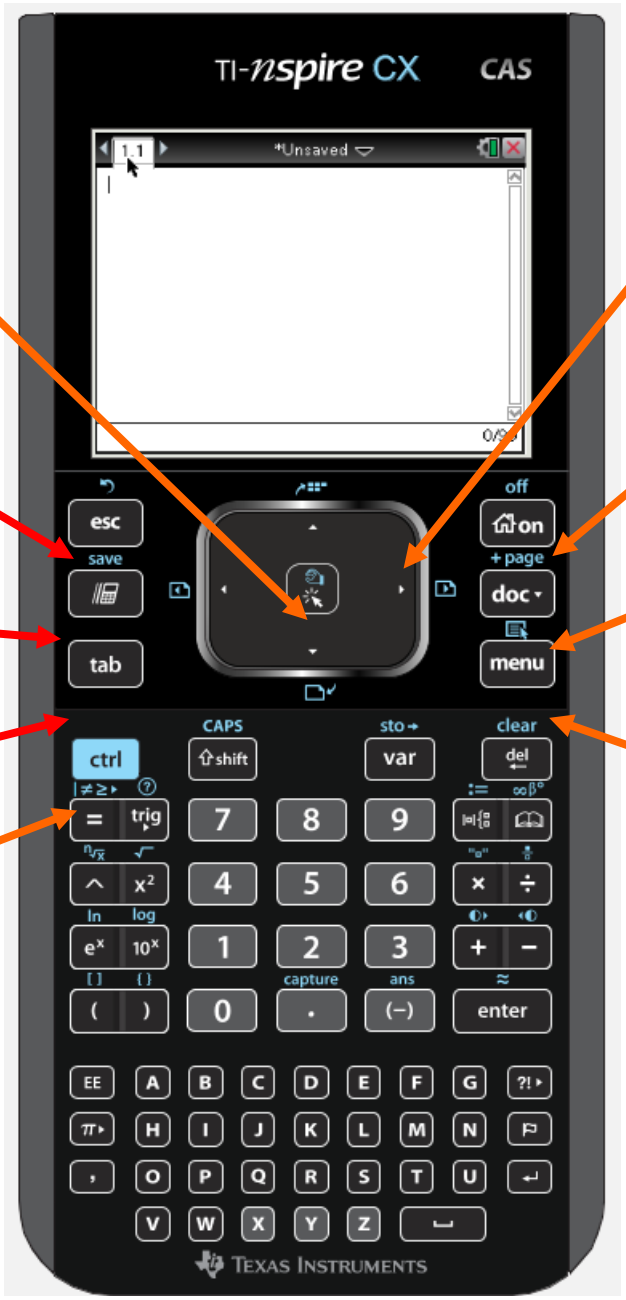
TI-Nspire™ CX CAS Introduction

TI PROFESSIONAL DEVELOPMENT

TEACHER NOTES

Activity Overview

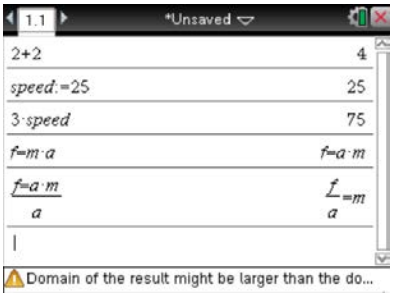
In this activity you will become familiar with the most commonly used keys on the TI-Nspire™ CX CAS handhelds. You will also learn about each of the built-in applications.



Built-In Applications

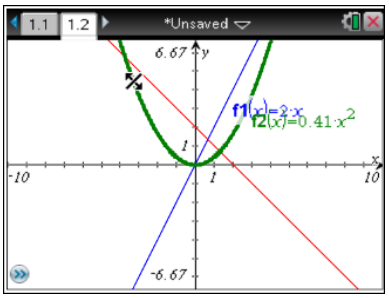
Calculator

- Typical mathematical calculations can be done.
- Variables can be defined and used throughout a document.
- On a CAS handheld, formulas can be written and equations can be solved.



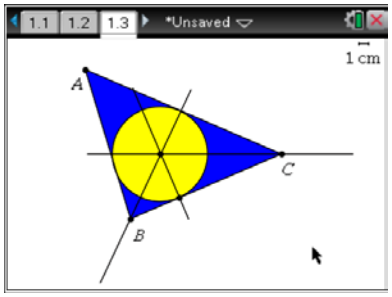
Graphs

- Equations such as $y=2x$ can be graphed.
- Functions $f(x) = 2x$
- Equations can be manipulated by mousing over them, clicking and holding, and then dragging a finger across the Touchpad.
- Trace, intersect, minimum, and maximum can all be determined.
- The Menu button shows all of the tool possibilities for a graph.



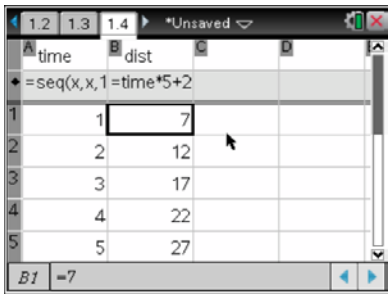
Geometry

- Geometric constructions
- Construct simulations



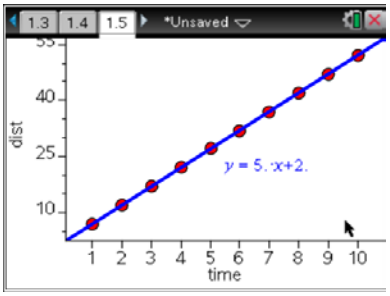
Lists & Spreadsheet

- Typical spreadsheet calculations such as (sum(A1:A12), average(A1:A12)).
- Columns titles define data throughout the document.
- Diamond row (♦) are for performing calculations on the whole column. Functions such as sequence are powerful.



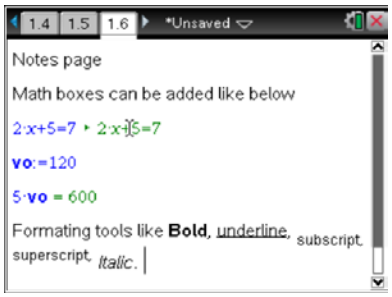
Data & Statistics

- Plot Data from Lists & Spreadsheets based on the column titles (variables).
- Regression equations and hand fit lines can be added to do analysis on a set of data.
- Multiple sets of data can be compared.



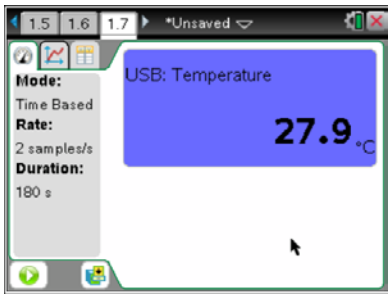
Notes

- Write text within a document
- Math boxes can be added to Notes pages to show calculations and define variables.
- ChemBox allows you to write chemical equations with appropriate subscripts and arrows and coefficients.
- Fonts can be changed.

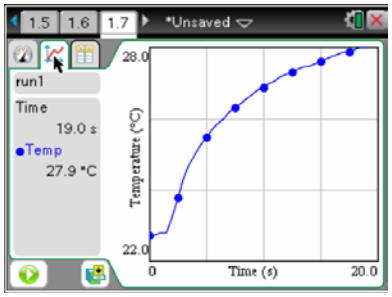


Vernier DataQuest™

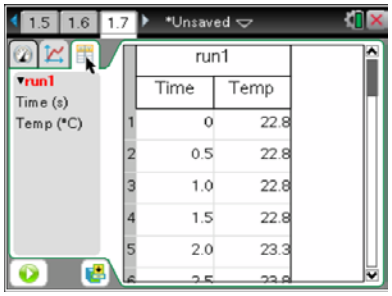
- Meter mode
  - Shows measurement
  - Collection Mode
    - Time based
    - Events with Entry
    - Selected Events



- Graph screen
  - Run #
    - Graph multiple runs
  - Graphical analysis
    - Tangent to data
    - Calculate Regressions
    - Draw predictions
    - Strike Data

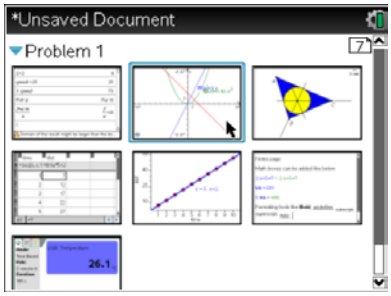


- Spreadsheet
  - Run#
  - Add calculated columns



Document Navigation

- Control up Arrow (ctrl ▲)opens the Document Viewer.
- Control right arrow (ctrl ▶)moves to the page to the right.
- Control left arrow (ctrl ◀) moves to the page to the left.



Activity Overview

Everyone is familiar with the effects of the wind on their wet body as they get out of the pool. The cooling effect is significant and is mimicked in warm climates with fine mists at bus stops to help patrons waiting for a bus keep cool. The effect is grander when there is a breeze and when the humidity is low. When we perspire, the body is using this phenomenon to help keep the person cool.

In this investigation, we will model this cooling by evaporation with a liquid other than water and explore if the "feeling" of being cool is real or just a perception, and we will try to quantify the effect with different liquid concentrations.

Create a New Document on your TI-Nspire handheld

Press ctrl I to create new pages.

Your Instructor might send you a starting Document that you could open as an option.

Step 1:

Press on and the select option **1: New Document**. If you are challenged to Save the current Document, choose the right choice.

Step 2:

Start with a Notes page from the Menu Options and key in the appropriate information to help document your team's work.

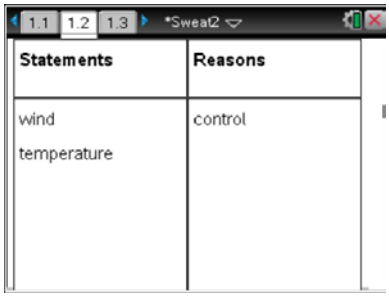
The Design

Step 3:

We want to collect data from the evaporation of a liquid on an object that is held in the ambient air. To do this, we will dip a metal temperature probe in our substance and then hold it in the air and monitor its temperature for a length of time.

Step 4:

Given this scenario, discuss with your partners what variables you see, and identify if you will be controlling them or if you will let them change. Once you have talked a bit, list these in a Notes page and share with the class.

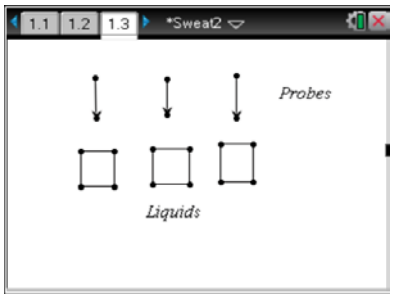


Step 5:

Did your group have the same variables as the others in your class? Did you see some that were not worthy? That you forgot?

Step 6:

Make a sketch of how you will set up the data collection. Draw this below or on your TI-Nspire handheld in a Geometry page. Assume that you will have one Target and two Controls (air and water).



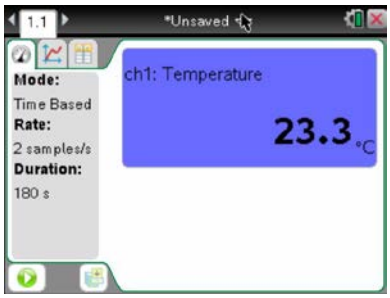
Step 7:

Share your design with the group and come to consensus on the set up.

The Time

Step 8:

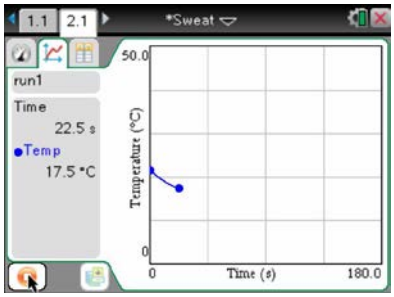
We now need to determine how long it will take to get enough data on the cooling event to see a pattern. Your teacher will provide you with a sample of the strongest concentration of the liquid you will be using.



- Place one temperature probe in the liquid and have one person hold it so that you don't get a spill.
- Slide the handheld into the TI-Nspire Lab Cradle™ Data Collection Cradle and plug one temperature probe into the port named ch 1.
- This should launch the Vernier DataQuest™ app and show the current temperature of the liquid (which should be at room temperature).

Step 9:

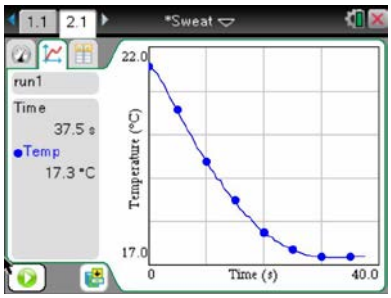
Note that the Mode is Time Based and that the Rate is 2 samples/second for 180 seconds.



To get a feel for the time needed, we will lift the probe out of the liquid and immediately press the Play button ( ). As the probe is hanging (without movement) in the air, the TI-Nspire will collect and display the temperature over time. Note that the Play button has changed to a Stop button ( ) and you can stop the experiment at any time.

Step 10:

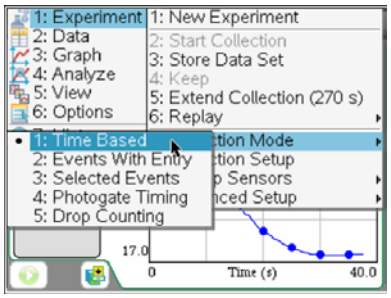
Looking at this data, determine the Time settings you want to use for the complete experiment where you will test two different liquids. Note that the other liquid will be at a weaker concentration and therefore might cause the cooling to occur more slowly.

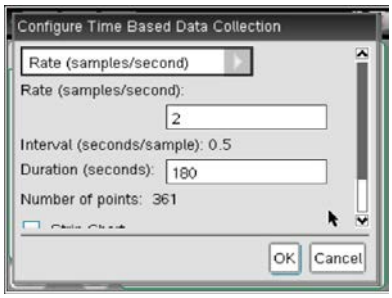


Step 11:

Adjust the time setting for the experiment by selecting **Experiment > Collection Mode > Time Based.**

Share your settings with the class.





The Experiment

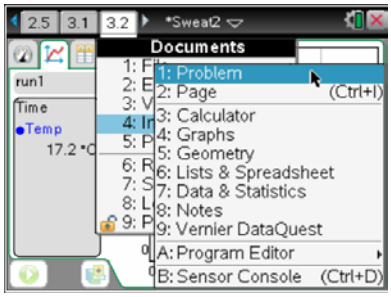
Step 12:

Now we are ready to perform the first complete data collection. You will be using three temperature probes, a sample of room temperature water and one of the liquids. In this experiment, we will use about 50 ml of water and 50 ml of Isopropyl Alcohol, and just air (a dry temperature probe).

- Why are we using water and air? Are these the Targets or Controls?

Step 13:

Introduce a new Problem for this experiment. Do this by pressing doc and selecting **Insert** > **Problem**. This will preserve your initial work for the record.



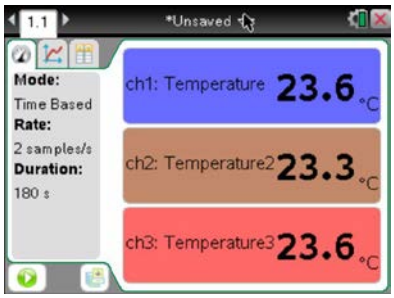
Step 14:

If the new Problem does not launch the Vernier DataQuest app, press ctrl I, and select the option. Now decide which probe will go with which item and report this on a Notes page in this document.

Step 15:

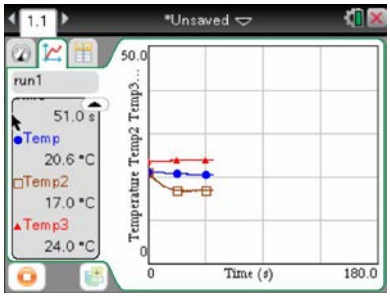
Plug the 2nd and 3rd probes into the appropriate channels one at a time. Place them in the locations they are designed for and wait until you get "about" the same readings.

Note: You might have trouble getting these to all be the same reading. How important is this?

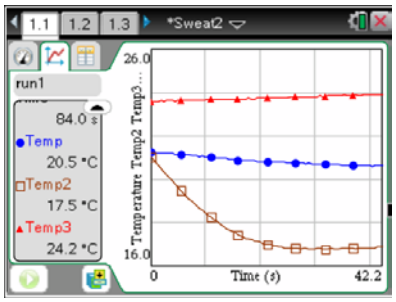


Step 16:

Lift the probes into the air as per your set-up design and then immediately start the experiment. If your time choice was grand, you should let the experiment move to the end times. Make sure all of the variables you determined to be fixed – stay that way. Watch for movement of the probes and any air currents.



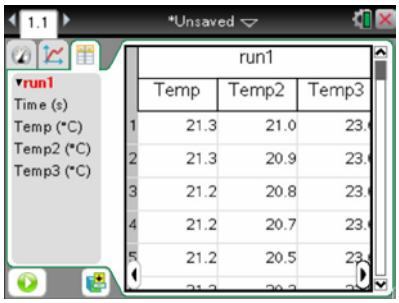
The Analysis



Step 17:

We should examine the data now, looking for patterns. Click or tab to the Table View ( ) to look at the data.

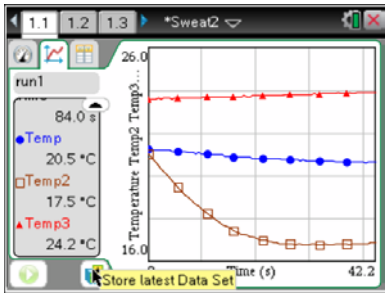
- Would you say that the Target changed and the Controls did not (or only slightly changed)?
- How could you discuss the rate of change? What units does it have?



Run Two

Step 18:

Now we want to save this Run and repeat the experiment with the other concentration of Alcohol. Place the temperature probes, after wiping them off in a position to become one with the temperature of the room. Collect the new sample; and before you place the probes in the three containers, store the first run by clicking on the File Cabinet ( ). This will set you up for run 2.

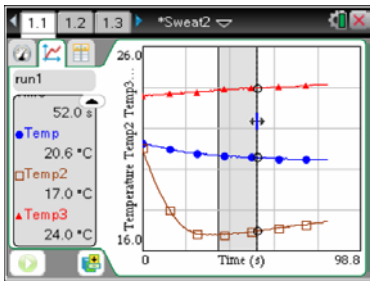


Step 19:

Now place the probes in place, wait until they come to know each other, and then start the collection as before. Do you note any changes in the event as it is happening?

Has the temperature of the room/liquids changed? Will this matter?

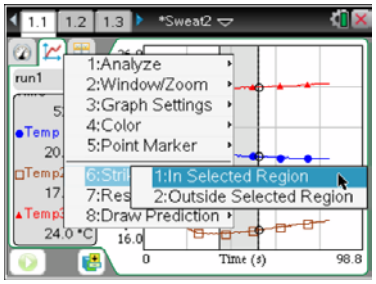
Striking Data



Step 20:

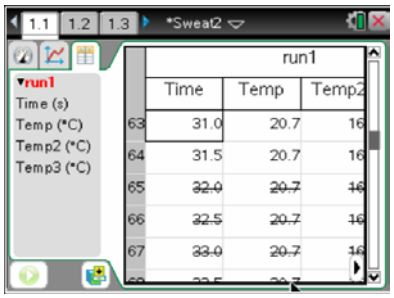
If your estimation of time was off, you may Strike the data to help in the analysis.

To strike data from the graph, you must move your cursor to the point where you want to start or end, click (⬚) then with the ctrl ⬚ use the Touchpad to highlight the segment of interest. Then right-click to choose the in or out option.



Step 21:

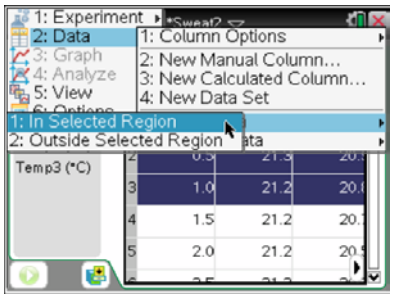
Look at the table and note the results.



Step 22:

Note that the data is still in the handheld. Why is this important?

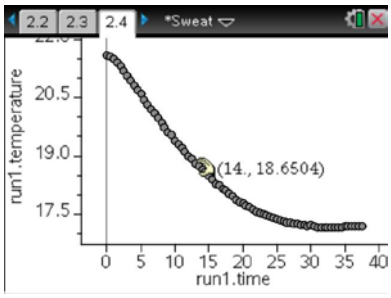
Note: This action may also take place in the table environment using the Menu.



The Rest of the Story

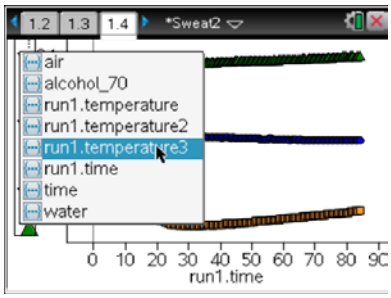
Step 23:

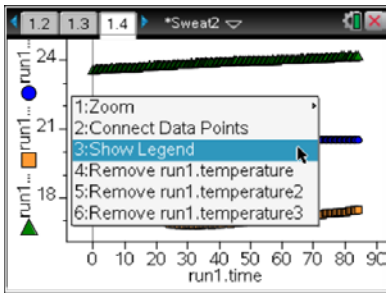
You can move into the rest of the TI-Nspire environment by introducing a new application page as before. If you select Data & Statistics, you can set up a plot to examine the data.



Step 24:

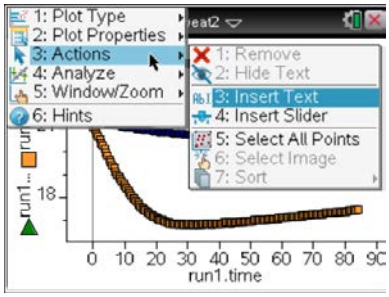
You can also set-up multiple plots using the right-click (ctrl menu) on the y-axis. In addition, you can add a legend by right-clicking on the center of the screen.

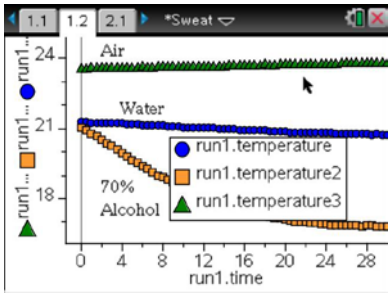




Step 25:

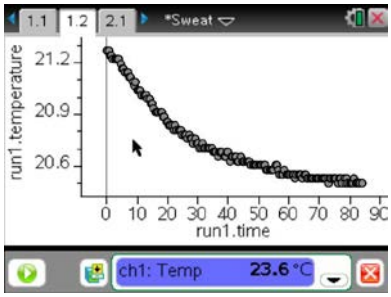
Using the Menu options under Actions, you can also add text.





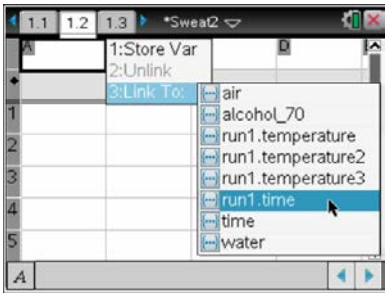
Step 26:

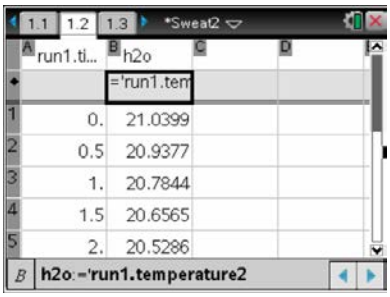
In some situations, the use of ctrl D will set up a plot for you automatically.



Step 27:

Data can also be placed in the List & Spreadsheet environment using the Header or Diamond Line with the var key. In the second case, you might want to name the list before you add the data.





Walk a Line
Student Activity

Name _____
Class _____

Activity Overview

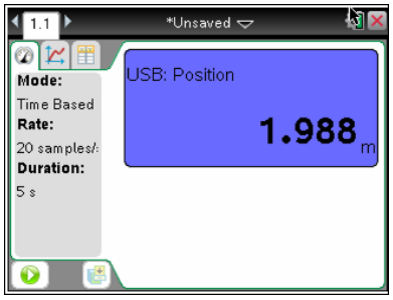
This activity will introduce the CBR 2™ and the Vernier DataQuest™ application. You will collect and analyze linear data.

Materials

- CBR 2
- USB Connection Cable for CBR 2

Step 1:

Connect the CBR 2 to the handheld with the USB cable. A Vernier DataQuest page will automatically open and the CBR 2 will begin measuring the position of the closest object.

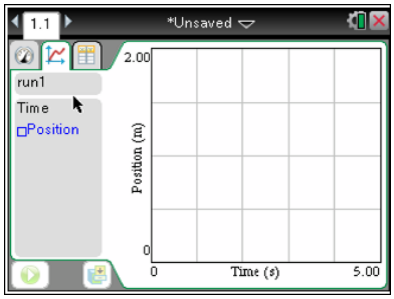


Step 2:

Work in groups of two. One person will operate the TI-Nspire™ and point the CBR 2 toward the other partner, the "walker." The walker should be standing approximately two meters from the motion detector. The walker will walk slowly toward the motion detector at a constant velocity.

Step 3:

Before collecting the data, make a prediction of what the graph of position versus time should look like. Sketch your prediction on the grid to the right.



Step 4:

The calculator operator should click the green **Start** button in the lower left corner of the screen. The walker should walk SLOWLY toward the CBR 2 at a constant velocity to close the gap in approximately 5 seconds. Don't go too fast or you will run out of room and need to try again. You must walk at the same velocity the entire time.

Walk a Line
Student Activity

Name _____
Class _____

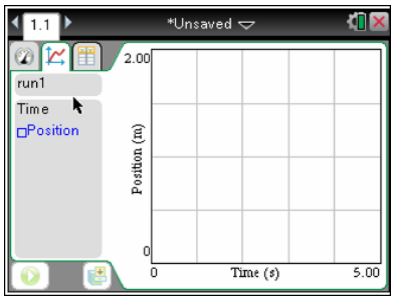
Step 5:

Graphs for position versus time and velocity versus time are created and displayed on the same screen. Repeat as necessary until you generate a graph for position versus time that is roughly linear. How does the graph compare with your prediction?

Step 6:

To display only the position versus time graph, press **Menu > Graph > Show Graph > Graph 1**.

Sketch the actual graph of your position versus time graph on the grid shown to the right.



Step 7:

Manual Analysis of Data

a. How can you estimate the average velocity of the walker?

b. What was the position of the walker at time t = 0 seconds? At time t = 5 seconds?

c. Show your work to calculate the slope of the graph using your positions at time t = 0 seconds and t = 5 seconds.

d. What does the slope of the graph represent physically?

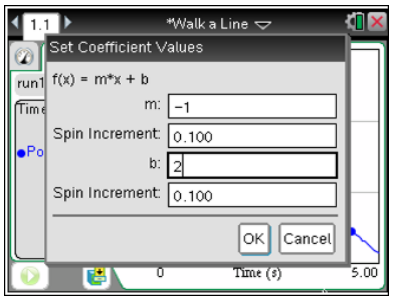
e. Why is the velocity negative?

f. Linear functions are usually written in the form $f(x) = mx + b$. Determine the y-intercept of your line and write an equation that you think will model the data.

g. What does the y-intercept represent?

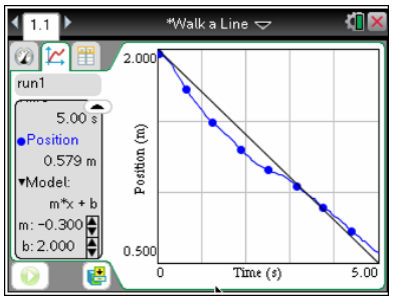
Step 8:

Press **Menu > Analyze > Model**. Select **m*x + b** to create a linear model by clicking **OK**. Type your values calculated manually from above in the fields for m and b and click **OK**.



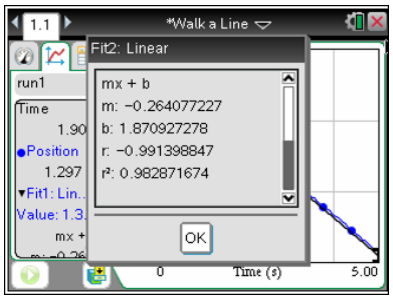
Step 9:

The model can be adjusted by clicking the slider arrows on the left side of the screen or by changing the values of m and b manually. See the sample shown to the right. If you made adjustments, record the new values below.



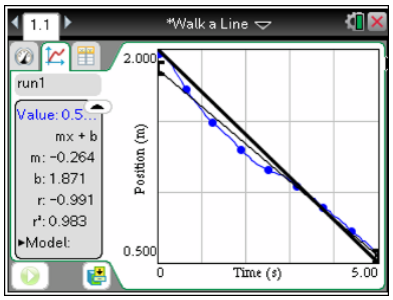
Step 10:

To analyze the data with a regression, a linear curve fit can be performed within the Vernier DataQuest™ application. Press **Menu > Analyze >Curve Fit > Linear**. This will give the equation of the linear regression model. You will have to scroll down the dialog box to see the values of m and b for the linear model. Record the values for m and b below.



Step 11:

Click **OK** to see the graphical results of the regression. How does your linear regression compare with the equation you found in Step 9? How do the values for m and b compare?



Walk a Line
Student Activity

Name _____
Class _____

Discussions/Explorations

1. As you may have gathered from your practice trials, the CBR 2 collects data measuring how far an object is located from the sensor. By walking in front of the CBR 2, collect a set of data which appears linear and has a positive slope. Provide a detailed description of your walk. Be sure to discuss the real-world connections for the slope and *y*-intercept of the model.

2. By walking in front of the CBR 2, collect a set of data that appears linear and has a slope that is approximately zero. Provide a detailed description of your walk, including the connection between slope and *y*-intercept and the physical actions.

3. By walking in front of the CBR 2, collect a set of data that represents a piecewise function with two parts, both of which are linear—one with a positive slope and one with a negative slope. Provide a detailed description of your walk, including the connections between slope and *y*-intercept and the physical actions.

Math and Science Objectives

- Students will find the slope and *y*-intercept of a linear equation to model position versus time data.
- Students will explain the relationship between a position-time graph and the physical motion used to create it.
- Students will model with mathematics. (CCSS Mathematical Practice)

Vocabulary

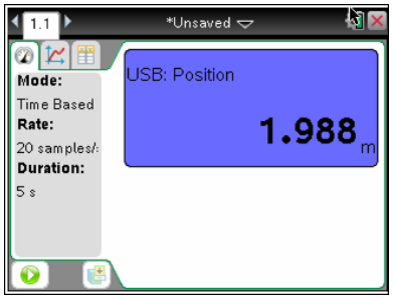
- linear equation
- position
- speed
- velocity
- average velocity

About the Lesson

- In this lesson, students collect data by moving at a constant velocity in front of a CBR 2™.
- As a result, students will:
  - Develop a linear model for a scatter plot of position versus time data
  - Make a real-world connection between a linear equation used to model the data and the physical motion involved in the data collection process

Materials

- CBR 2 with USB CBR 2–to–calculator cable.
- Using the CBR 2 with a computer requires the use the mini-standard USB adaptor to plug the CBR 2 into a computer with TI-Nspire Teacher or Student Software. This adapter will convert the CBR 2™ USB cable to a standard USB connection so that it can be connected to the computer.
- Use the legacy CBR with the TI-Nspire™ Lab Cradle. You will need the MDC-BTD cord to connect a motion detector to the TI-Nspire Lab Cradle. With the Lab Cradle, you can even connect multiple motion detectors to extend your exploration.



TI-Nspire™ Technology Skills:

- Collect motion data with the Vernier DataQuest™ app.
- Run a linear regression in the Vernier DataQuest app.

Tech Tips:

1. Flip the motion detector open. Set the switch to normal.
2. Check that the four AA batteries in the motion detector are good.
3. Unplug and plug the CBR 2 back in.
4. When using an older CBR or motion detector with the Lab Cradle, you may need to launch Vernier LabQuest™. Then select **Menu > Experiment > Advanced Setup > Configure Sensor > TI-Nspire Lab Cradle: dig1 > Motion Detector**.

Lesson Files:
Student Activity
Walk_a_Line_Student.pdf
Walk_a_Line_Student.doc

TI-Nspire™ Navigator™ System

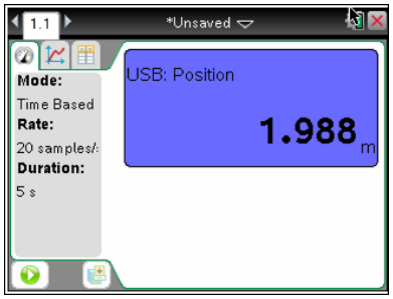
- Use Class Capture to monitor student progress and compare students' mathematical models.
- Use Live Presenter so that a student may demonstrate various steps in the modeling process.
- Share data via File Transfer, if desired.

Discussion Points and Possible Answers

Tech Tip: The Vernier DataQuest application is user-friendly. It should launch when the CBR 2™ is connected. To begin the data collection, click the green Play button ( ) in the lower-left corner of the screen.

Step 1:

Connect the CBR 2 to the handheld with the USB cable. A Vernier DataQuest page will automatically open and the CBR 2 will begin measuring the position of the closest object.



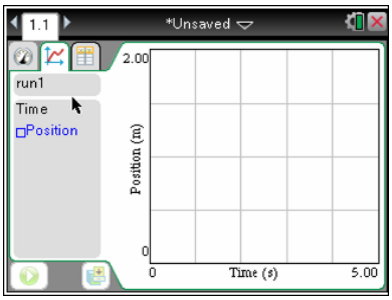
Teacher Tip: When the CBR 2 is first connected, it begins clicking and recording measurements. Have the students move the CBR 2 and point it at different objects. Ask them what the motion detector is doing. It should be measuring the distance from the CBR 2 to the object directly in front of it. We call this the position of the object with respect to the CBR 2. Be aware that it reads the position of the closest object in its path, so students should have an open area between the CBR 2 and the student whose position they will measure.

Step 2:

Work in groups of two. One person will operate the TI-Nspire handheld and point the CBR 2 toward the other partner, the "walker." The walker should be standing approximately two meters from the motion detector. The walker will walk slowly toward the motion detector at a constant velocity.

Step 3:

Before collecting the data, make a prediction of what the graph of position versus time should look like. Sketch your prediction on the grid to the right.



Answer: Predictions will vary.

Teacher Tip: It is important for students to make a prediction before simply pressing the **Play** button. Making predictions and testing those predictions supports higher-level thinking.

Step 4:

The calculator operator should click the green Start button in the lower left corner of the screen. The walker should walk SLOWLY toward the CBR 2 at a constant velocity to close the gap in approximately 5 seconds. Don't go too fast or you will run out of room and need to try again. You must walk at the same velocity the entire time.

Teacher Tip: Students often cannot get the timing right at the beginning of this activity. You may want to suggest that the recording partner press the enter key to begin data collection after the walker starts walking. This gives students a better opportunity to collect linear data for the entire collection time period. You may also want to remind students that they must walk slowly at a constant velocity.

Step 5:

Graphs for position versus time and velocity versus time are created and displayed on the same screen. Repeat as necessary until you generate a graph for position versus time that is roughly linear. How does the graph compare with your prediction?

Sample answer: Comparisons can include function type (linear, quadratic, etc.), *y*-intercept, and whether the graph is increasing or decreasing.

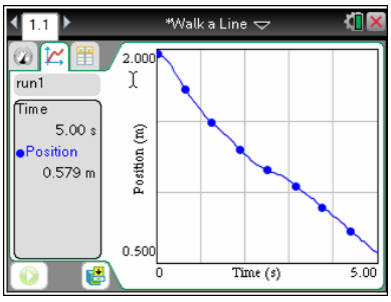
Tech Tip: If the students are not satisfied with their results, they can repeat the data collection by clicking the **Play** button again. This will overwrite the previous trial.

Step 6:

To display only the position versus time graph, press **Menu > Graph > Show Graph > Graph 1**.

Sketch the actual graph of your position versus time graph on the grid shown to the right.

Sample answer: A sample graph is shown to the right. Since students are all walking toward the CBR 2, all graphs should show a negative slope.



Step 7:

Manual Analysis of Data

a. How can you estimate the average velocity of the walker?

Answer: Find the change in the position (final – initial) and divide that change in position by the elapsed time.

b. What was the position of the walker at time t = 0 seconds? At time t = 5 seconds?

Sample answer: At time t = 0, the position was 2 meters. At time t = 5, the position was 0.579 meters. Answers for t = 5 will vary but should be a positive value less than 5 given in meters.

c. Show your work to calculate the approximate slope of your line using your positions at time t = 0 seconds and t = 5 seconds.

Sample answer: $\frac{0.579-2}{5-0}=\frac{-1.421}{5}=-0.2842$

Answers will vary, but the slope should be negative.

d. What does the slope of the graph represent physically?

Answer: The slope represents the velocity of the walker.

Teacher Tip: Some students may answer "speed." This is a great opportunity to explain the difference between speed and velocity. Speed indicates how fast the walker is moving but does not include direction. Since speed has magnitude only, it is referred to as a scalar quantity. Speed is always positive. Velocity is called a vector quantity. It includes both speed and direction. Velocity can be positive or negative for a person moving back and forth along a line. Velocity is positive when the walker moves away from the motion detector, increasing the position, and negative when the walker moves toward the motion detector, decreasing the position.

e. Why is the velocity negative?

Answer: The velocity is negative because the position between the walker and the CBR 2 is decreasing.

f. Linear functions are usually written in the form $f(x) = mx + b$. Determine the y-intercept of your line and write an equation that you think will model the data.

Sample answer: The y-intercept is 2; $y = –0.2842x + 2$. Equations will vary but should have $b = 2$ and y = the slope from part c in Step 7.

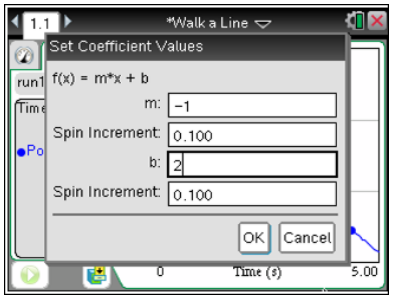
g. What does the y-intercept represent?

Answer: The y-intercept represents the initial or starting position—the distance, in meters, of the walker from the motion detector at time $t = 0$ seconds.

Teacher Tip: Students should determine an equation by hand first to practice finding slope and to help make the connections between the physical actions and the mathematical equation. Students will better understand the meaning and physical representations of the slope and y-intercept if they write their own model rather than simply run a linear regression.

Step 8:

Press **Menu > Analyze > Model**. Select **m*x + b** to create a linear model and click **OK**. Type your values calculated manually from above in the fields for m and b and click **OK**.

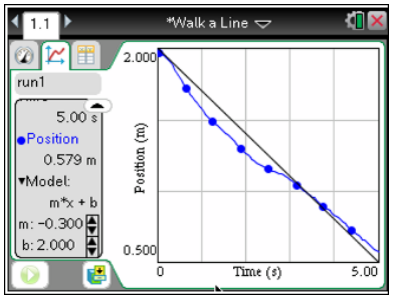


TI-Nspire™ Navigator™ Opportunity: Live Presenter
See Note 1 at the end of this lesson.

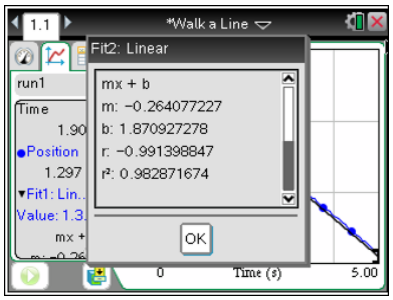
Step 9:

The model can be adjusted by clicking the slider arrows on the left side of the screen or by changing the values of m and b manually. See the sample shown at the right. If you made adjustments, record the new values below.

Sample answer: $m = –0.3$, $b = 2$; $y = –0.3x + 2$



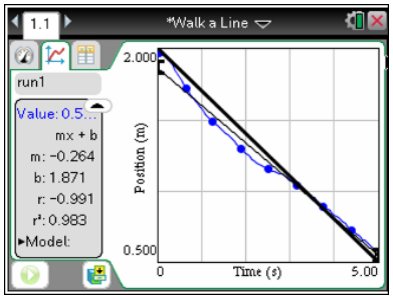
Step 10:



To analyze the data with a regression, a linear curve fit can be performed within the Vernier DataQuest™ application. Press **Menu > Analyze > Curve Fit > Linear**. This will give the equation of the linear regression model. You will have to scroll down the dialog box to see the values of *m* and *b* for the linear model. Record the values for *m* and *b* below.

Sample Answer: *m* = –0.264077227; *b* = 1.870927278

Step 11:



Click **OK** to see the graphical results of the regression. How does your linear regression compare with the equation you found in Step 9? How do the values for *m* and *b* compare?

Sample answer: The linear regression is similar to the equation from Step 9 but not exactly the same. The value of *m* in the linear regression is slightly greater (less negative) than in Step 9. The value of *b* is less than in Step 9. Answers will vary.

Teacher Tip: The regression equation should be similar to the students' equations. In some ways a student's equation may appear to be a better fit because the regression equation may not go through the actual starting position.

Discussions/Explorations

1. As you may have gathered from your practice trials, the CBR 2 collects data measuring how far an object is located from the sensor. By walking in front of the CBR 2, collect a set of data that appears linear and has a positive slope. Provide a detailed description of your walk. Be sure to discuss the real-world connections for the slope and *y*-intercept of the model.

   Sample answer: The walker stands close to the CBR 2 and slowly walks away at a steady rate. The *y*-intercept is the walker's distance from the CBR 2 at time $t = 0$ seconds. The slope is the walker's average velocity.

2. By walking in front of the CBR 2, collect a set of data that appears linear and has a slope that is approximately zero. Provide a detailed description of your walk, including the connection between slope and *y*-intercept and the physical actions.

   Answer: The walker stands still in front of the CBR 2 and does not move for the entire experiment. The *y*-intercept is the walker's distance from the CBR 2. Since there is no movement toward or away from the CBR 2, the slope is 0.

3. By walking in front of the CBR 2, collect a set of data that represents a piecewise function with two parts, both of which are linear—one with a positive slope and one with a negative slope. Provide a detailed description of your walk, including the connections between slope and *y*-intercept and the physical actions.

   Sample answer: The walker starts close to the CBR 2 and slowly walks away at a steady velocity and then changes direction and heads back toward the CBR 2 at a steady velocity. This could be reversed so that the walker started walking toward the CBR 2 and then walked away. The *y*-intercept is the walker's distance from the CBR 2 at time $t = 0$ seconds. The slopes are the walker's average velocities—positive when walking away from the CBR 2 and negative when walking toward it. During the change in direction, the graph will not be linear.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- That the *y*-intercept of a graph of position versus time shows starting position
- That the slope of a position-versus-time graph shows velocity
- How negative, zero, and positive slopes relate to motion in a graph of position versus time

Assessment

Explain why the *y*-intercept on a position-versus-time graph can never be negative.

TI-Nspire™ Navigator™

Note 1

Step 8, Live Presenter: You may wish to use **Live Presenter** here to allow students to share how well their equations fit the data points.

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Radioactive Decay
Student Activity

Name _____
Class _____

Open the TI-Nspire™ document *Radioactive_Decay_MG.tns*

In this activity, you will conduct an experiment to simulate the process of radioactive particle decay. You will learn how to predict the leftover particles based on the decay rate and the initial population.

Radioactive decay occurs when heavy elemental particles, such as Uranium and Plutonium, reach critical mass and begin to break down into smaller elements at a constant rate. Each atom within the element has the same probability of breaking down. We can't predict exactly which atoms will break down, but on average, all of them will break down at the *same rate*.

Move to pages 1.2, 1.3, and 1.4.

Press ctrl ▶ and ctrl ◀ to navigate through the lesson.

1. Acquire a half cup of M&M®s from your teacher.
2. Pour the M&Ms out onto a flat surface and count them. Enter the count on the spreadsheet on Page 1.4.
3. Place the M&M's back in the cup, shake, and pour all of them out again.
4. Remove the candies that landed M-side up, and count the remaining M&Ms (with no M showing).
5. Repeat steps 3 and 4 until no M&M's remain to put back into the cup.
6. Record each trial in the data table on Page 1.4.

Note: Do not enter the trial where you have no M&M's left.

Move to page 1.5.

7. Plot the *number* vs. the *trial* on the Data & Statistics page.

Move to pages 1.6 and 1.7.

8. What is the independent variable?

9. What is the dependent variable?

Move to page 1.9.

10. What observations can you make about the data? Is it linear? Non-linear?

Move to pages 1.10 through 1.15.

11. What is the meaning of the *y*-intercept?

12. What is the meaning of the *x*-intercept?

13. How many trials did it take to get to approximately half of your original amount? What does this represent?

14. How did the number of sides impact the half life? Hypothesize how the half life would be impacted if there were three sides with only one side marked?

15. Summarize your conclusions about the pattern of the relationship in this decay model.

Science Objectives

- Students will count the number of decaying particles, which are modeled by M&M's®.
- Students will graph the particles (M&M's) vs. the trials.
- Students will determine a decay curve and the variables that affect the curve.

Vocabulary

- decay
- exponential
- population
- growth rate
- growth factor

About the Lesson

- This lesson involves the idea of exponential decay.
- As a result, students will:
  - Observe particles decaying (in the form of M&M's).
  - Calculate a relationship between the time and the number of M&M's.
  - Analyze the pattern of the graph for their sample.
  - Determine what each variable in the decay graph represents.

TI-Nspire™ Navigator™ System

- Use the Quick Poll to send a list out to the students and gather the data from their trials.
- Use TI-Nspire™ Navigator™ Teacher Software to review student TI-Nspire documents.

TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.

Lesson Files:

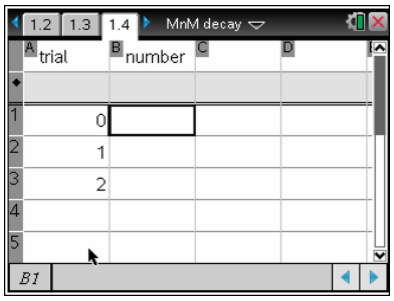
Student Activity

Radioactive_Decay_Student.pdf
Radioactive_Decay_Student.doc

TI-Nspire document

Radioactive_Decay_MG.tns

Discussion Points and Possible Answers



Move to pages 1.2, 1.3, and 1.4.

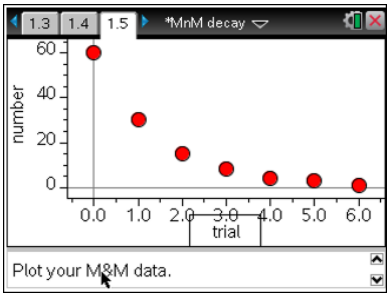
1. Acquire a half cup of M&M®s from your teacher.
2. Pour the M&Ms out onto a flat surface and count them. Enter the count on the spreadsheet on Page 1.4.
3. Place the M&M's back in the cup, shake, and pour all of them out again.
4. Remove the candies that landed M-side up, and count the remaining M&Ms (with no M showing).
5. Repeat steps 3 and 4 until no M&M's remain to put back into the cup.
6. Record each trial in the data table on Page 1.4.

Note: Do not enter the trial where you have no M&M's left.

Teacher Tip: You might want to demonstrate how to drag segments and how to join segments to form a vertex of an angle.

Move to page 1.5

7. Plot the *number* vs. the *trial* on the Data & Statistics page.



Move to pages 1.6 and 1.7.

8. What is your independent variable?

Answer: trials

9. What is the dependent variable?

Answer: number of candies

Teacher Tip: This is a good time to talk about radioactive particle decay and that the trials would represent the number of years it takes the particles to decay.

TI-Nspire Navigator Opportunity: *Quick Polls (Multiple Choice or Open Response)*
See Note 1 at the end of this lesson.

Move to page 1.9.

10. What observations can you make about the data? Is it linear? Non-linear?

    Answer: Non-linear.

TI-Nspire Navigator Opportunity: *Live Presenter*
See Note 2 at the end of this lesson.

Teacher Tip: Bring out the basic curve of the line (exponential) while staying in middle school level. Ask questions to bring out understanding of components of the problem.

Move to pages 1.10 through 1.15.

11. What is the meaning of the *y*-intercept?

    Answer: Starting population of M&M's.

12. What is the meaning of the *x*-intercept?

    Answer: The amount of trials it takes for exponential decay to occur based on this example.

13. How many trials did it take to get to approximately half of your original amount? What does this represent?

    Answer: one; half life

14. How did the number of sides impact the half life? Hypothesize how the half life would be impacted if there were three sides with only one side marked?

Answer: .two sides = ½; 3 sides = 1/3

15. Summarize your conclusions about the pattern of the relationship in this decay model.

Sample Answers: Decay is not linear; it has a half life.

Teacher Tip: Now that the students have established an understanding of a growth or decay curve, you can discuss the idea of initial state and the *y*-intercept.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students are able to understand:

- The basic shape of the graph of the decay model is non-linear.
- What the *y*- and *x*-intercepts represent; and that decay models always have a half life.

TI-Nspire Navigator

Note 1

Question 9, *Quick Polls* (*Multiple Choice* or *Open Response*)

Draw a sketch of 4 different decay curves with different steepness of curve and the initial point crossing the y-axis marked. Ask the students:

1. What is the initial population for the first curve?
2. Which curve has the smallest growth factor?
3. Which graph decays the quickest?
4. Which graph has the greatest decay rate?

Note 2

Question 10, Live Presenter

Once students have generated a graph, it would be a good time to make one of the students Live Presenter to discuss the meaning of the curve that is generated with the class.

Getting Started with the TI-Nspire™ Family of Teacher Software

Activity Overview

In this activity, you will explore basic features of the TI-Nspire™ family of Teacher Software. You will explore the Welcome Screen, add pages with Calculator and Graphs applications, and explore the menus and submenus of each application. You will explore the five tabs within the Documents Toolbox, as well as the options available in the Documents toolbar and the Status bar.

Materials

- TI-Nspire™ Teacher Software

Step 1:

Open the Teacher Software. The Welcome Screen displays an icon for each of the eight applications: Calculator, Graphs, Geometry, Lists & Spreadsheet, Data & Statistics, Notes, Vernier DataQuest™, and Question. To see a brief description of each application, hover the cursor over each icon.

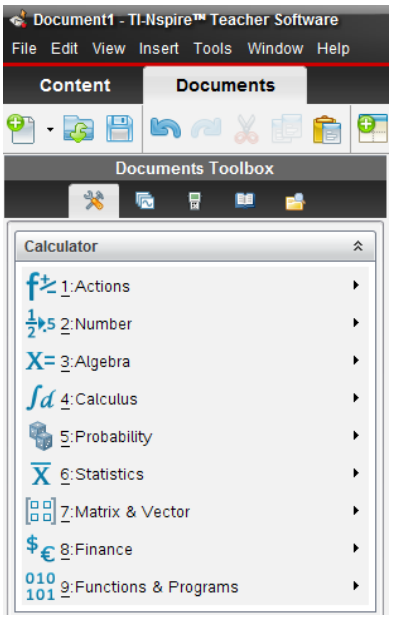
The Welcome Screen also allows you to view content, manage handhelds, transfer documents, and open documents. To see a description of each option, hover the cursor over each icon. To view the Welcome Screen at any time, go to **Help > Welcome Screen**.

To create a new document with a Calculator application as the first page, click .

Step 2:

The Calculator application allows you to enter and evaluate mathematical expressions as well as create functions and programs.

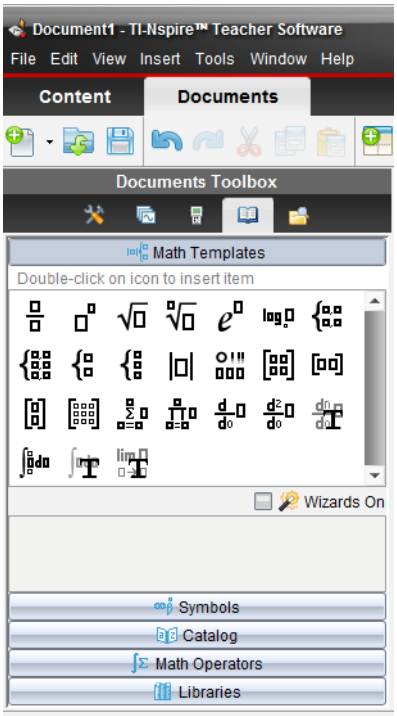
In most cases, each application has a unique menu of commands and tools. To view the Calculator menu, go to the Documents Toolbox and select the **Document Tools** tab. Each item in the Calculator menu has a submenu. Explore the various menus and submenus by entering and evaluating your own expressions.



Note: To access the Calculator menu on the handheld, press menu.

Step 3:

The **Utilities** tab contains Math Templates, Symbols, Catalog, Math Operators, and Libraries panes. Only one pane is displayed at a time, and the Math Templates pane is the default pane. Explore each of the other panes by clicking them.

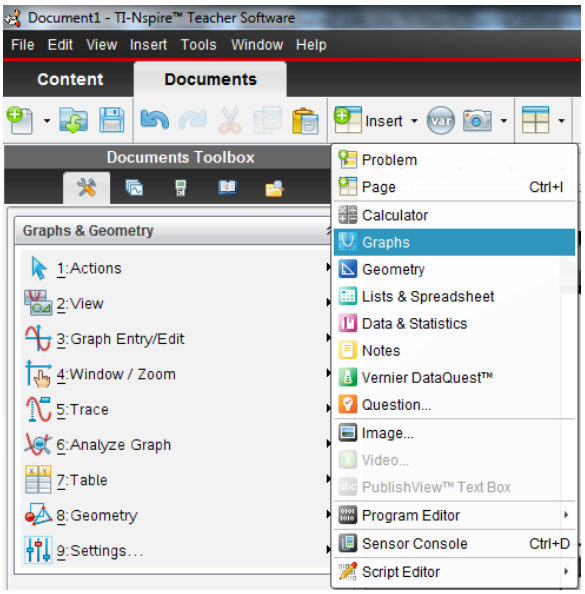


To insert a Math Template into the Calculator application, double-click it. Explore various Math Templates by evaluating your own expressions involving fractions, exponents, square roots, logarithms, and absolute value expressions.

Note: When evaluating expressions, the Calculator application displays rational expressions by default. To display a decimal approximation on a PC, press **CTRL + Enter**. To display a decimal approximation on a Mac, press **Command + Enter**.

Step 4:

The **Insert** menu allows you to insert problems and pages, along with each of the eight applications. A problem can contain multiple pages, and variables that are linked within a problem are linked across pages.

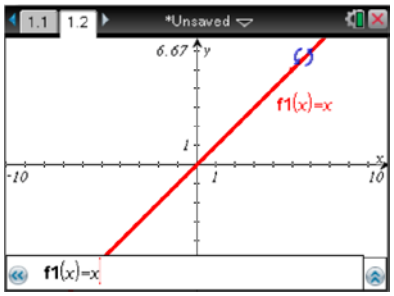


Insert a Graphs application by selecting **Insert > Graphs**.

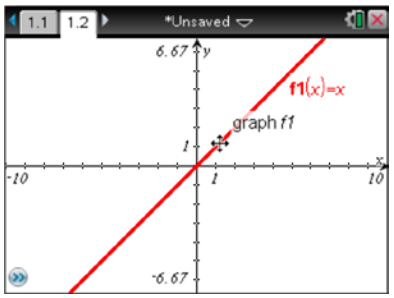
The Graphs application allows you to graph and analyze relations and functions. Explore the various menus and submenus available in the Graphs application.

Step 5:

Graph the function *f*(*x*) = *x* by typing ***x*** into the function entry line and pressing **Enter**.



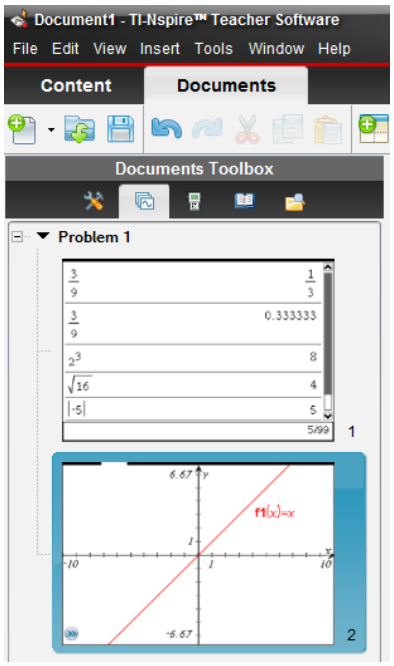
Rotate the line by hovering the cursor over the upper-right corner of the graph. When the rotational cursor, ↻, appears, rotate the line by clicking and dragging it.



Translate the line by hovering the cursor over the line near the origin. When the translational cursor, ✣, appears, translate the line up and down by clicking and dragging it.

Step 6:

Since you have inserted a Calculator application and a Graphs application, your TI-Nspire™ document now has two pages. The Page Sorter view allows you to view thumbnail images of all pages in the current TI-Nspire document.



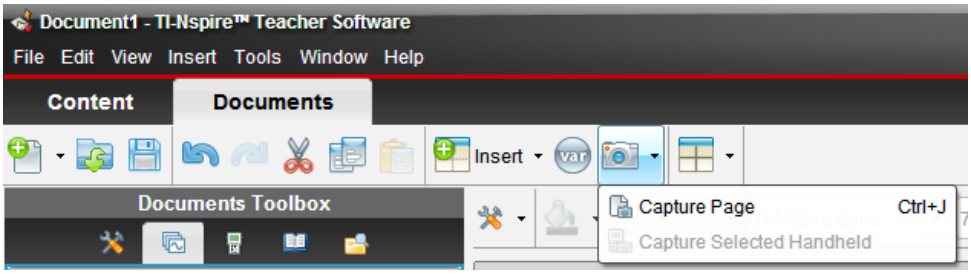
Access the Page Sorter by going to the Documents Toolbox and clicking the **Page Sorter** tab. Pages can be rearranged by grabbing and moving them. Right-clicking allows for pages to be cut, copied, and pasted.

Note: To access Page Sorter in the handheld, press ctrl ▲. To right-click in the handheld, press ctrl menu.

Step 7:

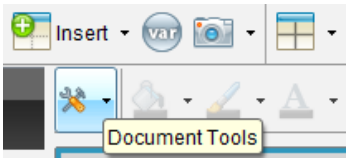
The Documents toolbar allows you to create, open, and save a TI-Nspire document. Commands such as Undo, Redo, Cut, Copy, and Paste are also available. Explore these options by hovering the cursor over each icon. Pages, problems, and applications can be inserted and variables can be stored.

Take a Screen Capture of the current page by selecting **Take Screen Capture > Capture Page**. This Screen Capture can be saved as an image.



Page layouts allow multiple applications to appear on one screen. Explore the various page layouts that are available by clicking **Page Layout**.

The Document Tools menu contains tools and commands for the current application.

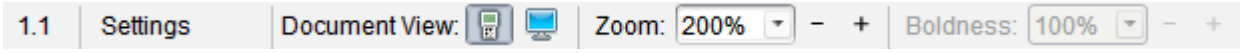


To change the fill color, line color, or text color, select an object and then select a color from the appropriate menu. To receive additional information about a given menu, hover the cursor over it. Not all color menus are available on all applications.

Step 8:

The Status Bar allows the user to access Settings, change the Document View from Handheld mode to Computer mode, and adjust the zoom of the SideScreen. Change the Document View to Computer mode by clicking **Computer mode**.

Change the Document View back to Handheld mode by clicking **Handheld mode**. Increase the zoom of the SideScreen to 200% by selecting *200%* in the Zoom menu. The Boldness feature is enabled when using a PublishView™ document.



Step 9:

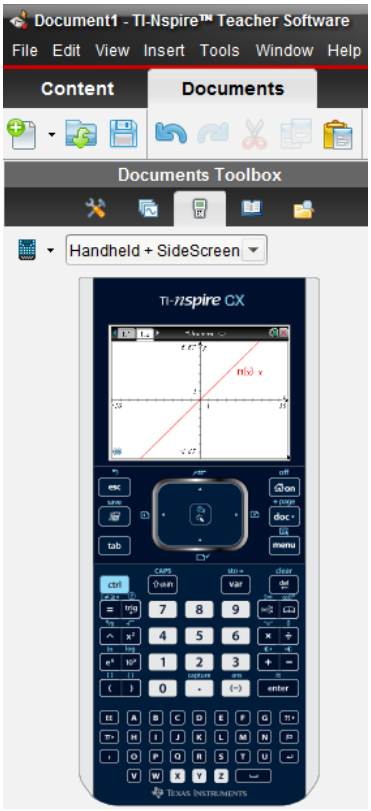
To access the TI-SmartView™ emulator for TI-Nspire, go to the Documents Toolbox and select the **TI-SmartView** tab.

TI-SmartView emulator has three available views: Handheld only, Keypad + SideScreen, and Handheld + Side Screen. Explore each of these views.

The TI-SmartView emulator has three available keypads:

- TI-Nspire™ CX
- TI-Nspire™ with Touchpad
- TI-Nspire™ with Clickpad

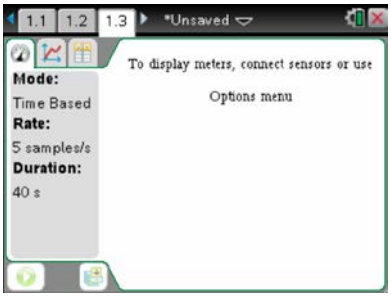
Each keypad has three available views: Normal, High Contrast, and Outline. Click the **Keypad** menu and explore each keypad and view.



Step 10:

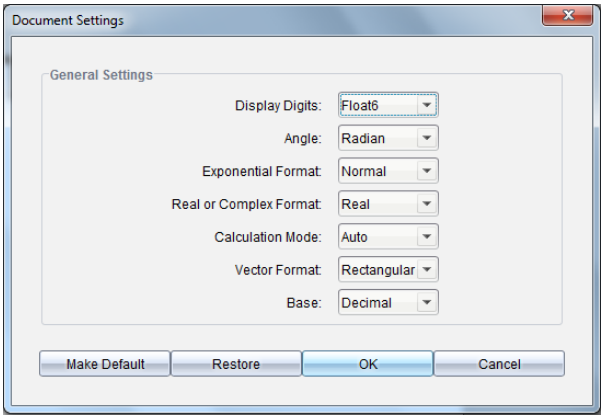
The Vernier DataQuest™ app can be used to collect, view, and analyze real-world data. Insert a page with the Vernier DataQuest app by selecting **Insert > Vernier DataQuest™**.

Though no data will be collected during this activity, the data meter will automatically launch when a Vernier sensor is connected to the computer's USB port.



Step 11:

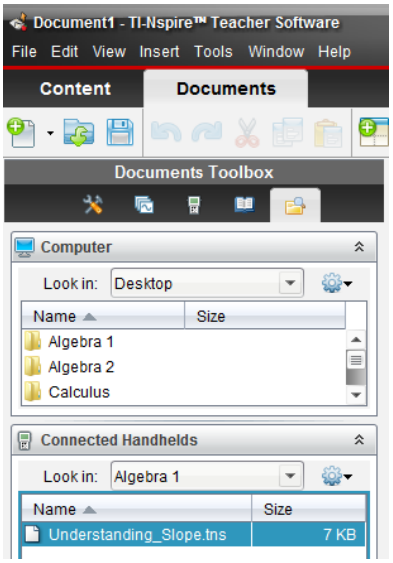
View the Document Settings by going to **File > Settings > Document Settings**. The Document Settings also can be viewed by going to the Status Bar and double-clicking **Settings**.



Note: To move across fields in the Document Settings window, press tab. To change the setting in a given field, press ▾, select the desired setting, and press tab to move to the next field. To exit the window, press enter.

Step 12:

Documents can be transferred between the computer and connected handhelds using the Content Explorer in the Documents Workspace. Explore the Content Explorer by clicking the **Content Explorer** tab.



To transfer a TI-Nspire document from the computer to the connected handheld, locate the document in the Computer panel. Click, drag, and drop it into the desired handheld or folder in the Connected Handhelds panel.

To transfer a TI-Nspire document from the connected handheld to the computer, locate the document in the Connected Handhelds panel. Click, drag, and drop it into the desired folder in the Computer panel.

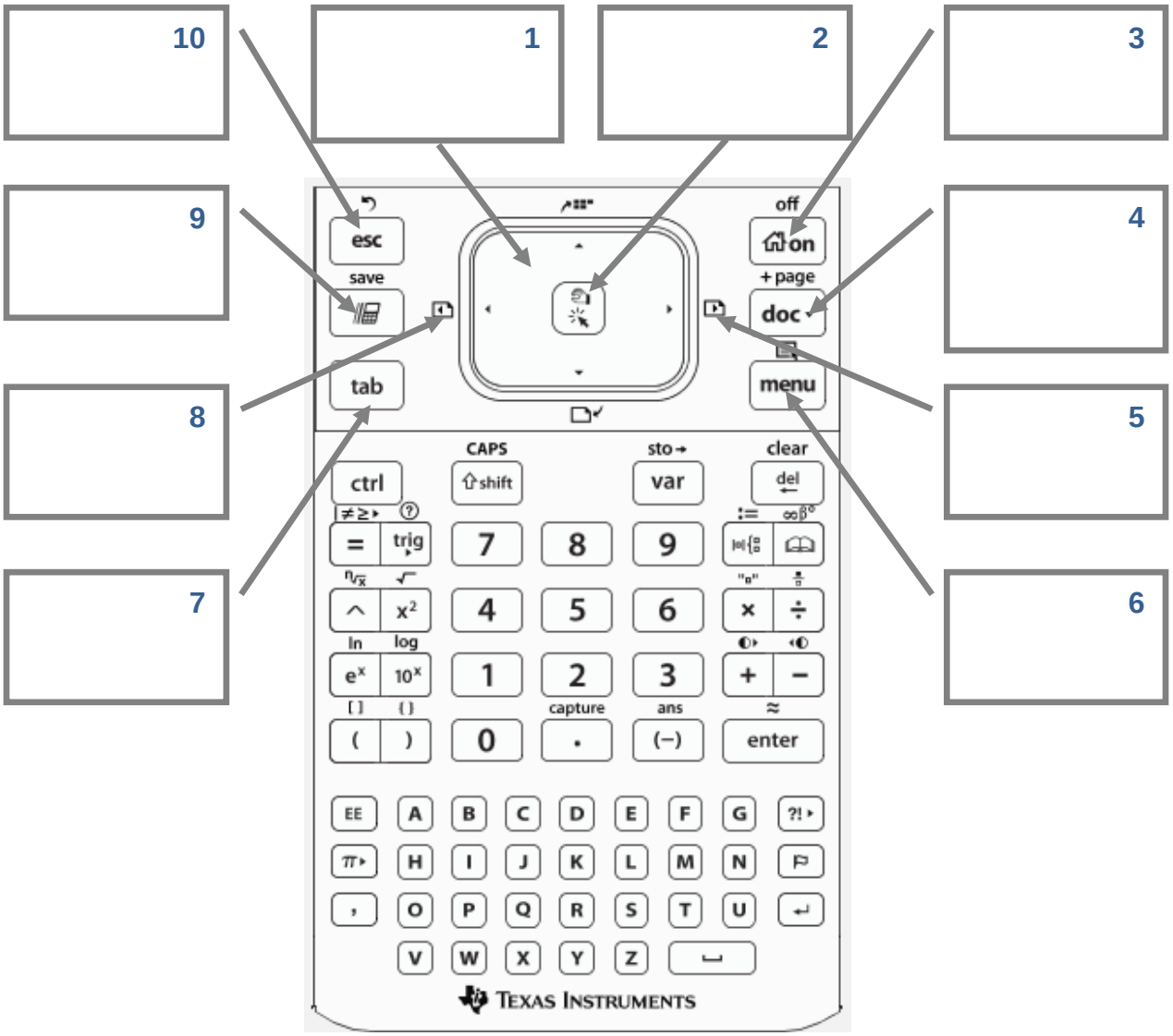
TI-Nspire™ CX Family Overview

TI PROFESSIONAL DEVELOPMENT

STUDENT ACTIVITY

Activity Overview

In this activity you will become familiar with the most commonly used keys on the TI-Nspire™ CX family of handhelds.



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Introduction to Data Collection

TI PROFESSIONAL DEVELOPMENT

TEACHER NOTES

Activity Overview

In this activity, you will see how easy and efficient it is to collect and analyze data using TI-Nspire™ technology and the built-in Vernier® DataQuest™ application.

Materials

- *Vernier® EasyLink™ adapter*
- *Stainless Steel Temperature probe*

Step 1:

Turn on the TI-Nspire™ CX handheld, and create a new document by selecting **New Document**.

- If asked to save the current document, select "Yes" or "No."

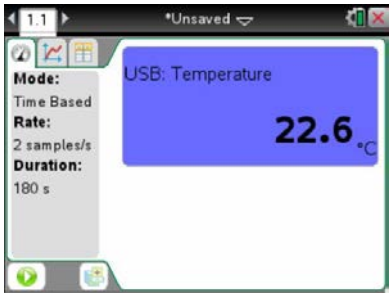
A new document will appear. Though you have the opportunity to add one of the seven built-in TI-Nspire applications, do not select an application at this time.

Step 2:

Obtain a TI Stainless Steel Temperature probe and the Vernier EasyLink adapter.

Plug the TI Stainless Steel Temperature probe into the EasyLink adapter, and then connect the Vernier EasyLink adapter to the mini-USB port on top of the handheld.

This should launch the Vernier DataQuest application on Page 1.1.



Step 3:

Discuss the following questions with your partner:

- What is the temperature? What are the units?
- How often does the temperature reading update?
- What are the default settings for the mode, rate, and duration?
- What happens as tab is pressed?
- What do you think each of the following icons represent?

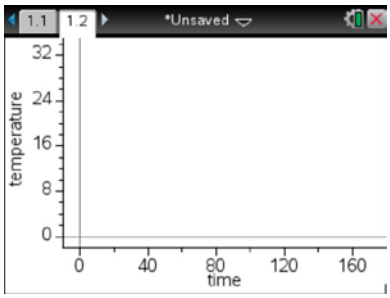
Step 4:

Let the temperature return to room temperature. Note your measure of the temperature of the room and compare it with others around you.

- Are the values the same?
- If not, how could one account for the differences?

Step 5:

Now we want to heat the temperature probe. Discuss with your partner how you might go about this, and share your plan with others in the room.



Predict what a plot of temperature vs. time would look like if you implemented your plan.

Step 6:

The best way to perform most temperature change experiments is to start the temperature change event and then start the data collection.

Start heating the probe. To start collecting the data, press tab until the Play button in the lower left of the screen is highlighted. Then press enter. Alternately, you can hover the cursor over the Play button and use the click button ( ) on the Touchpad.

Note: The enter and buttons perform slightly different commands. The click ( ) is like a left-click on a computer mouse and will activate the part of the screen that the cursor or pointer ( ) is over.

Step 7:

During the data collection, a scaled graph will appear and the Play button will change to a Stop button. After a brief period of time, end the experiment by clicking the Stop button.

When the experiment ends, the File Cabinet appears .

Step 8:

Examine your results and compare with your prediction. Discuss the following questions:

- Did you need the full time for the experiment, or did you end it early?
- We are interested in the rate at which the temperature increased. How would you describe this rate? At the start? Toward the end?
- What material did you use to warm the probe? Do you think that the material used to heat the probe matters? Why?
- Check with others in the room, and see their results. How do they compare with your results? What material did they use to warm the probe? Would that account for the differences?

Step 9:

To look at the table of data from the experiment, press tab until the Table option is highlighted and then press enter. Alternately, use the Touchpad to position the pointer over the Table icon and press .

Explore your rate of warming by looking at the change in temperature over equal increments of time.

- How could you quantify this change in rate of warming?
- How does this compare with your earlier analysis?

Step 10:

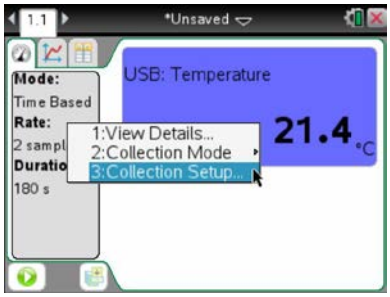
To save the results from the first experiment, place this "run" in the File Cabinet. Press tab until the File Cabinet is highlighted and press enter.

- What changes do you notice on the screen?

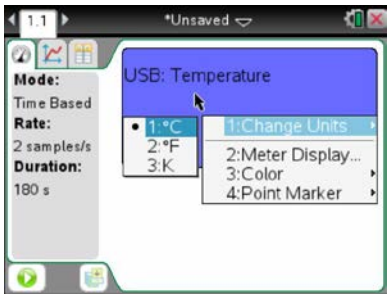
Step 11:

Now design an experiment that will cool the temperature probe.

Consider changing some of the options by right-clicking (ctrl menu) an area of interest (Mode, or the Gauge reading). For example, the default settings of three minutes and the units can be changed.

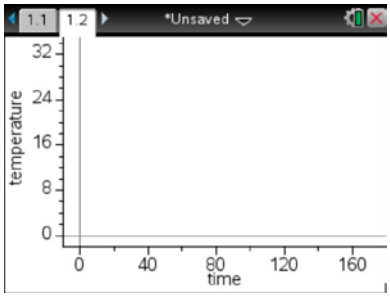


Note that these options are also under the menu. Based on what you learned in the heating experiment, adjust the settings as needed for your cooling experiment.



Step 12:

As you prepare for the cooling experiment, consider the following questions:



- What will you use to cool the probe?
- How long will it take to cool?
- What units will you use?
- What will the plot of temperature vs. time look like this time?

Step 13:

Collect the data using your design for cooling. Once the cooling begins, start the data collection as soon as possible. Highlight the play button  , and press enter to start.

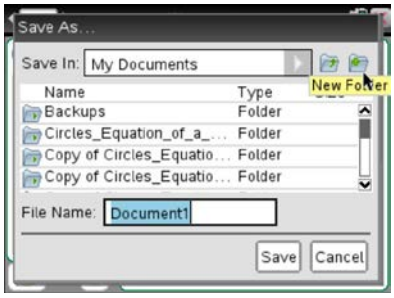
Step 14:

Explore your rate of cooling as before, and look at the table of data. Discuss the following questions:

- Were the rates of cooling or heating the same in both experiments? Explain.
- To compare the heating and cooling experiments, what variables should you control?

Step 15:

We might use this data again, so the experiment should be saved. To save the experiment, press ctrl S, name the document, and select a folder to place it in. Create a new folder if you want.



Interactive Math and Science Classrooms…

I.C.E.R

Interaction
Communication
Engagement
Reasoning & Sense-Making

5Es Learning Cycle for Science

Engagement
Exploration
Explanation
Elaboration
Evaluation

CCSS Mathematical Practices

Make sense of problems & persevere in solving them

Reason abstractly & quantitatively

Construct viable arguments & critique others' reasoning

Model with mathematics

Use appropriate tools strategically

Attend to precision

Look for & make use of structure

Look for & express regularity in repeated reasoning

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Checking and Updating the OS

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to check the operating system (OS) on a handheld and update it using the Content Workspace of the TI-Nspire™ Teacher Software.

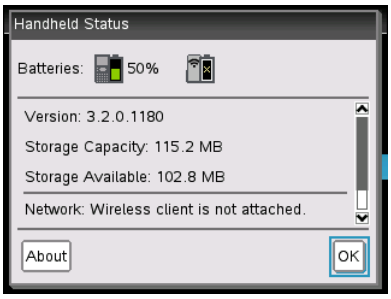
Materials

- *TI-Nspire™ Teacher Software and USB connection cable*

Viewing handheld status

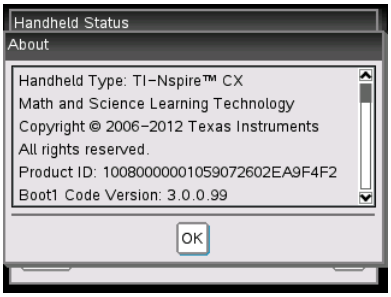
The Handheld Status screen displays the battery status, (OS) version, available space, the network (if any), and your student login name and whether you are logged in

To view the Handheld Status, press on and select **Settings** > **Status**. The Handheld Status dialog box opens.



Viewing handheld details on the About screen

The About screen displays the handheld type and product ID.
To view the About screen from the Handheld Status screen, click **About**. To return to the home screen, press enter.



Updating the handheld OS

You can update the OS on your TI-Nspire™ handheld using your computer and TI-Nspire™ Teacher Software or by transferring the OS from one handheld to another. OS upgrade operations do not delete user documents. If there is not enough room on the receiving handheld for the upgrade, the sending handheld is notified. The only time documents can be affected by an OS installation is if the receiving handheld has a corrupted OS. In this situation, documents may be affected by OS restoration. It is a good practice to back up your important documents and folders before installing an updated operating system.

Important OS download information

The OS for the TI-Nspire™ CX handheld has the file extension *.tco*; the OS for the TI-Nspire™ CX CAS has the file extension *.tcc*; the OS for the TI-Nspire™ with Touchpad or Clickpad has the file extension *.tno*; and the OS for the TI-Nspire™ CAS with Touchpad or Clickpad has the file extension *.tnc*. Always install new batteries before beginning an OS download. When in OS download mode, the APD™ (Automatic Power Down) feature does not function. If you leave your handheld in download mode for an extended time before you begin the downloading process, your batteries may become depleted. You will then need to install new batteries before downloading the OS.

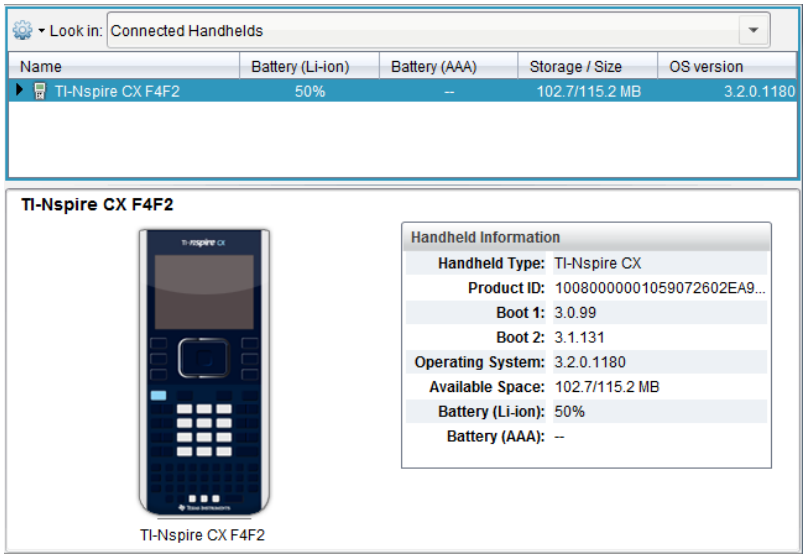
Finding operating system upgrades

Your TI-Nspire™ Teacher Software has convenient links to a number of useful Texas Instruments web sites, including those with handheld OS updates. You will need an Internet connection and the appropriate USB cable to download and install the updates.

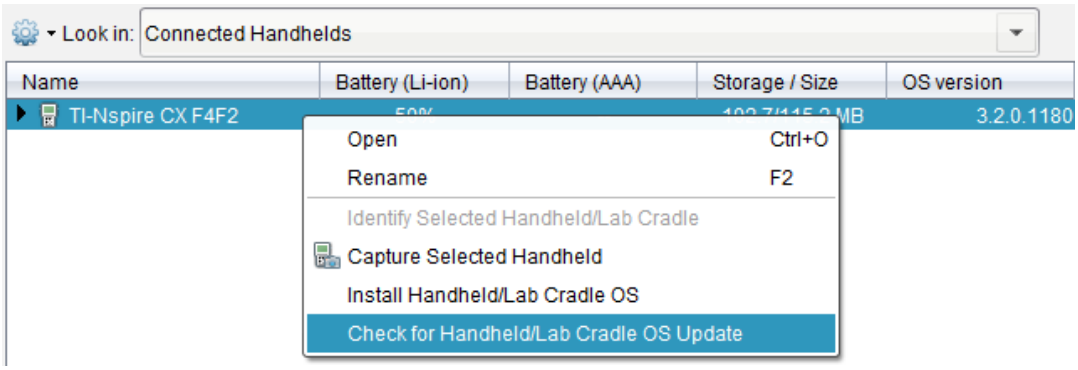
Using TI-Nspire Teacher Software to update the handheld OS

Open the TI-Nspire Teacher Software and connect a TI-Nspire handheld to the computer using the USB connection cable. Go to the Document Workspace, select the Content Explorer tab, and click **Connected Handhelds**. Multiple handhelds can be connected to the computer using multiple USB ports, USB hubs, or the TI-Nspire™ Docking Station. If multiple handhelds are connected to the computer, then multiple handhelds appear in the list of Connected Handhelds.

The connected handheld appears in the Content Window, along with battery, storage, and OS information. More detailed information appears in the Handheld Information window.



To see if a new OS is available, right-click the handheld and select **Check for Handheld OS Update**. To update the OS, right-click the handheld and select **Install Handheld OS**. A window appears that asks you to select the handheld OS file. Select the OS file and click **Install OS**. A window appears informing you that any unsaved data will be lost, and it asks if you want to continue. Click **Yes**.



Press-to-Test

TI PROFESSIONAL DEVELOPMENT

TEACHER NOTES

Activity Overview

The Press-to-Test feature enables you to quickly prepare student handhelds for exams by temporarily disabling folders, documents, and select features and commands.

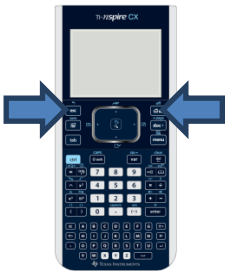
Materials

- TI-Nspire™ handheld-to-handheld or handheld-to-computer USB connection cable

Step 1:

To enable Press-to-Test on the TI-Nspire™ with Touchpad and TI-Nspire CX™, first ensure that the handheld is turned off. Press and hold esc and on until the Press-to-Test screen appears.

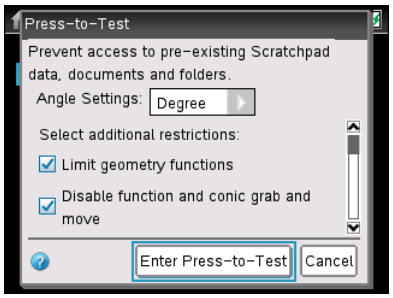
Note: To enable Press-to-Test on TI-Nspire™ with Clickpad, press and hold esc, on, and off on.



Step 2:

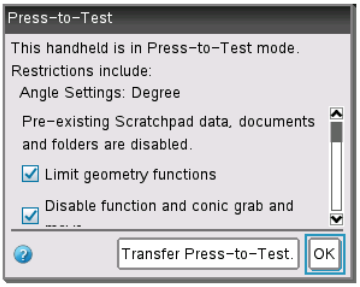
By default, Press-to-Test disables 3D graphing and pre-existing Scratchpad data, documents, and folders. The angle settings can be changed by pressing ▶, selecting the appropriate setting, and pressing ▶ or enter.

By default, all of the commands and features listed are disabled. To enable a feature or command, uncheck its box. Keep all boxes checked. Enter Press-to-Test by clicking **Enter Press-to-Test**.



Step 3:

Once the handheld is in Press-to-Test mode, the handheld reboots. A dialog box confirms that the handheld is in Press-to-Test mode and the restrictions are listed. Click OK.

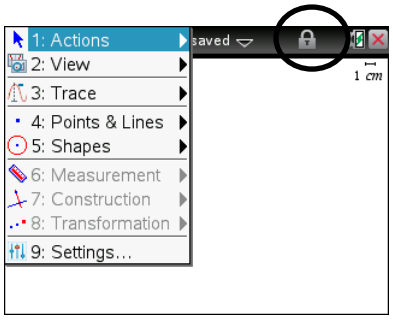


Step 4:

When in Press-to-Test mode, the LED at the top of the handheld begins blinking. Green indicates that all restrictions are selected (default), while yellow indicates that one or more restrictions are unselected. During the initial reboot, the LED alternates between red and, depending on the restrictions, either green or yellow.

Step 5:

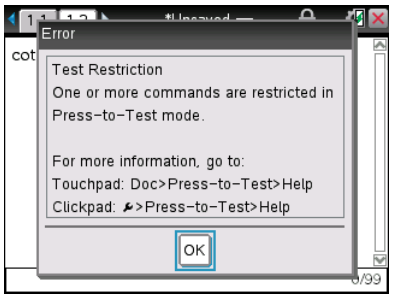
Create a new document, add a Geometry page, and press menu. Since geometry functions are limited, observe that the **Measurement**, **Construction**, and **Transformation** menus are not accessible.



Note: The lock icon at the top of the screen indicates that the handheld is in Press-to-Test mode.

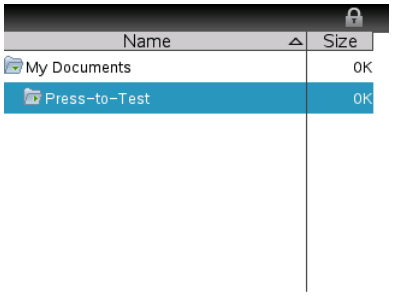
Step 6:

Add a Calculator application by selecting doc **> Insert > Calculator**. Type **cot(*π*/2)** and press enter. Since trigonometric functions are limited, an error message appears. The dialog box tells students how to access additional information about the restrictions. Click on OK.



Step 7:

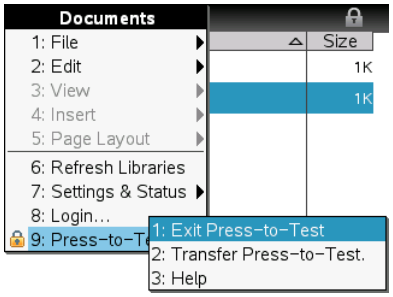
Select on **> My Documents.** While in Press-to-Test mode, a Press-to-Test folder appears in My Documents. All other folders and documents present on the handheld before Press-to-Test mode was entered are inaccessible.



Step 8:

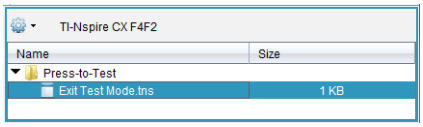
To exit Press-to-Test mode, connect two handhelds using the handheld-to-handheld USB connection cable. Then select doc **> Press-to-Test > Exit Press-to-Test**. The Exit Press-to-Test option appears regardless of whether the other handheld is in Press-to-Test mode.

Press-to-Test can also be exited with the TI-Nspire™ Navigator™ Teacher Software. Once a class has been started, students can select doc **> Press-to-Test > Exit Press-to-Test**.



Step 9:

Press-to-Test can also be exited with TI-Nspire Teacher Software or TI-Nspire Navigator Teacher Software by creating a document named ***Exit Test Mode.tns*** and transferring it to connected handhelds.



Note: The name of the TI-Nspire document must be spelled exactly as it is above.

Go to the Tools menu and select **Transfer Tool**. Click **Add to Transfer List** and select *Exit Test Mode.tns*. In the Edit Destination Folder, select the Press-to-Test folder and click Change. Then, click **Start Transfer.**

Transferring Documents Between Handhelds
TI Professional Development

Teacher Notes

Activity Overview

In this activity, you will learn how to transfer a document from one TI-Nspire™ CX handheld to another.

Materials

- Two TI-Nspire CX handhelds
- Unit-to-unit connection cable (Mini A to Mini B USB)

Transferring a document or a folder

Documents can be transferred between two TI-Nspire CX handhelds by connecting them with the unit-to-unit mini USB cable. The USB A port is located at the top of the handheld on the right side.

Step 1:

Firmly insert the ends of the mini USB unit-to-unit cable into the USB A ports of the handhelds. The handhelds will automatically turn on when the cable is plugged in.

Step 2:

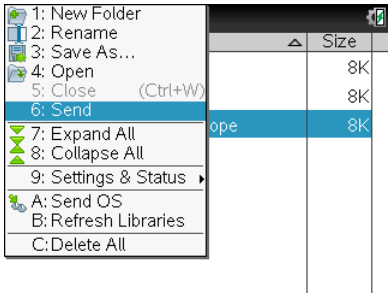
Open **My Documents** on the sending handheld.

Step 3:

Press the ▲ and ▼ keys to highlight the document or folder to send.

Step 4:

Press menu and select **Send**. No action is required by the user of the receiving TI-Nspire CX handheld. Once the transfer begins, a progress bar displays the status of the transfer. When the transfer is complete, a message displays on the receiving handheld. If the document was renamed on the receiving handheld, the new document name appears.



Note: When sending a folder from one handheld to another, the file structure in the sending folder is retained. If the folder does not exist on the receiving handheld, it will be created. If the folder does exist, files will be copied into it, with appended names added to any duplicate files.

Note: To cancel a transmission in progress, select **Cancel** in the dialog box of the sending handheld. To cancel a transfer from the receiving handheld, press esc. The receiving handheld, however, cannot cancel a transfer of folders. If an error message appears, press esc or enter to clear it.

Guidelines for transferring documents or folders

The guidelines for sending an individual document also apply to documents within folders that are sent.

- If you send a document with the same name as an existing document on the receiving TI-Nspire CX handheld, the system renames the sent document by appending a number to the name. For example, if you send a document named *Mydata* to another TI-Nspire handheld that already contains a document named *Mydata*, the document you send will be renamed *Mydata(2)*. Both the sending and receiving units display a message that shows the new name.

- There is a 255-character maximum length for a document name, including the entire path. If a transmitted document has the same name as an existing document on the receiving handheld and the document names contain 255 characters, then the name of the transmitted document will be truncated to allow the software to follow the renaming scheme described in the previous bullet.

- All variables associated with the document being transmitted are transferred with the document.

- Transmissions will time out after 30 seconds.

Transferring Documents Using the TI-Nspire™ Family of Teacher Software

TI PROFESSIONAL DEVELOPMENT **TEACHER NOTES**

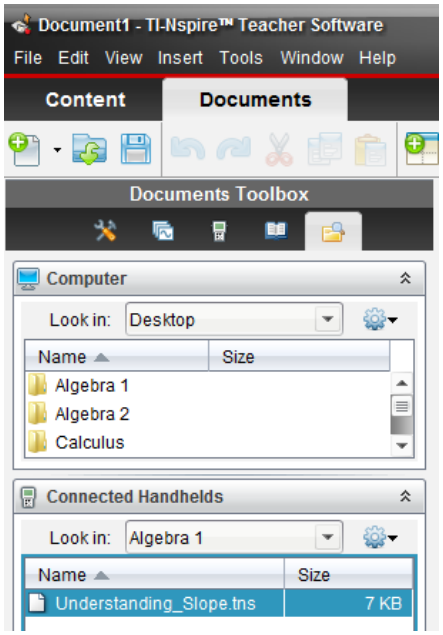
Activity Overview

In this activity, you will use the Documents and Content Workspaces of the TI-Nspire™ family of Teacher Software to transfer TI-Nspire™ documents between the computer and the handheld.

Materials

- TI-Nspire™ Teacher Software
- TI-Nspire™ handheld and USB connection cable

Transferring Documents in the Documents Workspace



Step 1:

Open the Teacher Software. Go to the Documents Workspace by clicking the **Documents** tab.

Step 2:

Connect a TI-Nspire™ handheld to the computer using the USB connection cable. Multiple handhelds can be connected using multiple USB ports, USB hubs, or the TI-Nspire™ Docking Station. If multiple handhelds are connected, then multiple handhelds appear in the Connected Handhelds panel.

Step 3:

Documents can be transferred between the computer and connected handhelds using the Content Explorer in the Documents Toolbox. Open the Content Explorer by clicking the **Content Explorer** tab.

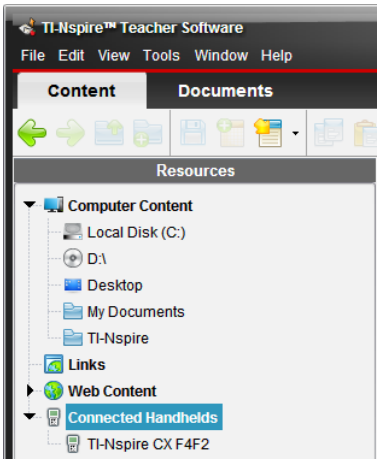
Step 4:

To transfer a TI-Nspire document from the computer to the handheld, locate the document in the Computer panel. Click, drag, and drop it into the handheld in the Connected Handhelds panel.

Step 5:

To transfer a TI-Nspire™ document from the connected handheld to the computer, locate the document in the Connected Handhelds panel. Click, drag, and drop it into the desired folder in the Computer panel.

Transferring Documents in the Content Workspace

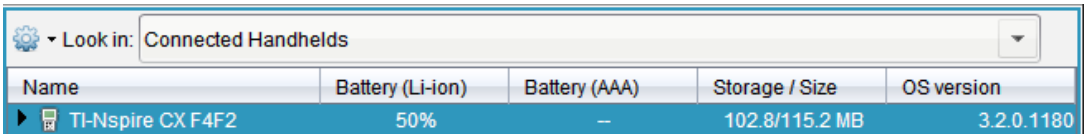


Step 6:

Go to the Content Workspace by clicking the **Content** tab. In the Resources panel, select **Connected Handhelds**.

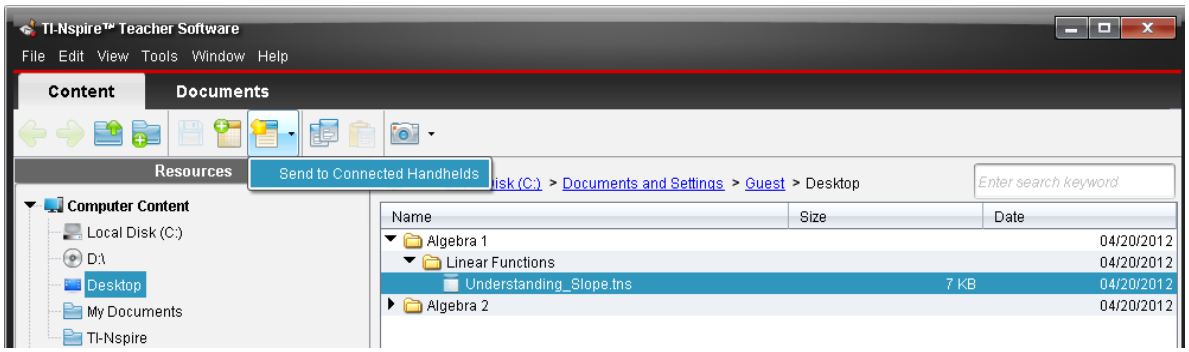
Step 7:

The connected handheld appears in the Content window, along with battery, storage, and OS information. To view the documents on a connected handheld, right-click it and select Open.



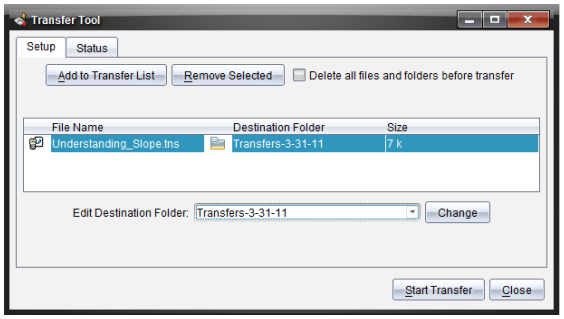
Step 8:

Locate a TI-Nspire™ document on your computer by browsing Computer Content in the Resources panel. Send the document by dragging and dropping it to the connected handheld. The document can also be sent by right-clicking it and selecting  **Send to Connected Handhelds**.



Step 9:

The Transfer Tool window appears with the current document. Documents can be added to or removed from the transfer list, and the destination folder on the handheld(s) can be edited or changed. To send the document to the handheld(s), click **Start Transfer**. Once the Status tab indicates that the transfer is complete, click **Stop Transfer**.



Inserting an Image into a TI-Nspire™ Document

TEACHER NOTES

TI PROFESSIONAL DEVELOPMENT

Activity Overview

In this activity, you will learn how to use the TI-Nspire™ family of Teacher Software to insert images into the Graphs and Geometry applications. You will also learn how to move, resize, compress, and stretch an image, as well as make it appear more transparent.

Materials

- TI-Nspire™ Teacher Software

Step 1:

Open the Teacher Software. If the Welcome Screen appears when the software is opened, click to create a new document with a Graphs application as its first page. Otherwise, insert a Graphs application by selecting **Insert > Graphs**.

Note: Images can be inserted into Graphs, Geometry, Data & Statistics, Notes, and Question applications.

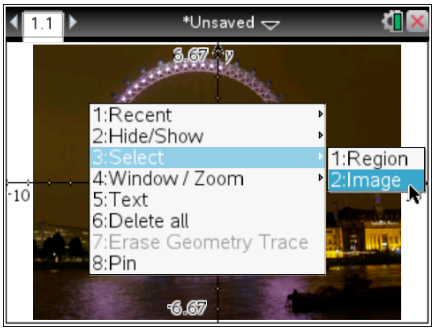
Step 2:

Insert an image into the Graphs application by selecting **Insert > Image**. A selection of images is preloaded in the **My Documents >TI-Nspire > Images** folder. Select **Ferris Wheel.jpg** and click Open.

Note: Although the Teacher Software comes with a selection of preloaded images, all jpg, jpeg, bmp, and png images are supported. The optimal format is .jpeg 560 × 240. Larger images may take the document longer to load on the handheld. Images appear in grayscale for TI-Nspire™ handhelds with Touchpads and Clickpads.

Step 3:

Images can be moved, resized, and vertically or horizontally stretched or compressed. To select an image in the Graphs, Geometry, or Question application, right-click on the image and choose **Select > Image**. To select an image in the Notes application, click the image. To move the image, grab and move the image. To resize the image, grab and move a corner. To vertically stretch or compress the image, grab and move the top or bottom edge. To horizontally stretch or compress the image, grab and move the left or right edge.

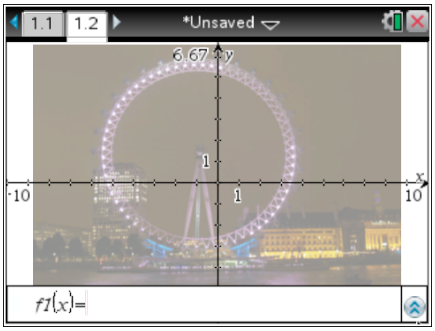


Note: To right-click an object on a handheld, press ctrl menu. To grab an object, press ctrl . To let go of an object, press esc.

Step 4:

To make an image appear more transparent, insert the image in a Geometry application, and then change the page to a Graphs application.

Select **Insert > Geometry**. Then insert an image by selecting **Insert > Image**. Again, choose **Ferris Wheel.jpg.** To change the Geometry application to a Graphs application, select **View > Graphing**.



TI-Nspire™ Keypad Shortcuts
TI Professional Development

Teacher Notes

Activity Overview

The following keypad shortcuts can be used to perform common functions on the TI-Nspire™ CX family of handhelds. Many shortcuts can also be performed in the TI-Nspire™ family of Teacher Software, as well as by selecting options from various menus and submenus.

Getting Help	
Open Hints	ctrl trig
Editing Text	
Cut	ctrl X
Copy	ctrl C
Paste	ctrl V
Undo	ctrl Z or ctrl esc
Redo	ctrl Y or shift esc
Toggle approximate and exact results	ctrl enter
Change key to include appropriate accent	
Inserting Characters and Symbols in a Document	
Display character/symbol palette	ctrl
Underscore	ctrl
Display math template palette	
Backslash	shift ÷
Manual data capture point	ctrl .
Clear	ctrl del
Caps lock	ctrl shift
Store	ctrl var
Square brackets	ctrl (
Curly brackets	ctrl)
Display Trig symbol palette	trig
Equals symbol	=
Display pi symbols palette (π, /, θ, and so on)	
Display equality/inequality palette (>, <, ≠, ≥, ≤, |)	ctrl =
Display marks and letter symbols palette (? ! $ ‘ “ : ; _ \)	
Square root	ctrl x^2
log	ctrl 10^x
ln	ctrl e^x
ans	ctrl (−)

Managing Documents	
Open document menu	doc ▾
Open document	ctrl O
Close document	ctrl W
Create new document	ctrl N
Insert new page	ctrl I
Select application	ctrl K
Save current document	ctrl S or ctrl

Navigation	
Top of page	ctrl 7
End of page	ctrl 1
Page up	ctrl 9
Page down	ctrl 3
Up a level in the hierarchy	ctrl ▲
Down a level in the hierarchy	ctrl ▼
Context menu for selection	menu
Extends selection in direction of arrow	shift any arrow

Navigating in Documents	
Displays previous page	ctrl ◀
Displays next page	ctrl ▶
Displays Page Sorter	ctrl ▲
Exits Page Sorter	ctrl ▼
Switch between applications on a split page	ctrl tab
Moves focus backward within a page	shift tab

Wizards and Templates	
Add a column to a matrix after the current column	shift ↵
Add a row to a matrix after the current row	↵
Integration template	shift +
Derivative template	shift −
Math template palette	or ctrl
Fraction template	ctrl ÷

Modifying the Display	
Increase contrast	ctrl +
Decrease contrast	ctrl −
Power off	ctrl on

Using Application-Specific Shortcuts	
Select all in Notes or Program Editor	ctrl A
Check syntax and store (in Program Editor)	ctrl B
Insert Data Collection console	ctrl D
Find (in Program Editor)	ctrl F
Hide/Show Entry Line (in Graphs or Geometry)	ctrl G
Go To (in Lists & Spreadsheet, Program Editor)	
Find and Replace (in Program Editor)	ctrl H
Insert Math Box (in Notes)	ctrl M
Open the Scratchpad	
Recalculate (in Lists & Spreadsheet)	ctrl R
Add Function Table (in Lists & Spreadsheet, Graphs, and Geometry)	ctrl T
Group/ungroup	ctrl 4 / ctrl 6

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Online Resources

TI PROFESSIONAL DEVELOPMENT

TEACHER NOTES

Activity Overview

In this activity, you will explore resources available at education.ti.com. You will browse for activities at Math Nspired, Science Nspired, and TI-Math. You will search for activities using the Standards Search and Textbook Search, and you will explore additional information regarding professional development.

Materials

- Computer with Internet connection

Step 1:

Go to **education.ti.com > Downloads & Activities**. Select either **Math Nspired** or **Science Nspired**. These pages can also be accessed directly at mathnspired.com and sciencenspired.com. Select a subject on the left and view the available units.

Step 2:

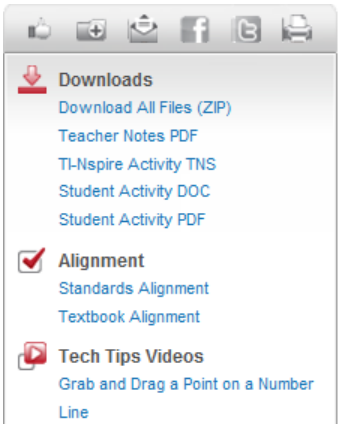
Select a unit from the list. When a unit is selected, a table appears with an image from each activity. The table contains links to download, recommend, and save each activity. It also identifies each activity type:

Icon	Type	Description
	Bell Ringer	Bell ringers are short lessons designed to help transition quickly into class after the bell rings.
	Action Consequence Simulation	Interactive, engaging lessons allow students to perform actions on a mathematical object or scientific simulation, observe consequences, and make conjectures. Each lesson contains a pre-made TI-Nspire™ document, a Student Activity, and Teacher Notes.
	Create Your Own	In addition to the Student Activity and Teacher Notes, the lesson also includes step-by-step instructions on how to create the TI-Nspire document.
	Data Collection with Probes	Data Collection Labs give students the opportunity to collect and analyze real-world data with more than 50 data collection sensors from Vernier Software and Technology™.
	TI-Nspire™ Navigator™ Compatible	The Teacher Notes identify opportunities to use the TI-Nspire Navigator System, including opportunities for Quick Polls, Class Captures, and Live Presenter.

Step 3:

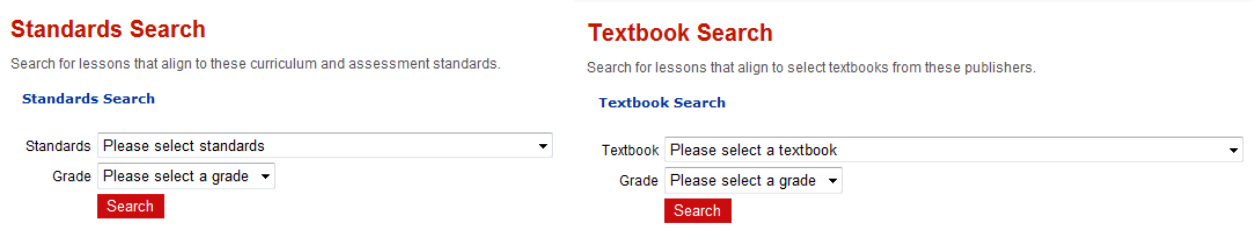
Select an activity from the list. The activity page shows math objectives, relevant vocabulary, and additional information about the lesson. A video offers a preview of the lesson, and related lessons are recommended below.

Icons above the Downloads section allow you to recommend, save, email, and print an activity. Links to Facebook and Twitter are also available. The Downloads section contains links to activity files. Links for Standards Alignment, Textbook Alignment, and relevant Tech Tip Videos are also available.



Step 4:

Explore the Standards and Textbook Search channels on the left. Select a set of standards or a textbook from the drop-down box, select a grade, and click **Search**.



Step 6:

Go to **Downloads & Activities > TI Math**. This page can also be accessed directly at www.timath.com.

Featured TI-Nspire™ and TI-84 Plus activities for various subjects appear in the center of the page. Links to activity archives for each subject appear on the left. Click one of the featured activities. The activity page contains an overview, a video preview, activity files, and alignments for standards and textbooks.

Step 7:

Go to **Professional Development > Online Learning**.

The Tutorials page contains link to free Atomic Learning video tutorials. There are video tutorials for the TI-Nspire™ handheld, the TI-Nspire™ software, and the TI-Nspire™ Navigator™ System.

The Webinars page contains links to upcoming, free PD webinars. The Archive page contains recordings of past webinars. Associated webinar documents are available for download.

Step 8:

Explore each of the following pages by clicking the appropriate tab: Products, Downloads & Activities, In Your Subject, Professional Development, Funding & Research, and Student Zone.

T^3 Ticket Outta Here

2.71828

I have learned …

My question is …

My next steps are …

2.71828

T^3 Ticket Outta Here

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