Temperature Conversions

About the Lesson

In this activity, students will use the conversion formulas in lists to convert between the different temperature scales. Then students will use the SciTools app to find the linear regression equation and use the regression equation to convert temperatures. As a result, students will:

- be able to convert temperatures between the various scales.

- be able to use the linear regression equation as a conversion formula.

Vocabulary

- Fahrenheit

- Celsius

- Kelvin

- Absolute zero

Teacher Preparation and Notes

- If students have some experience using lists in the Stat Editor, this activity might take less than 20 minutes to do.

- Be familiar with the SciTools App (Science Tools App). This app will graph and analyze data, convert all types of units (length, time, temperature, force, pressure, etc.), calculate significant digits, and calculate vectors.
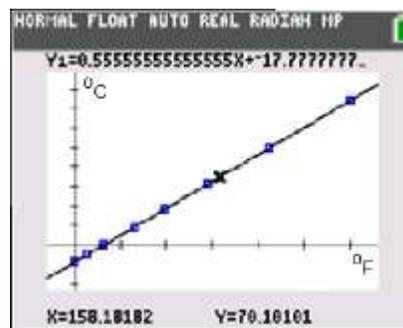
Activity Materials

- Compatible TI Technologies:

    TI-84 Plus*
    TI-84 Plus Silver Edition*
    🌀 TI-84 Plus C Silver Edition
    🌀 TI-84 Plus CE

* with the latest operating system (2.55MP) featuring MathPrint^{TM} functionality.

Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.

- Watch for additional Tech Tips throughout the activity for the specific technology you are using.

- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Lesson Files:

- Temperature_Conversions_Student.pdf

- Temperature_Conversions_Student.doc

Tech Tip: While using the Science Tools App, the tabs at the bottom of the screen indicate menus that are accessed by pressing the key directly below it. An example is shown here:

Data Table- *with Sample Data*

Degrees Fahrenheit (°F)	Degrees Celsius (°C)	Kelvin (K)
0	-17.78	255.22
14	-10.00	263.00
32	0.00	273.00
65	18.33	291.33
98	36.667	309.67
145	62.778	335.78
212	100.00	373.00
300	148.89	421.89

Entering the Data

1. Have students start by clearing all existing lists from their calculator. To do this, press [2nd], [MEM], then use the arrow keys to scroll to **ClrAll Lists**. Press [ENTER], [ENTER].

2. The data is provided to students on the student activity sheet, or you can supply students with data of your own. Students will Press [STAT], [ENTER]. Now enter into list L1 the temperatures in degrees Fahrenheit from the data table.

3. After entering the Fahrenheit temperatures in L1, make sure students highlight the header of L2 **before** entering the formula for the Celsius temperatures. Frequently students miss the step of going to the header and will get an error message when they press [enter].
Conversion equation for degrees Fahrenheit to degrees Celsius: [( ] [5] [÷] [9] [ )] [( ] [( ] [2nd] [L1] –32 [ )]. Then press [enter].

    Students will then record the values from L2 into the second column of the data table.

4. After students have entered the conversion formula from Fahrenheit to Celsius, they move to L3 and use the conversion formula from Celsius to Kelvin. The screen to the right shows the conversions.

    Students should enter the following conversion equation for degrees Celsius to kelvins: [2nd] [L2] + 273 [ENTER].

    Students will then record the values from L3 into the third column of their data table.

5. In the Science Tools App, to make the scatterplot students will be prompted to select the independent and dependent variables. See the following screen shots.

6. In the Science Tools App, students will come to the **Choose a Fit Method** menu. The list of regressions here is similar to the one in the STAT [CALC] menu. They should select 1: **LIN REG** for a linear regression, and press [ENTER].
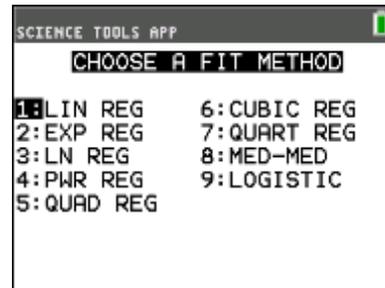
7. Their graph should look similar to the one shown here. They can use this graph to convert other temperature values. Press [TRACE][▲]. and use the left and right arrow keys [◄][►] to move the cursor along the linear model. Ordered pairs along the bottom of the screen give you equivalent temperatures on the Fahrenheit and Celsius scales.
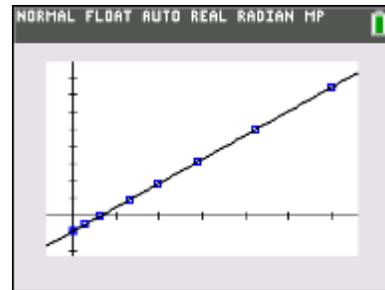
Data Analysis

1. In the graph below, what is the temperature in °F? What is the temperature in °C? (Round to one decimal place.)
   Answer: The temperature is 158.2 °F and 70.1 °C.
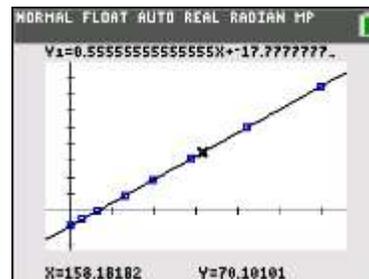
2. How would you find the Celsius temperature shown above in Kelvins? Calculate this value.

   Answer: Add 273 to the Celsius temperature. 343.1 Kelvin.

3. Why do you think it is helpful for scientists to use the Celsius scale rather than the Fahrenheit scale?

   Student answers will vary.
   Sample Response: There are not a whole lot of big advantages of Celsius over Fahrenheit. Students can mention the 100-degree difference between freezing and boiling points of water as being more logical than a 180-degree difference. They could also observe that a one-degree difference in Celsius is easier to notice since it is a bigger unit.

4. What advantage does the Kelvin scale offer over the Celsius scale in science?

   Student answers will vary.
   Sample Response: One advantage of the Kelvin scale is that it has no negative values. The advantage of having an absolute zero is that when the Kelvin temperature doubles it means that the thermal energy of the substance also doubles. This is not true of the Celsius or the Fahrenheit scales.