# Computer Survival Skills in C1151 Laboratory
# MCTC Chemistry

*v.11.10*

The objective of this experiment is to introduce you to computer skills and applications that will let you acquire and process data collected in chemistry experiments. Keep these instructions and bring them to each lab session as they will be used throughout the semester.

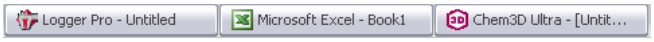
Network Login: *(only one person can be logged in at a time)*

- On the Novell Login screen, enter your MCTC ID in the username field and your PIN for the password.
- Make sure that the "Workstation Only" checkbox is NOT checked.
- Click OK

Desktop Description

- These C1151 applications appear on the desktop:
  - **Logger Pro** ... data acquisition
  - **Internet Explorer** ... browser
  - **Excel** ... spreadsheet
  - **Word** ... word processing
  - **Chem 3D Ultra 3.0** ... molecular modeling


- Double click the appropriate icon to activate the application.
- Switch between applications by clicking on their button in the lower application tray (below).




***Windows survival skill:***

*Do you have a computer/application related question? "RIGHT CLICK" on the object you have a question about.* A contextual menu of options will appear that will likely answer your questions or give you additional options.

## Typical Data Acquisition Procedure

1. Activate **LoggerPro** and collect data in table format

2. Select and Copy data in **LoggerPro** table.

3. Open Microsoft **Excel** and Paste data into **Excel** spreadsheet

4. Save the **Excel** spreadsheet (it contains valuable data!). Saving options include:
   a. USB flash drive (highly recommended). 128MB is more than plenty and they're cheap.
   b. Saving the data to the /temp directory on the C:\ drive and emailing it to yourself
   c. Saving the data to your H:\ drive (you can access this from home)
   d. *Save only **Excel** and **Word** files. Don't save **LoggerPro** files.*

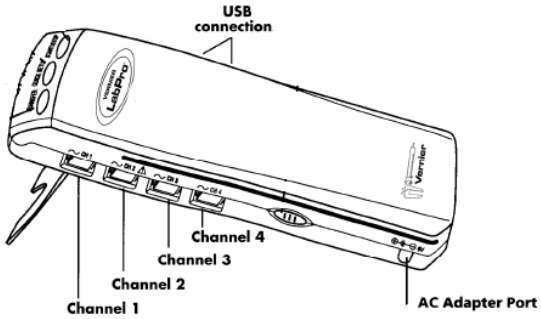
5. Manipulate your data in **Excel**
   a. Construct graphs
   b. Perform calculations
   c. Look for patterns and relationships among data
   d. Print graph and submit with experimental data sheet.

***Windows survival skill:***

Save your files often to avoid lost data!!!

## **Today's Experiment**: Computer Setup

1. Obtain a laptop computer and charger. Connect the charger to a wall outlet and the laptop computer.
2. Plug in the Lab-Pro interface box power supply into an available outlet and the interface.
3. Plug the temperature probe into the Channel 1 (CH 1) position of the Lab-Pro Interface (Figure at right).
4. Connect the Logger Pro interface box to the computer using the USB cable.
5. Activate the LoggerPro software application.
6. Check to be sure the "Collect" button is green. If it is not, check the interface box power cord and the USB cable connections.
7. Open the "Computer Survival" LoggerPro file *(You must be properly logged into the network to open this file)*




### ***Windows survival skill:***

You can alternate between full screen and window mode by double clicking on the bar at the top of an open application.

## Today's Experiment: Procedure

1. Fill a 250 mL beaker ¾ full with hot tap water.

2. Hold the temperature probe in the hot water. Make sure it does not touch the bottom or sides of the beaker when collecting data.

3. Click the "Collect" button (Green button at the top right-hand corner) on the LoggerPro window to start data acquisition. LoggerPro will start recording the data.

4. Measure the temperature of the hot water **for a period of 2 minutes**; **STIR THE WATER WITH THE TEMPERATURE PROBE AT ALL TIMES** using the temperature probe.

5. Continue to stir, acquire data and have your partner quickly add ~**1/2 cup of ice**.

6. Continue collecting data for an additional **3 minutes after the addition of ice**.

7. Click the red "Stop" button in the top right corner when you have finished.

**DO NOT EXIT THE LOGGERPRO PROGRAM!!**

8. Note: You will see a curve being plotted by the LoggerPro. The x- and y-axis scales and range can be modified to fit the curve on the screen (Right click on a number on the axis and choose Autoscale from the drop down menu).

9. Select all the data in the LoggerPro data table:
   a. Click and drag over the data in the table **or better…**
   b. **Click the word "latest"** at the top of the table to select the entire data
   c. Click edit and copy.

10. Minimize the LoggerPro application.

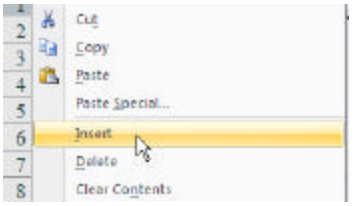
11. Activate Microsoft Excel then click in the top left cell and then Click on Edit→Paste

12. Save the Excel spreadsheet on the network H:/ drive
    a. Click of File→Save
    b. Choose H:/ drive (this will be the one with the student ID number next to it)
    c. Give an appropriate name (Use the date, experiment number, your names, etc in the file name) before saving the file

## ***Windows survival skill:***

Use Ctrl-x, Ctrl-c and Ctrl-v as quick and easy alternatives to Cut, Copy and Paste.
The shortcuts will often work even when the usual editing functions can't be seen on the screen.

# Data Analysis: Microsoft Excel Operations (Excel 2007)




### Inserting Column Titles

1. Select the first horizontal line of data by RIGHT clicking on the number "1" at the far left

2. Select "Insert" from the popup menu that appears. A blank line should be inserted above your data thus shifting your data downward one line.

3. Click on the cell above the first data column and enter the words "Time (sec)". Repeat the procedure for the second column using "Temperature (°C).

| | A | B |
|---|---|---|
| 1 | Time (sec) | Temp (°C) |
| 2 | 0 | 38.25132 |
| 3 | 1 | 38.22652 |
| 4 | 2 | 38.20172 |

### Calculations: Creating a formula

*You will now create a formula that will convert all Celsius temperature measurements to Fahrenheit.*

1. Click on the cell C2 (an empty cell next to the first temperature reading)

2. Formula entry:
   a. **Enter =** (all equations begin with an equals sign)

   b. Then enter: 1.8*B2+32 (This formula, $T_F = 1.8 \times T_C + 32$, converts the temperature in cell B2 from Celsius into Fahrenheit)

   c. Press Enter

   d. Click on cell C2

   e. Now click edit→copy ... to copy the contents of cell C2 which will now appear with a dotted line around it.

   f. Select the entire range of cells in the C column, i.e., drag through until the last data cell
      (...or click on the top cell and then shift click on the bottom cell).

      **Important:** ***DON'T select entire columns by clicking on their headers*** (letters at top).

   g. Click edit→paste

   h. The cells which you paste automatically use the next entry in the B column (...i.e. B2, B3 etc.) and converts it into Fahrenheit degrees in the C column.

3. Label the calculated column Temperature (°F)

| | A | B | C |
|---|---|---|---|
| 1 | Time (sec) | Temp (°C) | |
| 2 | 0 | 38.25132 | =1.8*b2+32 |
| 3 | 1 | 38.22652 | |
| 4 | 2 | 38.20172 | |

| | A | B | C |
|---|---|---|---|
| 1 | Time (sec) | Temp (°C) | |
| 2 | 0 | 38.25132 | 100.8524 |
| 3 | 1 | 38.22652 | |
| 4 | 2 | 38.20172 | |
| 5 | 3 | 38.20172 | |

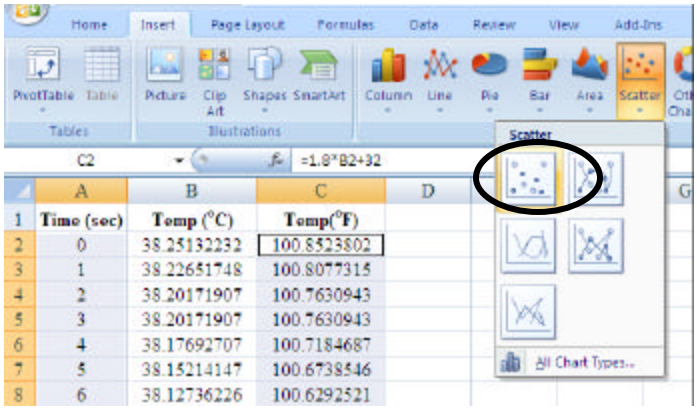
| | A | B | C |
|---|---|---|---|
| 1 | Time (sec) | Temp (°C) | Temp (°F) |
| 2 | 0 | 38.25132 | 100.8524 |
| 3 | 1 | 38.22652 | 100.8077 |
| 4 | 2 | 38.20172 | 100.7631 |
| 5 | 3 | 38.20172 | 100.7631 |
| 6 | 4 | 38.17693 | 100.7185 |

**Creating a line graph**

*In this exercise you will select two columns of data and use them to construct a graph. The first column of data is the "independent" variable (Time) and is what is used for the "X" axis. Similarly, the other column of data is the "dependent" variable (Temperature: $^{o}$F) and corresponds to "Y" axis values.*

1. Select the two columns, time and Temp $^{o}$F. (Click and drag over the first column. Then "Ctrl" click and drag over the Fahrenheit column.)

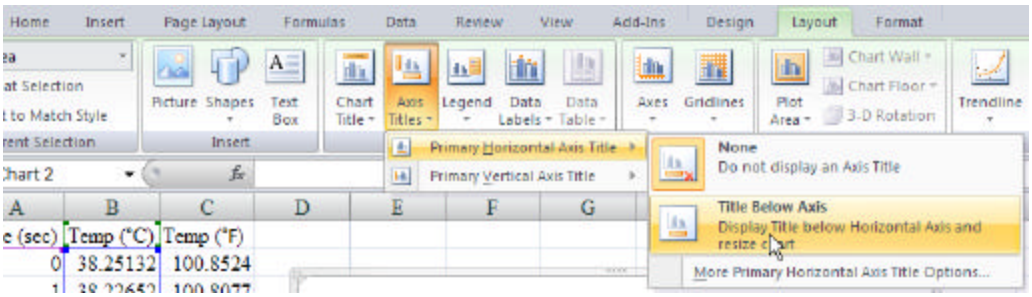
2. Click on the "Insert" tab .... Scatter Plot (↓ arrow for more options)... "Scatter with Straight Lines and Markers"




3. A graph will now appear on your spreadsheet

4. Click once on the graph to select it

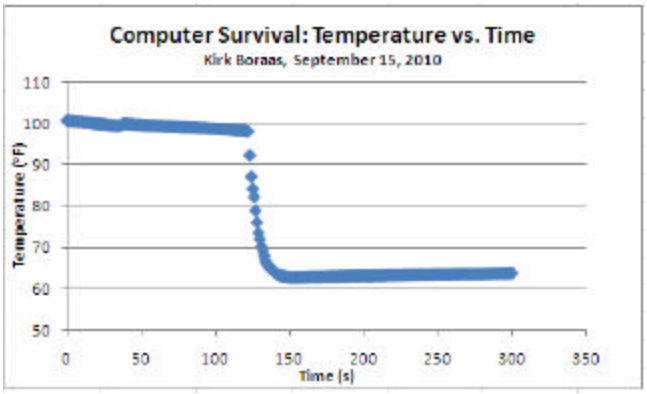
5. Click on the "Layout" tab
   → "Axis titles" (↓ arrow for more options)
   → "Primary Horizontal Axis Title"
   → "Title Below Axis"
   → Enter "Time (sec)" as the X axis title




6. Use a similar recipe to add the title for the Y axis.

7. Click on the graph title edit it. Type in "Computer Survival: Temperature vs. Time, your name and today's date" as the title.

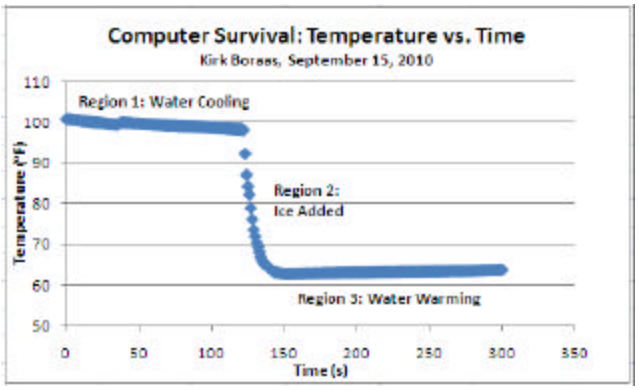
8. Click on the graph legend and then press the "delete" key on your keyboard to remove the legend. Adjust your graph axis to minimize the amount of wasted space (right click on the axis labels, then "format axis"):



## Graph Modification

Your graph should look similar to the one shown at right. Use the textbox tool (Click on graph→Layout Tab→Textbox tool) to create labels for each of the three graph regions.

You can also remove the "gridlines" from your graph by right clicking on a single gridline, selecting "format gridlines" from the menu and then changing their color to white.

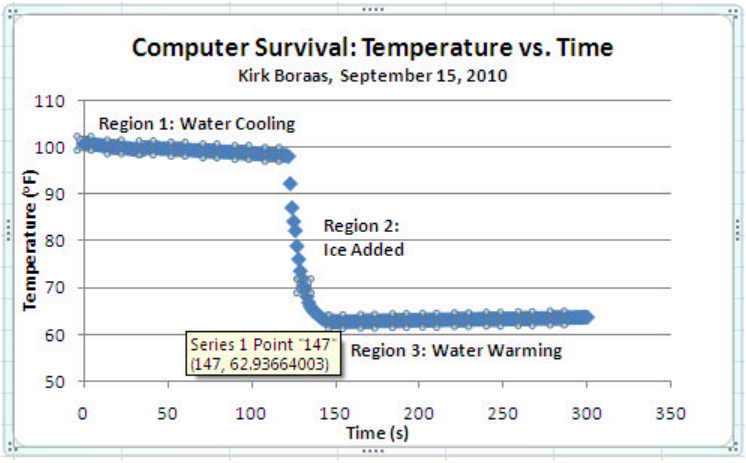



***Windows survival skill:***

Many graph options can be accessed by directly RIGHT clicking on the feature you want to change. For example, to turn off the data markers and leave only the line that connects them, right click on the dotted line, and select "Format Data Series".



## Identifying Data Points




You can easily identify data points on your graph by clicking on the data point.

In the example at right, the cursor has been positioned over a data point corresponding to time=147 seconds and Temperature=62.9366°F.

Using the mouse in this way, determine the X,Y points that define the beginnings and endings of regions 1 and 3 of your graph. Write these ranges/points down in your notebook.

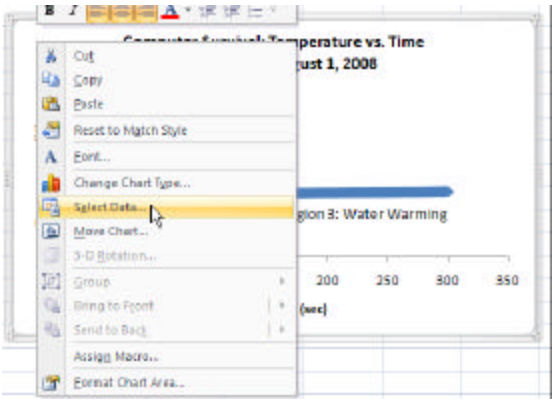
**Be careful to identify points where the line is perfectly straight and NOT curved.**

**Trendline Analysis**

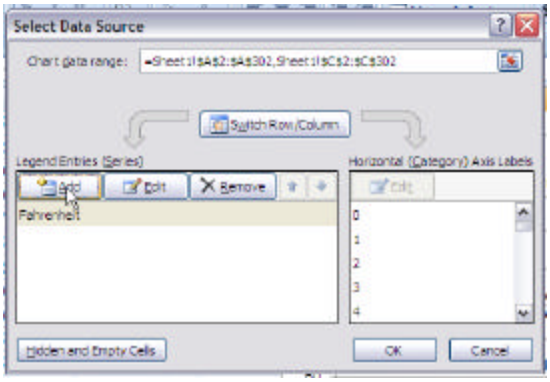
The word "Trendline" is Microsoft Excel's term for straight line analysis. *By specifying a particular range of data, you can instruct Excel to draw the best straight line through the range of data.* Furthermore, Excel can also display the equation of the best straight line in y = mx + b form (slope intercept form).

We will be creating trendlines for regions 1 and 3 of the graphs you've created. In these examples, the slope of the line is a number that tells us the rate of heating or cooling (i.e. degrees Celsius temperature change PER second.
You can create a Trendline for region 1 as follows:

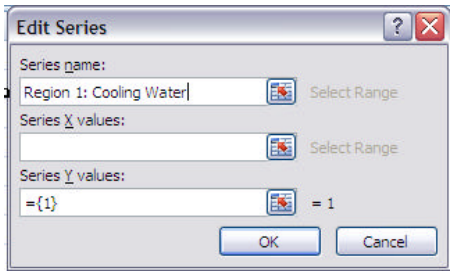
1. Create a new data series
   a. Right click on the graph and choose the "Select Data" option




   b. In the "Select Data Source" window that opens, Click on the "Add" button

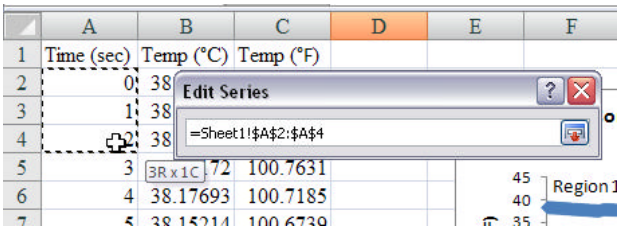



   c. When the "Edit Series" window opens, enter the name of the new series as "Region 1: Cooling Water"

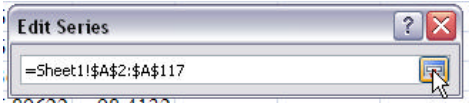



   d. Now click on the button to the right of the "Series X values" box. This will return you to the spread sheet.

   e. Use the information you recorded earlier as a guide and select the time (X) values corresponding to range 1.

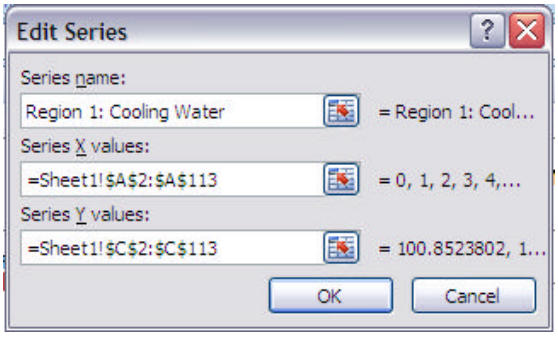



   f. Click on the button in the narrow window (figure below) to accept your selection.

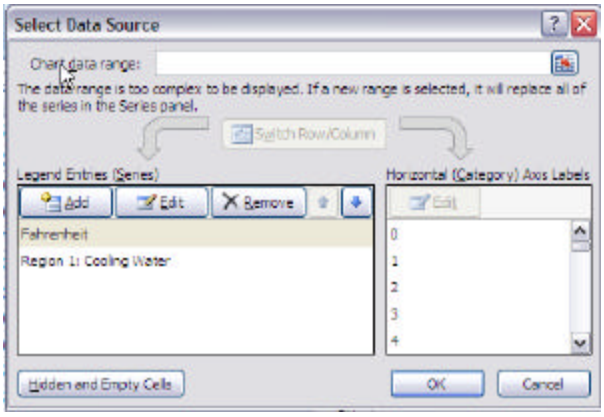


g. Repeat steps d, e, and f for the temperature values “Y”. Be careful to only select temperature values that are within the range of Region 1 of your graph.

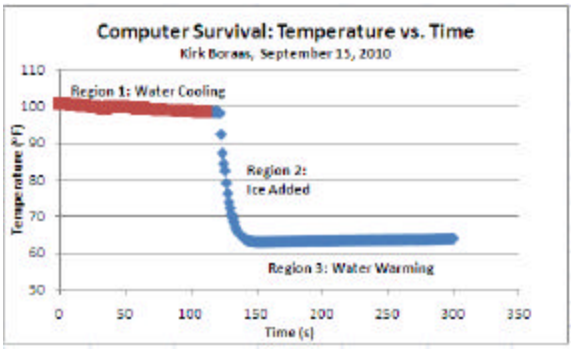
Click “OK” on the Edit Series window (See right)



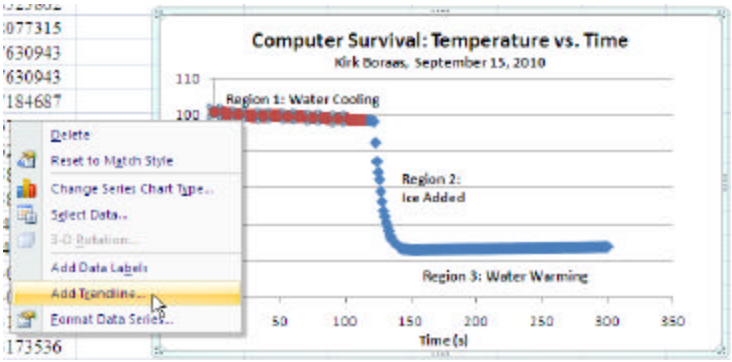

h. Click “OK” in the Select Data Source window.




i. Your graph should look like the one at right. The new series will be highlighted in a different color.




2. Right click on the red highlighted data series and choose the “Add Trendline” option.



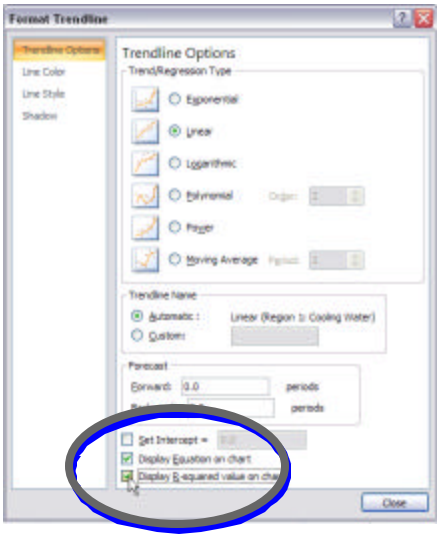
3. In the “Format Trendline” window opens, make the following changes:

   a. Trend/Regression Type: Linear (default)

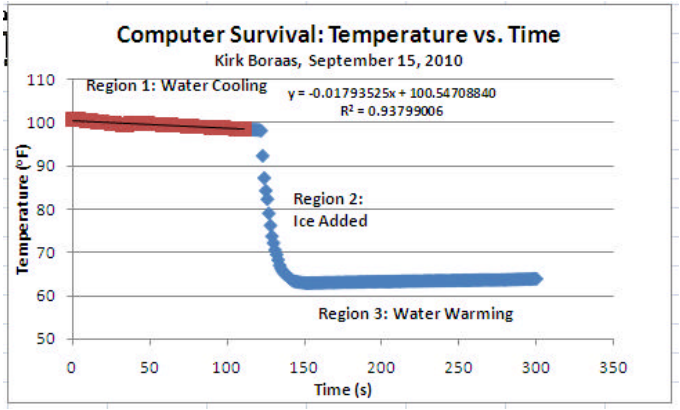
   b. Display Equation on Chart (Checked)

   c. Display R-squared value on Chart (Checked)

   d. Click “Close”



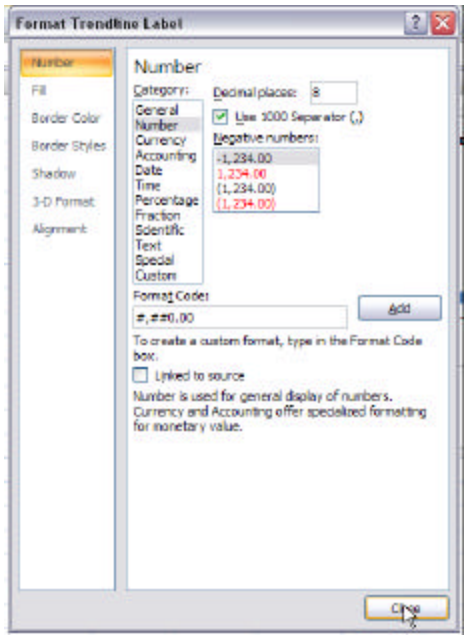

4. The trendline equation and R-Squared value will now be displayed on your graph. Drag this box to a clear region of the graph but not far from region 1 (where it belongs).




5. Frequently, we’ll use the trendline equation as we perform calculations. For this reason, it is important to display a trendline equation that has more than the default number of significant figures.

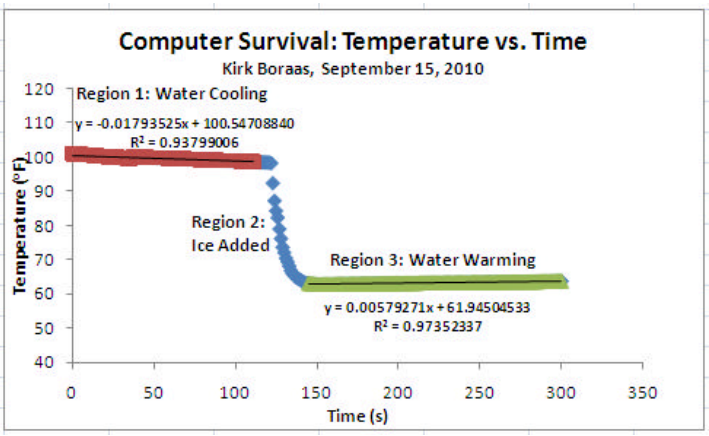
   Increase the number of decimal places displayed by the trendline:

   a. Right click on the trendline box
   b. Choose “Format Trendline Label”
   c. Click on “Number” in the list of display formats
   d. Enter “8” in the Decimal Places window
   e. Click OK




6. **<u>Repeat the above recipe for region 3 of the graph.</u>**

## Trendline analysis: Continued




The equations you generate will be in the form of

$$y = mx + b$$

However, in our experiment, didn't use X's and Y's, rather we have "Time" and "Temperature".

Thus, if you obtain an equation that looks like this:

$$\mathbf{y} = -0.01793525\mathbf{x} + 100.5470$$

**It really means:**

$$\mathbf{Temp} = -0.01793525 \times \mathbf{Time} + 100.5470$$

The slope (-0.01793525) is *negative* because the temperature is *DROPPING* at a rate of 0.0179 degrees Celsius per second (rise/run = °F/sec for units).

---

**Printing:** There is no printer in the laboratory. You will have to properly save your files and print them out in one of the student computer labs.

## File transfer

- **USB: Flash Drive.** The cost of memory has decreased dramatically. 4 GB USB flash drives currently cost less than $10.

- **Email attachments:** E-mail only Excel and Word files that you created.
  Don't email the LoggerPro files since no other computers will recognize these files!
  - Create a FREE email account:
    - Hotmail (**www.hotmail.com**)
    - Yahoo (**www.yahoo.com**)
    - Google (**www.google.com**).

- **H:/ drive**. When logged into the campus network, you will have access to your "H" drive.

## Finished? ...not quite

1. Don't leave lab today without knowing you have a secure, intact MS Excel file!!!
2. Be sure to SHUT DOWN the computer and put away all Logger pro accessories, the laptop charger and the laptop computer in their correct locations.
3. Leave your glassware upside down, on a paper towel on the benchtop. The next lab section will re-use your equipment.
4. Wash the benchtop with a wet SPONGE
5. Have your instructor sign your data sheet before you leave. You will not receive full credit without their signature.

C1151 Data Sheet
Computer Survival Skills
Instructor Initials_____

Name_____
Date of Exp. _____
Lab Section _____

*Your individual experimental report will be due at the beginning of class next week.*

Answer the following questions.

- Answers must be readable and make sense for credit.
- Copied answers will result in all involved students receiving a zero score

1. Region 1 of the graph will have a negative slope telling us that the temperature is dropping.
   a. *Where is hot water's heat energy going?*
   _____
   _____
   b. If left to cool for a long time, what will be the final temperature?
   _____
   _____

2. a. What are the slope values (include sign) for regions 1 & 3.
   _____
   b. Explain why these slopes are different.
   _____
   _____

3. How will the slope values of regions #1 and #3 change if the experiment is conducted in an insulated Styrofoam cup instead of a beaker? Why? (The word "heat" should appear in your answer)?
   _____
   _____
   _____

4. How would the temperature graphs you recorded be different if you mixed the liquid very slowly with the temperature probe?
   _____
   _____
   _____
   _____

5. In an experiment where a mass in cg (Y) is graphed vs. temperature in Kelvin (X) a straight line is observed. What are the units of the slope of a straight line on this graph?
   _____
   _____

Staple a printout of your Excel graph to report.

*(Hint: First click on the graph to select it and then print. This avoids printing out the data table)*

Your graph (Temperature ($^{o}$F) vs Time) should include:

- Adjusted axis limits. Make adjustments to the graph scales to fill the graph with your data.
- Correct and complete axis titles
- Correct and complete graph title (*Experimental name, your name and date of experiment)*
- Legible trendline equations for regions 1 and 3 in appropriate locations with the correct SF.