Name: _____ Date: _____ Partners: _____

Newton's Law of Cooling Questions

Data Table

Room Temperature (°C)	

A	
B	
k	

Analysis

1. Since the model for Newton's law of cooling use the difference between the sample temperature and room temperature, you must subtract the room temperature from the measured temperature before comparing data to the model. To do this:
   - Select QUIT from the MAIN MENU.
   - TI-89/92/92 Plus only: Press [F5] to return to the home screen.
   - Press "L2 [−] (room temperature) [STO▶] L2 " where (room temperature) is the numerical value you determined in Step 4 of the Procedure. This step replaces the measured water temperatures with the temperature above room temperature.
   - Restart the PHYSICS program and proceed to the MAIN MENU.

2. Fit the exponential function $y = A\, e^{-B*x}$ to your temperature difference *vs.* time data.
   - Select ANALYZE from the MAIN MENU.
   - Select CURVE FIT from the ANALYZE MENU.
   - Select EXPONENT L1, L2 from the CURVE FIT menu.
   - Record the fit parameters A and B in your Data Table.
   - Press [ENTER] to see a graph of your data with the fitted function.

3. Newton's law of cooling was given above as

   $$T_{diff} = T_0\, e^{-kt}$$

   Since you subtracted room temperature from the measured water temperatures, your graph shows the difference T_{diff} directly. The calculator fits the function $y = A\, e^{-B*x}$ to your data. The parameter *k* then corresponds to the value of B. Enter your value for *k* in the Data Table.

4. When $t = 0$, what is the value of e^{-kt}?

5. When *t* is very large, what is the value of temperature difference? What is the temperature of the water at this time?

6. What could you do to your experimental apparatus to decrease the value of *k* in another run? What quantity does *k* measure?

7. Use your equation to calculate the temperature after 800 seconds. Compare your calculated value with the actual data value.

8. Use your equation to predict the time it takes the water to reach a temperature 1°C above room temperature.

9. If the starting temperature difference is cut in half, does it take half as long to get to 1°C above room temperature?