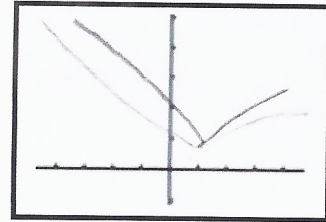


**Introduction:** A temperature probe is placed in a cup of hot water. It remains there for approximately 35 seconds, then it is removed from this cup and placed in a cup of cold water for another 35 seconds. The objective of this activity is to find an algebraic function that models the temperature recorded by the probe over the entire 70 seconds, then apply some calculus concepts to the function.

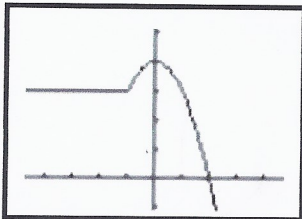
**An Algebra Review of Piecewise Functions:**

A piecewise function is a function that is defined differently over different values of the domain. Two examples are presented. In the first, a piecewise function is given, and you are to graph it. In the second, the graph of a piecewise function is shown, and you are to write its rule.

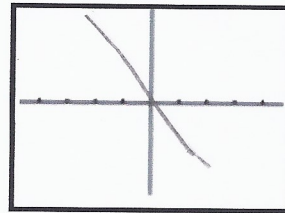
1. Given the function  $f(x) = \begin{cases} -x + 2 & \text{if } x \leq 1 \\ \sqrt{x} & \text{if } x > 1 \end{cases}$
- a. Evaluate:  $f(-1) = \underline{3}$ ,  $f(4) = \underline{2}$
- b. Sketch the graph of  $f$ .



2. Given a function  $f$  shown below. Write a rule for the piecewise function  $f$ , sketch the derivative  $f'$  and write a rule for the derivative  $f'$ .



$$f(x) = \begin{cases} 3 & \text{if } x \leq -1 \\ -x^2 + 4 & \text{if } x > -1 \end{cases}$$



$$f'(x) = \begin{cases} 0 & \text{if } x \leq -1 \\ -2x & \text{if } x > -1 \end{cases}$$

1. Complete the chart below from the data that was collected from the experiment. The data appears to have **horizontal asymptotes** at  $y = \underline{40}$  and  $y = \underline{150}$

Time	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
Temp	69.8	124.8	141	146.5	148.3	148.5	146.7	149.1	89.3	62.3	47.9	43.9	42	40.9	40.2

2. Create a scatterplot of the data on your calculator (**Time** in L1 and **Temperature** in L2). Sketch the scatterplot below.

