Homework Assignment 13: Due at the beginning of class 10/26/01

Figure 1: Ed Krachie (left) and Hirofumi Nakajima.

Every Fourth of July, the world championship of hot dog eating is held on Coney Island in New York City. Since July 6, 1996 (when 135 pound rank-outsider Hirofumi Nakajima beat the favored 381 Ed "The Animal" Krachie of Queens, New York - see Figure 1[1]) Japanese speed-eaters have had a dominated this event.

This year, onlookers accustomed to Japanese supremacy were again treated to an historic event when 131 pound Takeru Kobayashi (see Figure 2[2]) smashed the previous all-time world record[3] of 28.125 hot dogs by eating 50 hot dogs in 12 minutes[4]. The data for this accomplishment are given in the table below. Questions 1 and 2 use this data.

Figure 2: Takeru Kobayashi.

Time elapsed (minutes)	Number of hot dogs consumed by Takeru Kobayashi
0	0
3	16
4	21
8	33
11	44
12	50

1. Let t denote the number of minutes that have elapsed in the competition, and $N(t)$ denote the number of hot dogs that Takeru Kobayashi has eaten. Find a collection of linear functions that you could use to construct a formula for $N(t)$.

Note: You may find it helpful to draw a graph showing number of hot dogs eaten versus time.

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[1] Image source: International Federation of Competitive Eating, http://www.ifoce.org/

[2] Image source: New York Daily News, July 5, 2001. http://www.nydailynews.com

[3] Source: "Frankly, He's King of Coney." *New York Daily News*, July 5 2001. The previous record holder and former world hot dog eating champion was Kazutoyo "The Rabbit" Arai of Japan.

[4] This feat has been described by some semi-serious sport journalists as the greatest feat in the history of any athletic event. (See, for example, http://espn.go.com/gen/news/2001/0704/1222429.html) For comparison, Mr. Kobayashi's feat is comparable to: a professional baseball player hitting 140 home runs in a season OR a professional football player rushing for 550 yards in a single game OR a professional basketball player scoring 200 points in a single game.

2. Before Takeru Kobayashi shattered the world record on July 4, 2001, the previous world record was 28.125 hot dogs in 12 minutes. According to your equations for $N(t)$, how many minutes did Takeru Kobayashi need in order to break the world record?

In Questions 3, 4 and 5 the function that you are interested in will always be the function f defined below.

$$f(t) = \begin{cases} 2^t & ,0 < t < 1 \\ 3 - t & ,1 \le t < 2 \\ 3^t & ,2 \le t \le 3 \end{cases}$$

3. Sketch a graph of $y = f(x)$. Make sure that you label the end-points of each portion of your graph carefully.

4. Find the right and left hand limits of the function f as x approaches the values listed below.

- $x = 0$
- $x = 1$
- $x = 2$
- $x = 3$

5. Describe the set of x-values where the *limit* of the function f exists. For each point between $x = 0$ and $x = 3$ (inclusive) where the *limit* of f does not exist, briefly explain why the *limit* of f does not exist there.