Math Xa Lab
Modeling with Functions
October 5, 2004

Name _____
Section Instructor _____
Collaborators _____
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Radiocarbon Dating

Carbon 14 (C^{14}) is a radioactive isotope which is absorbed from the air by plants. Animals, including humans, absorb C^{14} by eating plants. Once a living organism dies, it stops absorbing C^{14} and the C^{14} already present in the organism begins to disintegrate. This disintegration is called *radioactive decay*; it is a process by which certain atoms will spontaneously transform by giving off protons, neutrons, or electrons. C^{14} decays into nitrogen (N^{14}). The rate of decay is usually expressed in terms of the *half-life*, or the length of time that it takes half of the material to decay. The half-life of C^{14} is 5730 years.

The amount, C, of C^{14} present in a sample of wood from an archeological site is a function of the amount of time, t, since the wood was cut.

1. What is the domain of $C(t)$?

2. Assume that $C(0) = 1000$. Describe in words what this means.

3. Is the function $C(t)$ ever zero? If so, when? If not, why not?

4. Where is the function $C(t)$ increasing or decreasing?

5. Draw a graph of the function $C(t)$, assuming $C(0) = 1000$. You should decide on the scale of your graph before you begin drawing. Your graph should have an asymptote, so be certain to include and identify the asymptote.

6. Where is $C(t)$ concave up? concave down?

Tides In Boston Harbor

Attached you will find a table listing observed heights of the tide in Boston Harbor on September 19, 2004, starting at around 10am and ending around 7:30pm. Please use the table to answer the following questions about the function $h(t)$ of height of tide, h, with respect to time, t.

1. Where is $h(t)$ increasing? Where is it decreasing?

2. Is $h(t)$ a continuous functions or does it have discontinuities? Be sure to explain your reasoning.

3. What is the increase in the height of the tide between 12:00 and and 16:00?

4. The *average rate of change* of height with respect to time is

$$\frac{\text{change in height between two times}}{\text{change in time}}$$

(you may want to read p. 74 in the textbook if you haven't already done so).

What is average rate of change in the height of the tide between 12:00 and 16:00?

5. What is the average rate of change in the height between 12:00 and 12:36?

6. What is the average rate of change in the height between 12:00 and 12:06?