Homework Assignment 17: Due at the beginning of class 11/5/01

The length of the day (i.e. the number of hours of daylight during a 24 hour period) varies throughout the year. During the summer, the days are long and there are many hours of daylight during each 24 hour period. During the winter, the days are short and there are fewer hours of daylight in each 24 hour period. Let the number of hours of daylight in Cambridge, Massachusetts on day 't' be represented by the function $h(t)$. (January 1 corresponds to $t = 1$ and December 31 corresponds to $t = 365$. Questions 1 to 5 refer to this situation.

Some dates (valid for 2001) that might be of use when answering Questions 1-5 are given in Table 1 (below).

Date	Name	Event
March 20, 2001	Northern hemisphere Spring Equinox	Day and night equal length
June 21, 2001	Northern hemisphere Summer Solstice	Most hours of daylight ("longest day")
September 22, 2001	Northern hemisphere Vernal Equinox	Day and night equal length
December 21, 2001	Northern hemisphere Winter Solstice	Fewest hours of daylight ("shortest day")

Table 1

1. Explain the meaning of the statements: $h(3) = 9.2$
                                                                    $h'(62) = 0.2$

    in practical terms that would be comprehensible to a reasonably intelligent person who had no knowledge of calculus.

2. Figure 1 (below) shows a plot of day length versus day of the year for Boston, MA. The data given in Figure 1 were collected between 12/31/97 and 12/26/98[1].
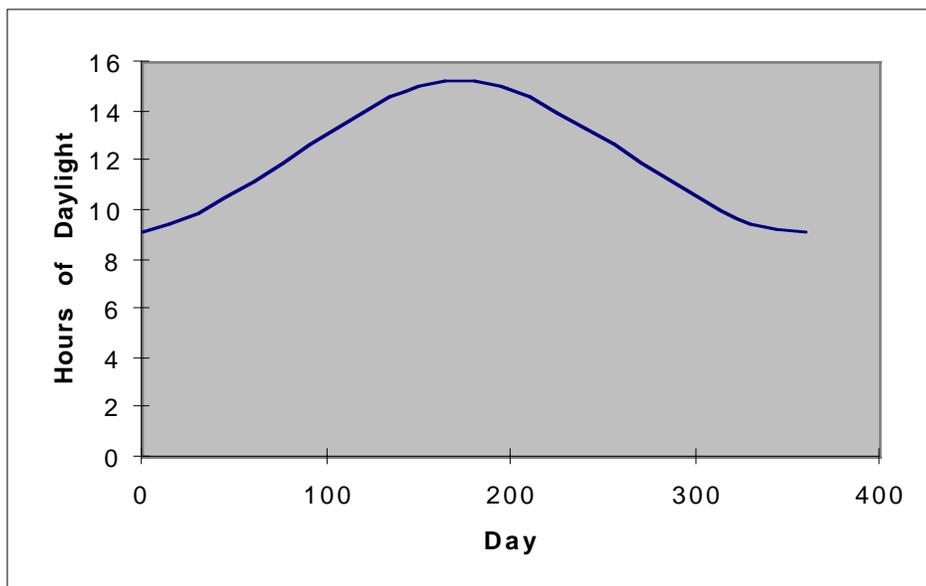

Figure 1: Hours of daylight for Boston, MA.

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[1] Source: The Texas Education Network, Texas Essential Knowledge and Skills, Mathematics Module: Oscillations.

Use Figure 1 to graphically represent the two pieces of information given in Question 1. (Possibilities include: heights on the graph at certain points, slopes of tangent lines at certain points, slopes of secant lines at certain points, etc.)

3. What can you say about the value of $h'(t)$ when t is in the month of May? (You should comment on whether $h'(t)$ is positive or negative, and whether $h'(t)$ is increasing or decreasing.) Explain your reasoning.

4. What can you say about the value of $h'(t)$ when t is in the month of September? (You should comment on whether $h'(t)$ is positive or negative, and whether $h'(t)$ is increasing or decreasing.) Explain your reasoning.

5. If $h(t)$ applied to Cambridge, New Zealand (See Figures 2^2 and 3^3), instead of Cambridge, Massachusetts how would your answers to Problems 3 and 4 be different? Explain your reasoning.
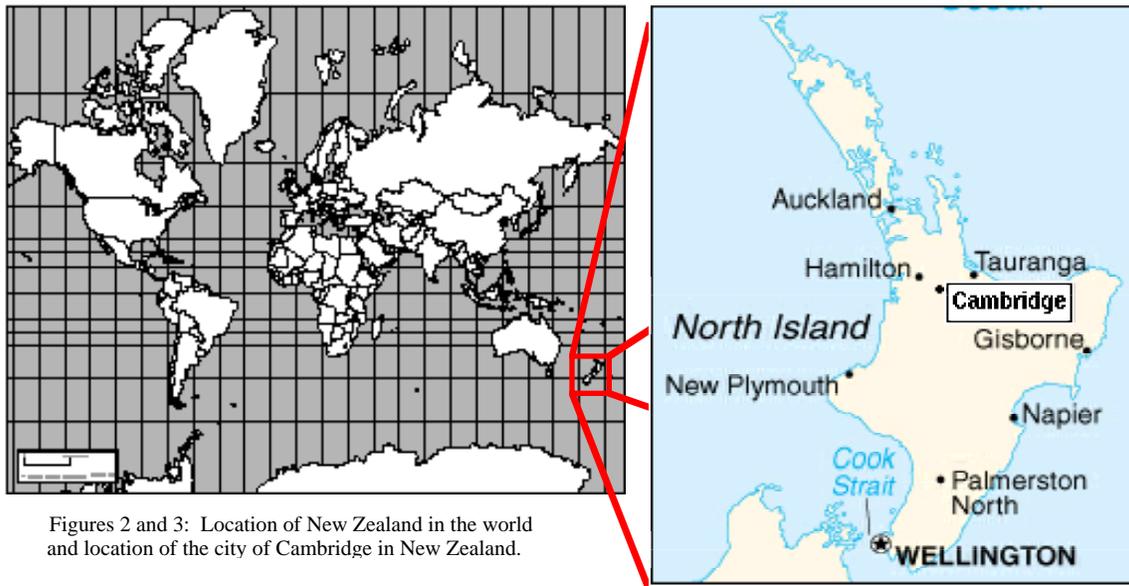
Figures 2 and 3: Location of New Zealand in the world and location of the city of Cambridge in New Zealand.