Homework Assignment 17: Solutions

1. The practical interpretations of the symbolic statements are given below.

$h(3) = 9.2$ means that on January 3, Cambridge, MA will experience 9.2 hours of daylight.

$h'(62) = 0.2$ means that the on 63rd day of the year, Cambridge MA will have approximately 0.2 hours (i.e. 12 minutes) more daylight than on 62nd day of the year. For example, if there were 10 hours of daylight in Cambridge MA on the 62nd day of the year, then Cambridge MA would have approximately 10.2 hours of daylight on the 63rd day of the year.

2. The graphical representations of the symbols are shown in Figure 1 (below). In words, $h(3) = 9.2$ means that when the independent variable is equal to 3, the dependent variable is equal to 9.2. Furthermore, $h'(62) = 0.2$ means that the slope of the tangent line is 0.2 (when the tangent line is drawn at the point the dependent variable is equal to 62).

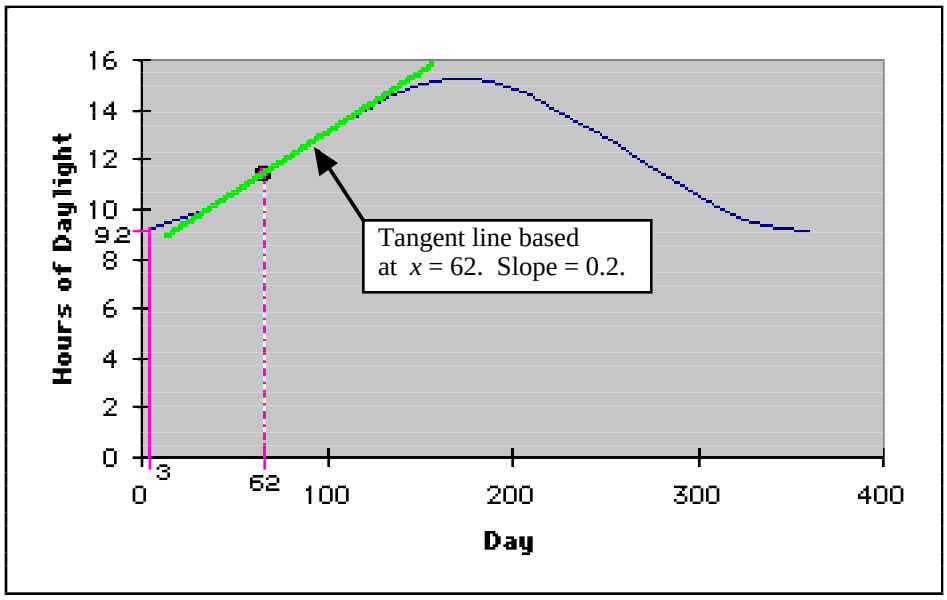

Figure 1.

3. Between the Spring Equinox and the Summer Solstice, I would expect $h(t)$ to be an increasing, concave down function. Throughout this period, the derivative $h'(t)$ will be positive as $h(t)$ is increasing. Furthermore, the derivative $h'(t)$ will itself be decreasing as the function $h(t)$ is concave down. As May lies between the Spring Equinox (March) and the Summer Solstice (June), then throughout May $h'(t)$ should be positive and decreasing.

4. Between the Summer Solstice and the Vernal Equinox, I would expect the function $h(t)$ to be a decreasing, concave down function. Between the Vernal Equinox and the Winter Solstice, I would expect $h(t)$ to be a decreasing, concave up function. Thus, during the entire month of September, the derivative $h'(t)$ will be negative to reflect the fact that $h(t)$ is decreasing. The concavity is a little more complicated, as the Vernal Equinox occurs on September 22. So, between September 1 and September 22, the derivative $h'(t)$ will be decreasing as $h(t)$ is concave down during this time period. However, from September 22 to September 30 the derivative $h'(t)$ will be increasing as $h(t)$ is increasing during this period.

5. New Zealand is in the Southern hemisphere, and so the seasons occur at the opposite times, compared with the Northern hemisphere. For example, when it is summer in the Northern hemisphere, it is winter in the Southern hemisphere, etc. This means that if $h(t)$ referred to Cambridge, New Zealand rather than Cambridge, MA, then the behavior of the derivative $h'(t)$ would be the opposite of that described in answers 8 and 9. For example, during May, $h'(t)$ would be negative and increasing.