Miniproject 5: Hours of Daylight

Overview: This miniproject will apply what you've learned about derivatives so far, especially the Chain Rule, to analyze the change the hours of daylight.

Prerequisites: The computational methods of Sections 2.1–2.5 of *Active Calculus*, especially Section 2.5 (The Chain Rule).

The number of hours of daylight in Las Vegas on the x-th day of the year ($x = 1$ for Jan 1) is given by the function

$$D(x) = 12.1 - 2.4 \cos\left(\frac{2\pi\,(x+10)}{365}\right).$$[1]

1. Plot a graph of the function $D(x)$. Be sure to follow the guidelines for formatting graphs from the specifications page for miniprojects.
2. According to this model how many hours of daylight will there be on July 19 (day 200)?
3. Go to http://www.timeanddate.com/sun/usa/las-vegas? and look up the actual number of hours of daylight for July 19 of this year. By how many minutes is the model's prediction off of the actual number of minutes of daylight?
4. Compute $D'(x)$. Show all work.
5. Find the rate at which the number of hours of daylight are changing on July 19. Give your answer in minutes/day and interpret the results.
6. Note that near the center of the year the day will reach its maximum length when the slope of $D(x)$ is zero. Find the day of the year that will be longest by setting $D'(x) = 0$ and solving.
7. Write an explanation of how you could find the day of the year when the number of hours of daylight is increasing most rapidly.

Submission instructions: The writeup that you prepare is to be saved as a PDF file and submitted using Canvas. (You may use any program you want to write the writeup but the submission *must* be a PDF, or your work will be marked at Novice level and returned without comment. You may important screenshots to show the Desmos output for any steps. Just remember to be neat with your work.)

[1] The model comes from some data at http://www.timeanddate.com/sun/usa/las-vegas? together with a best fit curve from Desmos.