

5. [12 points] Preparing a pot of soup for dinner, Billy heats the soup to boiling and then removes it from the stove. The function  $H(t)$  gives the temperature of the soup in  $^{\circ}\text{F}$  as a function of the number of minutes since it was removed from the stove. Assume that  $H(0) = 212$  and  $H'(0) = -2.7$ , and that Billy's kitchen is carefully air-conditioned to remain at a comfortable  $68^{\circ}\text{F}$  at all times. Throughout this problem, be sure to **include units** in your answers, where applicable.
- a. [3 points] Approximate  $H(1.5)$ .
- b. [3 points] Five minutes after removing the soup from the stove, Billy remarks to himself: "In the next 30 seconds, I expect the soup to cool by about  $0.875^{\circ}\text{F}$ ." Since he is both an excellent chef and a student of Math 115, his statement is consistent with the actual value of the derivative of the function  $H$ . Based on this information, find  $H'(5)$ , and justify your answer.
- c. [3 points] Assume that the concavity of  $H(t)$  is the same on its entire domain. Based on your answer to part (b) and the given information, do you expect that the function  $H(t)$  is concave up or concave down? Briefly explain your answer.
- d. [3 points] Called off on important business, Billy leaves the pot of soup uneaten. Approximate  $H'(300)$ . (You may use the practical interpretation of  $H(t)$ , but be sure to explain your answer.)