**Practice Question 2: Modeling a Non-periodic Context**

2. The temperature of Shania’s butternut squash soup when it is first removed from the stove is 185˚ Fahrenheit. Ten minutes later , Shania uses a thermometer to determine that the temperature of the soup has cooled to 130˚ Fahrenheit.

The temperature of Shania’s bowl of soup can be modeled by the function given by

, where is the temperature of the soup, in degrees Fahrenheit (˚F), and is the number of minutes since the soup was removed from the stove.

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| (A) | (i) | Use the given data to write two equations that can be used to find the values for constants and in the expression for . |
| (ii) | Find the values of and as decimal approximations. |
| (B) | (i) | Use the given data to find the average rate of change of the temperature of the soup, in degrees Fahrenheit per minute, from to . Express your answer as a decimal approximation. Show the computations that lead to your answer. |
| (ii) | Use the average rate of change found in (i) to estimate the temperature of the soup when . Show the work that leads to your answer. |
|  | (iii) | The average rate of change calculated in part (i) can be used to estimate the temperature of the soup at time for values of between and . Will the values estimated using the average rate of change be strictly greater than, strictly less than, or sometimes greater and sometimes less than the values predicted by the model, , for ? Explain why this is the case. |
| (C) | According to the model, the temperature of the soup will always exceed a certain temperature, , which corresponds to the temperature of the room in which the soup is cooling. In other words, for all . However, Shania finishes her soup by the time the soup’s temperature has cooled to 10˚ Fahrenheit above the room temperature, . Explain how this information could be used to determine an appropriate domain for based on the context. | |