Week 7 Class Problems

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1. Find a function f and a number a such that

$$lim_{h\to 0}\frac{(2+h)^6-64}{h} = f^{'}(a) \tag{1}$$

2. Suppose that the number of calories of heat required to raise 1 gram of water (or ice) from -40°C to x°C is given by

$$f(x) = \begin{cases} \frac{1}{2}x + 20 & \text{if } -40 \leq x < 0 \\ x + 100 & \text{if } 0 \leq x \end{cases} \tag{2}$$

Is the function continuous $\forall x \in [-40, \infty)$? What happens to water at 0°C that account for the behavior of the function at 0 °C?

3. Find the asymptotes of the graph of $f(x) = \frac{4-x}{3+x}$ and use them to sketch the graph and the graph of $f^{'}$. Find $f^{'}$ and graph it in R.

4. A bacteria culture contains 200 cells initially and grows at a rate proportional to its size. After half an hour the population has increased to 360 cells.

- Find the number of bacteria after t hours.
- Find the number of bacteria after 4 hours.
- Find the rate of growth after 4 hours
- When will the population reach 10,000?