E2-243
Programming Exercise - 5

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Instructions:

- Do not submit your code, output files, etc.
- There will one lab exam towards the end of the semester that will test your understanding of the concepts taught in class. The questions in the lab exam will be somewhat similar to these questions in both content and implementation complexity. If you do not program these exercises, handling the lab exam will not be easy! In a way, programming these assignments yourself will be your preparation for the lab exam.
- You may use any discrete plot like the 'stem' function in MATLAB.
- Whenever $x \in$ interval, you may have to take appropriate discrete points in the interval to realize the functions in matlab. Please use appropriate commands for continuous plots when x is continuous.

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1. Given an infinitely differentiable function $f : \mathbb{R} \to \mathbb{R}$, it's n^{th} order Taylor's series centered at $a \in \mathbb{R}$ is

$$T_a^{(n)}(x) = f(a) + \sum_{k=1}^{n} \frac{f^k(a)}{k!}(x-a)^k$$

   Write a program that takes as input a function f, numbers $a \in \mathbb{R}$, $n \in \mathbb{Z}_+$ and $\epsilon > 0$ and

   (a) plots $T_a^{(n)}(x)$ and $f(x)$, $x \in [a-1, a+1]$, on the same graph.

   (b) computes n_ϵ such that $\left|T_a^{(n_\epsilon)}(x) - f(x)\right| < \epsilon \quad \forall x \in [a-1, a+1]$ and plots $T_a^{(n_\epsilon)}(x)$ and $f(x)$, $x \in [a-1, a+1]$ on the same graph.