Math 152 Lab 8

Use MATLAB to solve each problem.

Some of the commands you may need on this assignment are: syms, simplify, limit, subs, symsum, sum, fplot, axis

1. Given the power series $\sum_{n=0}^{\infty} \frac{(-1)^n 5^{n+1} x^{n+1}}{n+1}$:

   (a) Simplify $\left|\frac{a_{n+1}}{a_n}\right|$ and find the limit.

   (b) State the radius of convergence and the endpoints. Substitute to show whether each endpoint is in the interval of convergence or not.

   (c) It can be shown that the series converges to $f(x) = \ln(1+5x)$ on its interval of convergence. To illustrate this, find s_5, s_{10}, and s_{15}. Plot these three polynomials and f on the same set of axes in the window $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$, $y \in [-7, 7]$.

2. Given the power series $\sum_{n=0}^{\infty} \frac{x^{8n+2}}{8n+2}$:

   (a) Simplify $\left|\frac{a_{n+1}}{a_n}\right|$ and find the limit.

   (b) State the radius of convergence and the endpoints. Substitute to show whether each endpoint is in the interval of convergence or not.

   (c) It can be shown that the series converges to $f(x) = \int_0^x \frac{t}{1-t^8}\, dt$ on its interval of convergence. To illustrate this, find s_1, s_3, and s_5. Plot these three polynomials and f on the same set of axes in the window $x \in [-1.5, 1.5]$, $y \in [0, 2]$.

3. Given the power series $\sum_{n=0}^{\infty} \frac{(-1)^n (n+1) 2^n (x-2)^n}{9^{n+2}}$:

   (a) Simplify $\left|\frac{a_{n+1}}{a_n}\right|$ and find the limit.

   (b) State the radius of convergence and the endpoints. Substitute to show whether each endpoint is in the interval of convergence or not.

   (c) It can be shown that the series converges to $f(x) = \frac{1}{(5+2x)^2}$ on its interval of convergence. To illustrate this, find s_5, s_{10}, and s_{15}. Plot these three polynomials and f on the same set of axes in the window $x \in [-4, 9]$, $y \in [-4, 4]$.

4. Given the power series $\sum_{n=0}^{\infty} \frac{(-1)^n (x-4)^n}{3^{n+1}}$:

(a) Simplify $\left|\frac{a_{n+1}}{a_n}\right|$ and find the limit.

(b) State the radius of convergence and the endpoints. Substitute to show whether each endpoint is in the interval of convergence or not.

(c) It can be shown that the series converges to $f(x) = \dfrac{1}{x^2 - 8x + 19}$ on its interval of convergence. To illustrate this, find s_5, s_{10}, and s_{15}. Plot these three polynomials and f on the same set of axes in the window $x \in [0,\, 8]\,,\ y \in [-4,\, 4]$.