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Mathematical Methods II

Homework 7

1. Problems 31, 32, and 33; page 249.
2. Problems 36 and 38; pages 250 and 251.
3. Problems 49 and 50 : (b) and (d); 52; page 254.
4. Problems 53, 57:(b) and (d); 58:(c); page 255.
5. **The Gibbs Phenomenon in Fourier Series:**

   Consider the function

$$f(x) = \begin{cases} +1 & 0 \le x \le \pi \\ -1 & -\pi \le x \le 0 \end{cases} \tag{1}$$

   (a) Show that its Fourier series is given by

$$F(x) = \frac{4}{\pi} \sum_{n=1}^{n=\infty} \frac{sin[(2n-1)x]}{(2n-1)}. \tag{2}$$

   What is the value of $F(x)$ at $x = 0, \pm\pi$?

   (b) We define the truncated series

$$F_N(x) = \frac{4}{\pi} \sum_{n=1}^{n=N} \frac{sin[(2n-1)x]}{(2n-1)}. \tag{3}$$

   Plot $F_N(x)$ over the interval $(-2\pi, 2\pi)$ for $N = 1, 3, 5, 10, 26$. The overshoot (undershoot) of $F_N(x)$ at $x = 0, \pm\pi, \pm 2\pi, \cdots$ is known as the Gibbs phenomenon.