Supplementary problems: 12.3 # 1, 3, 5, 7, 8, 11, 12, 18, 24, 25, 26, 27, 32, 39-42
Quiz: 12.1 - 12.3

Compulsory problems:

(1) Consider the Dirac delta “function” (which actually is not a function) at \( x = a \):

\[
\delta(x - a) = \begin{cases} 
\infty & x = a \\
0 & x \neq a
\end{cases}
\]

(1)

The delta function has two important properties: \( \int_{-L}^{L} \delta(x - a) = 1 \) for \( a \in [-L, L] \) and \( \int_{-L}^{L} \delta(x - a)f(x)dx = f(a) \).

(a) [10 pts.] Find the Fourier Series of \( \delta(x - \pi/4) \) on \([-\pi, \pi]\).

(b) [8 pts.] Use any programming language (MATLAB, Python, C++, etc)/computer algebra software (Mathematica, Maple, etc) of your choice to plot this Fourier Series for \( n = 1, 2, 5, 10, 20 \) (plot each curve on top of each other on the same figure so you can compare). [Hint: just write a for loop from 1 to 20 and an if statement to output plots at those specific values of \( n \)]. Please attach your code on the same page or right after the plot.

(2) Consider the function

\[
f(x) = \cos x \quad 0 < x < \pi
\]

(2)

(a) Fourier Sine Series:

(i) [4 pts.] Sketch the odd periodic extensions of the function on \([-2\pi, 2\pi]\)

(ii) [2 pts.] Sketch the solution on \([-2\pi, 2\pi]\) (yes before solving for the F.S.)

(iii) [10 pts.] Find the Fourier Sine Series of the odd periodic extension of the function.

(b) Fourier Cosine Series:

(i) [4 pts.] Sketch the even periodic extensions of the function on \([-2\pi, 2\pi]\)

(ii) [2 pts.] Sketch the solution on \([-2\pi, 2\pi]\) (yes before solving for the F.S.)

(iii) [10 pts.] Find the Fourier Cosine Series of the even periodic extension of the function.

Your homework raw score is: \( \frac{n}{2m} \cdot M + \left(1 - \frac{n}{2m}\right) \cdot N = N + \frac{n}{2m} (M - N) \). For this homework, \( M = 50, m = 17 \), \( N \) is the number of compulsory problems you get correct, and \( n \) is the number of supplementary problems you complete. It should be noted that for the supplementary problems I will be looking for full completion, but I won’t take off points for mistakes.