

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 $x = a$:

$$\delta(x - a) = \begin{cases} \infty & x = a \\ 0 & x \neq a \end{cases} \quad (1)$$

The delta function has two important properties: $\int_{-L}^L \delta(x - a) dx = 1$ 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

$$f(x) = \cos x \text{ on } 0 < x < \pi \quad (2)$$

(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.