

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.