

Homework #4: Phys 3344: Prof. Olness Fall 2018

Due 18 September 2018

Hint: Use the sample mathematica file posted on the web page:

1) By trial and error, find the coefficients $\{c_0, c_1, c_2, c_3\}$ of the following series,

$$f(x) = c_0 + c_1 \sin(2\pi \cdot 1 \cdot x) + c_2 \sin(2\pi \cdot 2 \cdot x) + c_3 \sin(2\pi \cdot 3 \cdot x)$$

to fit the function

$$f(x)=x$$

on the interval $x=[0,1]$.

Plot your results with the exact function.

2) By trial and error, find the coefficients $\{c_0, c_1, c_2, c_3\}$ of the following series,

$$f(x) = c_0 + c_1 \sin(2\pi \cdot 1 \cdot x) + c_2 \sin(2\pi \cdot 2 \cdot x) + c_3 \sin(2\pi \cdot 3 \cdot x)$$

to fit the function

$$f(x)=0 \text{ for } x=[0,1/2] \text{ and } f(x)=1 \text{ for } x=[1/2,1]$$

on the interval $x=[0,1]$.

Plot your results with the exact function.

3) By trial and error, find the coefficients $\{c_0, c_1, c_2, c_3\}$ of the following series,

$$f(x) = c_0 + c_1 \sin(2\pi \cdot 1 \cdot x) + c_2 \sin(2\pi \cdot 2 \cdot x) + c_3 \sin(2\pi \cdot 3 \cdot x)$$

to fit the function

$$f(x)=1 - |x|$$

on the interval $x=[-1,1]$. ($|x|$ is the Abs(x).)

Plot your results with the exact function.

Comment on your answer.

4) Consider an RLC circuit with $R=10$ ohms, $C=20\mu\text{F}$, $L=200\text{mH}$, and $V=200$ volts. Useful info:

$$X_R = R, \quad X_C = 1/(\omega C), \quad X_L = \omega L \quad Z = \sqrt{X_R^2 + (X_L - X_C)^2}$$

a) Find the maximum value of the current.

b) Also, find the values of ω where the current is $1/2$ the maximum value.

(You may do this approximately, but I want a number.)

c) If I increase R to 20 ohms, compute the new max current and sketch how the curve will change vs. ω .