Problem 1

Function

$y(t) = \cos(t) = \_\_\exp(\_\_t) + \_\_\exp(\_\_t)$

Fourier Series $y(t) = \sum_{n=\_\_}^{\_\_} y_n e^{\frac{\_\_it}{\_\_}}$ where y_n =

Function

$y(t) = 2\sin(3t) = \_\_\exp(\_\_t) + \_\_\exp(\_\_t)$

Fourier Series $y(t) = \sum_{n=\_\_}^{\_\_} y_n e^{\frac{\_\_it}{\_\_}}$ where y_n =

Function

$y(t) = A\cos(\omega_A t) + B\sin(\omega_B t) = \_\_\exp(\_\_t) + \_\_\exp(\_\_t) + \_\_\exp(\_\_t) + \_\_\exp(\_\_t)$

(Let $\omega_A = \omega_B = 1.5$ for the plot)

Fourier Series $y(t) = \sum_{n=\_\_}^{\_\_} y_n e^{\frac{\_\_it}{\_\_}}$ where y_n =

Function

$y(t) = \_\_ + \_\_\_\_\_ = \_\_\exp(\_\_t) + \_\_\exp(\_\_t)$

Fourier Series $y(t) = \sum_{n=\_\_}^{\_\_} y_n e^{\frac{\_\_it}{\_\_}}$ where y_n =

Function

$y(t) =$ _____ you may describe this function in words or piecewise functions

Fourier Series $y(t) = \sum_{odd} y_n e^{2\pi nit}$ where $y_n = \frac{2}{\pi in}$ and n is strictly odd

Problem 2

A periodic signal has one/many/infinite period length(s). (Circle one)
Locate the harmonic frequencies of a signal with base period 1, pi, and 4*pi
on 3 different x-axes

As you increase the period length the harmonic frequencies get closer/further
Increasing the period increases/decreases your resolution on the frequency axis.
If you were given some data with an ambiguous period and you wanted to extract the frequency content, what would you do?

Problem 3

Consider an underdamped system with forcing frequency $F(t) = \sum_{n=-\infty}^{\infty} f_n e^{\frac{2\pi nit}{T}}$, T = 1.

$m\ddot{y} + b\dot{y} + ky = F(t)$
Solve for yh (you may replace m, b, and k by their mathematical counterparts)

yh =

In previous homeworks, you solved for yp by _____
Apply this method to this situation (Hint: break up the sum and see if you can guess what form the particular solution should take)

yp =

Evaluate the derivatives of yp and plug them into the equation.

Solve for the Fourier coefficients of yp by using orthogonality (Recall $\frac{1}{T}\int_0^T e^{\frac{2\pi nit}{T}} e^{\frac{-2\pi nit}{T}} dt = 0$ for all $m \neq n$ and 1 for $m = n$).

Now assume $f_n = 2$ for n = 4 and n = -4. Give as simple of an expression for yp as possible