Problem 1

Function
\[ y(t) = \cos(t) = \text{__} \exp(\text{__} t) + \text{__} \exp(\text{__} t) \]

Fourier Series
\[ y(t) = \sum_{n=\text{__}} y_n e^{\text{__} t} \text{ where } y_n = \]

Function
\[ y(t) = 2 \sin(3t) = \text{__} \exp(\text{__} t) + \text{__} \exp(\text{__} t) \]

Fourier Series
\[ y(t) = \sum_{n=\text{__}} y_n e^{\text{__} t} \text{ where } y_n = \]

Function
\[ y(t) = \text{__} + \text{__} = \text{__} \exp(\text{__} t) + \text{__} \exp(\text{__} t) \]

Fourier Series
\[ y(t) = \sum_{n=\text{__}} y_n e^{\text{__} t} \text{ where } y_n = \]

Function
\[ y(t) = \text{__} \text{ you may describe this function in words or piecewise functions} \]

Fourier Series
\[ y(t) = \sum_{n=\text{__}} y_n e^{2\pi n t} \text{ where } y_n = \frac{2}{\pi n} \text{ and } n \text{ is strictly odd} \]
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 $F(t) = \sum_{n=-\infty}^{\infty} f_n e^{\frac{2n\pi i}{T}}$, $T = 1$.

$m\ddot{y} + b\dot{y} + ky = F(t)$

Solve for $y_h$ (you may replace m, b, and k by their mathematical counterparts)

$y_h = \ldots$

In previous homeworks, you solved for $y_p$ by \ldots$

Apply this method to this situation (Hint: break up the sum and see if you can guess what form the particular solution should take)

$y_p = \ldots$

Evaluate the derivatives of $y_p$ and plug them into the equation.

Solve for the Fourier coefficients of $y_p$ by using orthogonality (Recall $\frac{1}{T} \int_{0}^{T} e^{\frac{2n\pi i}{T}} e^{-\frac{2m\pi i}{T}} dt = 0$ 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 $y_p$ as possible