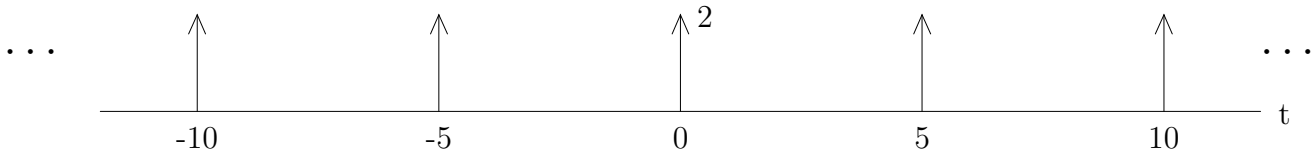
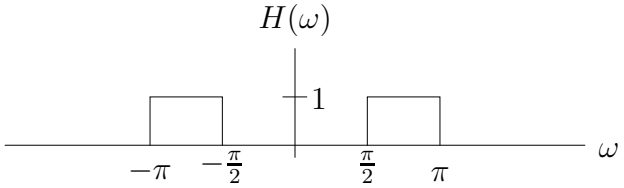
Problem 1 (15 points)

Consider the periodic signal $x(t)$ shown below:



(a) Determine the Fourier series representation of the signal $x(t)$.

(b) The signal $x(t)$ is the input to an LTI system with the real frequency response $H(\omega)$ shown below:



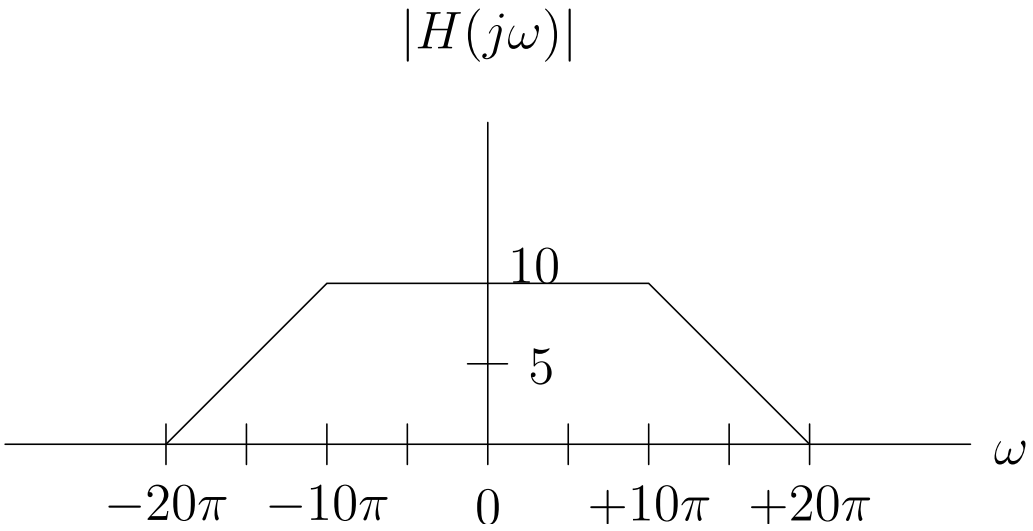
Determine the output $y(t)$ of the system.

Suppose that the input to an LTI system is $x(t)$ given below. The corresponding output is $y(t)$, also given below.

$$x(t) = 3\cos\left(5\pi t + \frac{\pi}{2}\right) + 5\cos(15\pi t).$$

$$y(t) = 30\cos\left(5\pi t\right) + 25\cos\left(15\pi t - \frac{3\pi}{2}\right)$$

Could the system have the frequency response given below? Why or why not?



$$\angle H(j\omega) = -\tfrac{\omega}{10}$$