

2024 October 2

$$x(t) = \sum_{k=-4}^4 X_k e^{j2\pi k 400 t} \Rightarrow x[n] = \sum_{k=-4}^4 X_k e^{jk\omega_0 n}$$
$$y(t) = \sum_{k=-4}^4 Y_k e^{j2\pi k 400 t} \Leftrightarrow y[n] = \sum_{k=-4}^4 Y_k e^{jk\omega_0 n}$$

$$y[n] = 7x[n-16] + 7x[n-28]$$

$$\omega_0 = \frac{2\pi 400}{F_s} = \frac{2\pi 400}{3600}$$

What is Y_k ? $Y_k = H(k\omega_0) X_k$

$$y[n] = \sum_m h[m] x[n-m]$$
$$h[m] = \begin{cases} 7 & m=16 \\ 7 & m=28 \\ 0 & \text{else} \end{cases}$$
$$= 7\delta[n-16] + 7\delta[n-28]$$

$$H(\omega) = \sum_m h[m] e^{-j\omega m} = 7e^{-j\omega 16} + 7e^{-j\omega 28}$$
$$= 7e^{-j\omega 22} \left(e^{j\omega 6} + e^{-j\omega 6} \right)$$
$$= 11$$