2024 October 14

$$y[n] = \underline{18x[n+5] + 18x[n-11]} = \underline{\sum_m h[m]x[n-m]}$$

$$h[m] = \left\{\begin{array}{ll} 18 & m=-5 \\ 18 & m=11 \\ 0 & \text{else} \end{array}\right\} = \underline{18\delta[m+5]} + \underline{18\delta[m-11]}$$

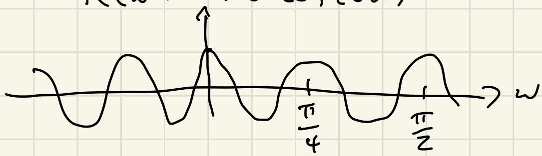
$$H(\omega) = \sum_m h[m]e^{-j\omega m} = |H(\omega)|e^{j\measuredangle H(\omega)} = R(\omega)e^{j\phi(\omega)}$$

$$= 18e^{j\omega 5} + 18e^{-j\omega 11}$$

$$= 36 \cdot \frac{1}{2}\left(e^{j\omega 8} + e^{-j\omega 8}\right) e^{-3j\omega}$$

$$= 36\cos(8\omega)\, e^{-3j\omega} = R(\omega)e^{+j\phi(\omega)}$$

$R(\omega) = 36\cos(8\omega)$ $\qquad$ $\phi(\omega) = -3\omega$



$$R(\omega)e^{j\phi(\omega)} = |H(\omega)|e^{j\angle H(\omega)}$$

$$\measuredangle H(\omega) = \begin{cases} -3\omega & \cos(8\omega) > 0 \\ -3\omega \pm \pi & \cos(8\omega) < 0 \end{cases}$$

$$\measuredangle H(\omega) = \begin{cases} -3\omega \bmod 2\pi & \cos(8\omega) > 0 \\ (-3\omega + \pi) \bmod 2\pi & \cos(8\omega) < 0 \end{cases}$$

x "mod 2π" $\equiv$ $x + k2\pi$ FOR k s.t.

$-\pi \leq x \bmod 2\pi < \pi$ $\boxed{\text{QED}}$