Example 6-1: Consider an LTI system for which the difference equation coefficients are $\{b_k\} = \{1, 2, 1\}$. Substituting into (**??**) gives

$$H(e^{j\hat{\omega}}) = 1 + 2e^{-j\hat{\omega}} + e^{-j\hat{\omega}2}$$

To obtain formulas for the magnitude and phase of the frequency response of this FIR filter, we can manipulate the equation as follows:

$$
\begin{aligned}
H(e^{j\hat{\omega}}) &= 1 + 2e^{-j\hat{\omega}} + e^{-j\hat{\omega}2} \\
&= e^{-j\hat{\omega}} \left(e^{j\hat{\omega}} + 2 + e^{-j\hat{\omega}} \right) \\
&= e^{-j\hat{\omega}} \left(2 + 2\cos\hat{\omega} \right)
\end{aligned}
$$

Since $(2 + 2\cos\hat{\omega}) \geq 0$ for frequencies $-\pi < \hat{\omega} \leq \pi$, the magnitude is $|H(e^{j\hat{\omega}})| = (2 + 2\cos\hat{\omega})$ and the phase is $\angle H(e^{j\hat{\omega}}) = -\hat{\omega}$.