Application to Linear Systems

\[ x(t) \xrightarrow{\text{Linear, time-invariant system}} y(t) \]

- Impulse response \( h(t) \)
- Frequency response \( H(w) \)

\[ \text{Input } \delta(t), \text{ output } h(t). \]

What is spectrum of output?

\[ \delta(t) \leftrightarrow 1 \]

Convolution property of Fourier transform:

\[ y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\lambda) h(t-\lambda) \, d\lambda \]

\[ Y(w) = X(w) \cdot H(w) \]

\( H(w) \) is the frequency response:

Tells amplitude gain and phase shift at each frequency \( w \).