Any image can be expressed as a linear combination of a bunch of sine gratings of different **frequency** and **orientation**

- Amplitude
- Phase
Fourier Transform in 1D

- example: \( g(t) = \sin(2\pi f t) + \frac{1}{3}\sin(2\pi (3f) t) \)
Fourier Transform in 1D
Representation in Both Domains

Time Domain

Frequency Domain

b. Analog frequency = 0.09 of sampling rate
Fourier Transform in 1D

Time Domain
\( s(t) \)

\[
\text{FT} \quad S(\omega)
\]

Frequency Domain
Representation in Both Domains

Time Domain

Frequency Domain
• Images representing sine waves
  – Frequency
  – Orientation
  – Amplitude
  – Phase
Extending it to 2D
• Amplitude
  – **How** much details?
  – Sharper details signify higher frequencies
  – Will deal with this mostly
- **Where** are the details?
- Though we do not use it much, it is important, especially for perception.