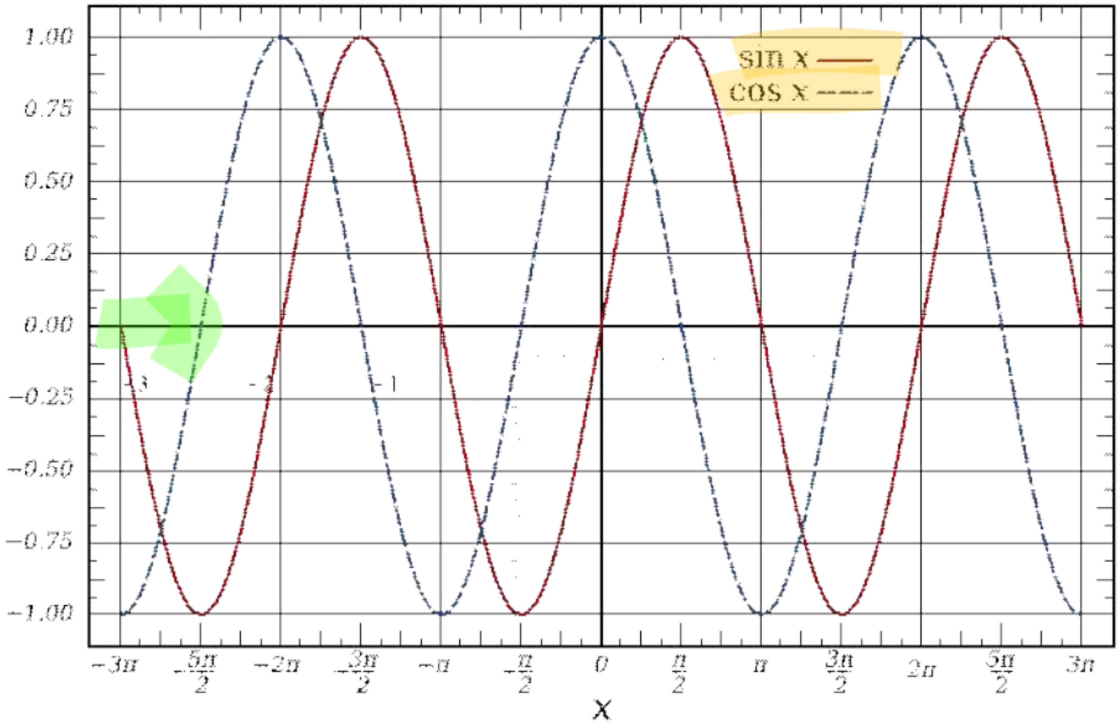
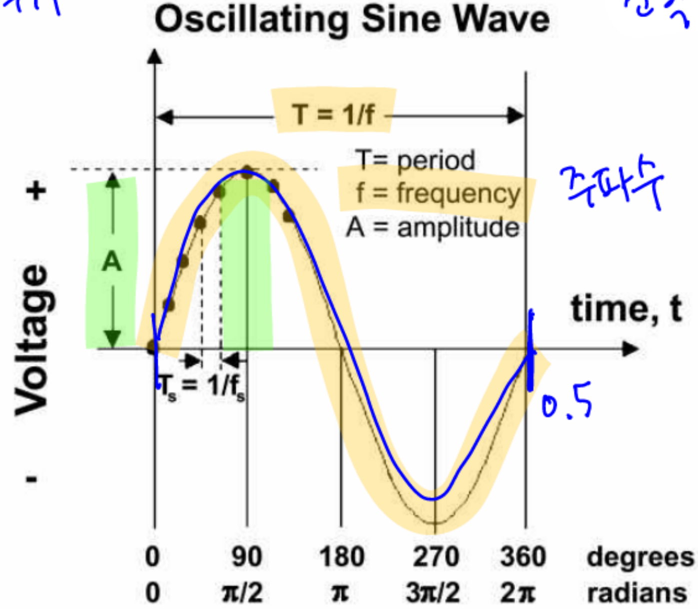
Fourier Transform

Sinusoid Curve



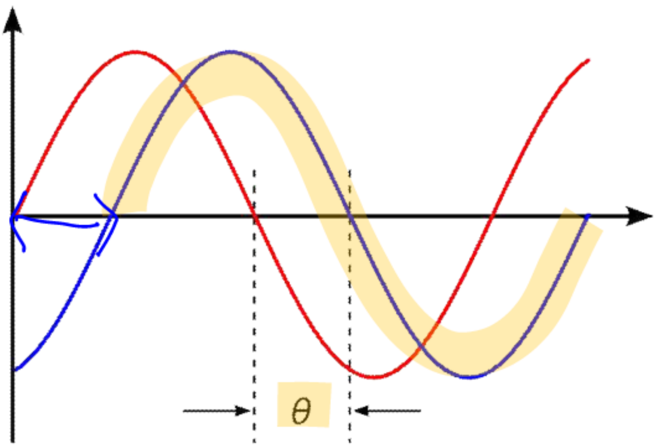
Period, Frequency and Amplitude

주기 진폭

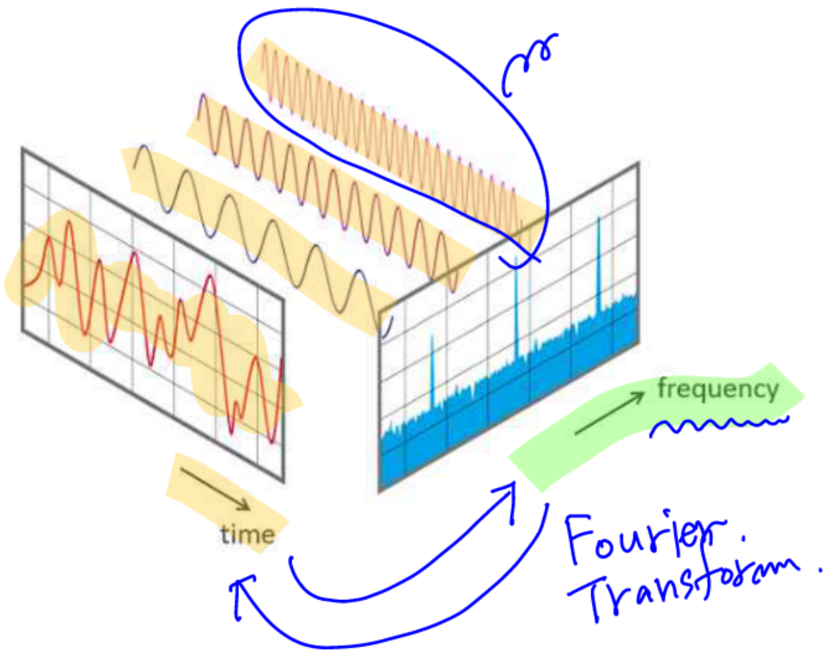


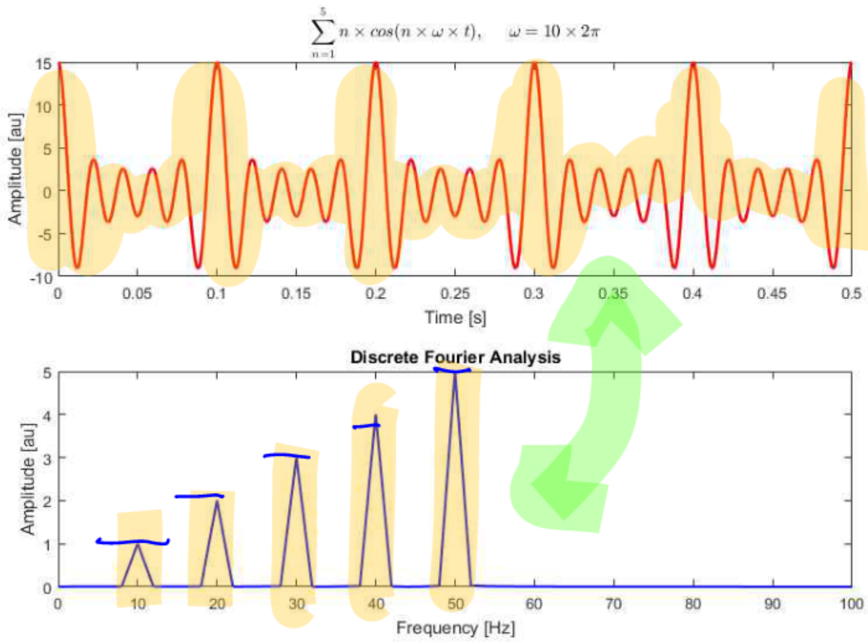
$\frac{1}{0.5} = 2.$

Phase 위상. shift



Observation



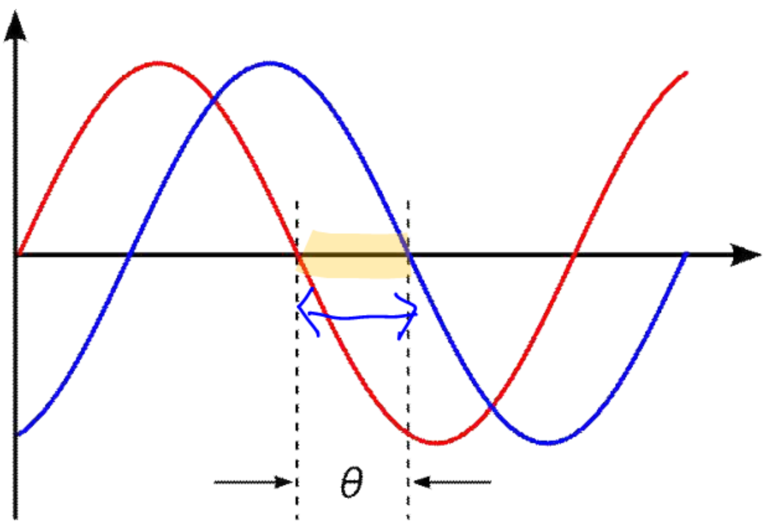


위상 = ϕ.

$$f(t) = \cos(2\pi t) + 0.5\cos(2\pi 4t) + \ldots$$

$$f(t) = \sum_{v=-\infty}^{\infty} A(v)\cos(2\pi v t)$$

Phase shift



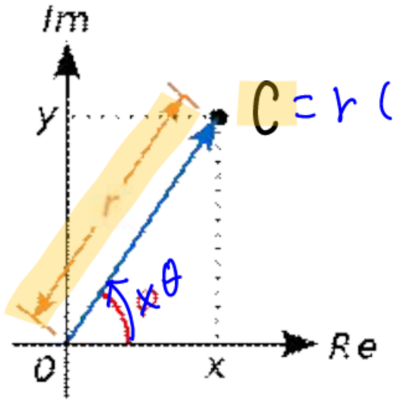
$$f(v) = \cos(2\pi t) + 0.5\cos(2\pi 4t + \pi/4) + \ldots$$

$e^a \cdot e^b = e^{a+b}$

$e^{i\theta} = \cos\theta + i\sin\theta$

$e^{i\delta}$, $e^{i\theta} \cdot e^{i\delta} = e^{(\theta+\delta)i}$

$= \cos(\theta+\delta) + i\sin(\theta+\delta)$



$C = r(\cos\theta, \sin\theta)$

$$F(v) = r(\cos(\theta) + i\sin(\theta)) \rightarrow r \cdot e^{i\theta}$$

$$e^{ix} = \cos(x) + i\sin(x)$$

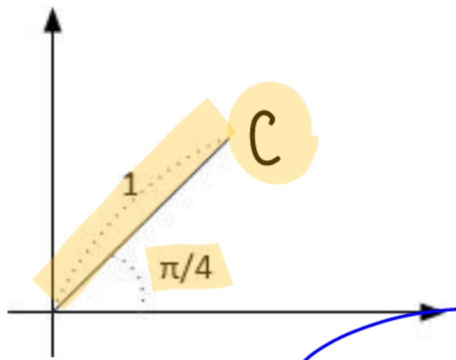
ν = frequency

$$f(t) = \sum_{v=-\infty}^{\infty} F(v)e^{(2\pi i v t)}$$

$r \cdot e^{i\theta} \cdot e^{2\pi i v t}$

$$f(t) = \int_{v=-\infty}^{\infty} F(v)e^{(2\pi i v t)}dv$$

Example



N

$e^{\pi/4\, i} \cdot e^{2\pi i v t} = e^{i(\pi/4 + 2\pi N t)}$

$$(\cos(\pi/4) + i\sin(\pi/4))e^{2\pi i v t}$$
$$= (\cos(\pi/4) + i\sin(\pi/4))(\cos(2\pi v t) + i\sin(2\pi v t))$$
$$= \cos(\pi/4)\cos(2\pi v t) + \cos(\pi/4)\sin(2\pi v t)i$$
$$+ \sin(\pi/4)\cos(2\pi v t)i - \sin(\pi/4)\sin(2\pi v t)$$

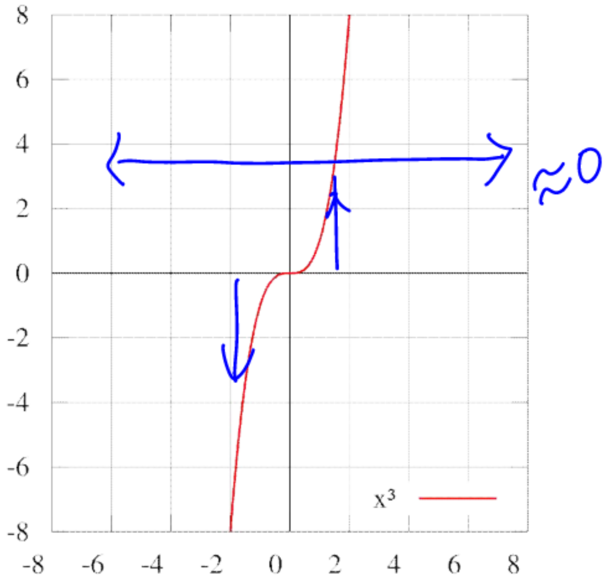
X

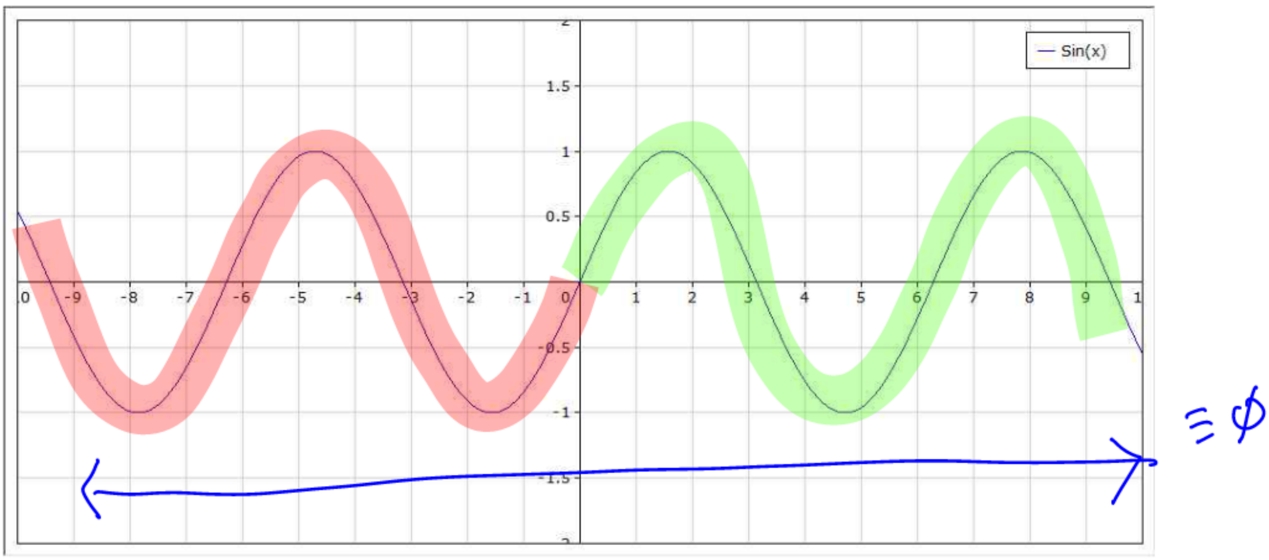
$$= \cos(2\pi v t + \frac{\pi}{4}) + \cancel{\sin(\frac{\pi}{4} + 2\pi v t)i}$$

①
②
③

Odd function

$$-f(x) = f(-x)$$





$$\sin(x)$$

Inverse Fourier Transform

$$f(t) = \sum_{v=-\infty}^{\infty} F(v)e^{2\pi ivt}$$

$$f(t) = \int_{v=-\infty}^{\infty} F(v)e^{2\pi ivt}dv$$

Forward Fourier Transform

$$F(v) = \sum_{t=-\infty}^{\infty} f(t)e^{-2\pi ivt}$$

$$F(v) = \int_{t=-\infty}^{\infty} f(t)e^{-2\pi ivt}dt$$

15/5 = 3

5^2

15

Hint

$$\frac{f(t)}{e^{2\pi ivt}} \Rightarrow F(v)$$