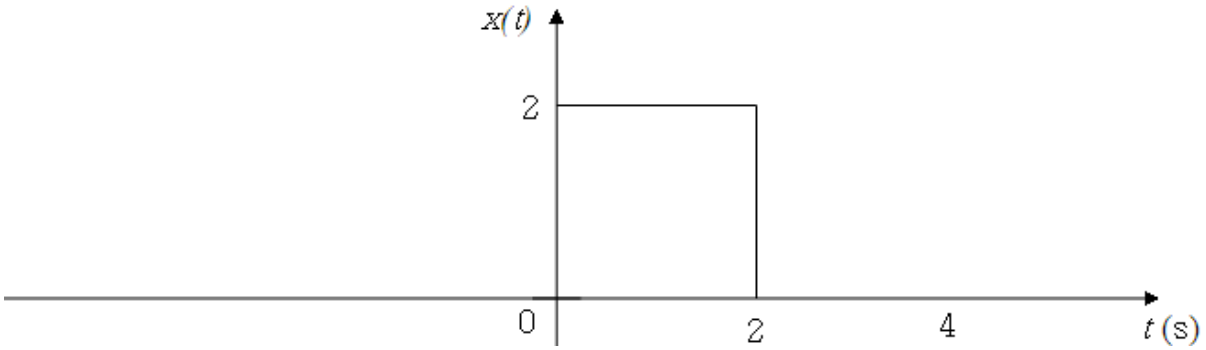
2020年 신호처리 과제 8 답안

1. 다음 신호의 Fourier transform을 구하고, magnitude spectrum을 그리시오.



$$X(f) = \int_{-\infty}^{\infty} x(t) \cdot e^{-jwt} dt = \int_{-\infty}^{\infty} x(t) \cdot e^{-j2\pi ft} dt$$

$$= \int_{0}^{2} 2 \cdot e^{-j2\pi ft} dt = \frac{2}{-j2\pi f} \cdot e^{-j2\pi ft}\Big|_0^2$$

$$= \frac{2}{-j2\pi f}\left(e^{-j4\pi f} - 1\right) = \frac{1}{\pi f} \cdot \frac{2}{-2j} \cdot \left(e^{-j4\pi f} - 1\right)$$

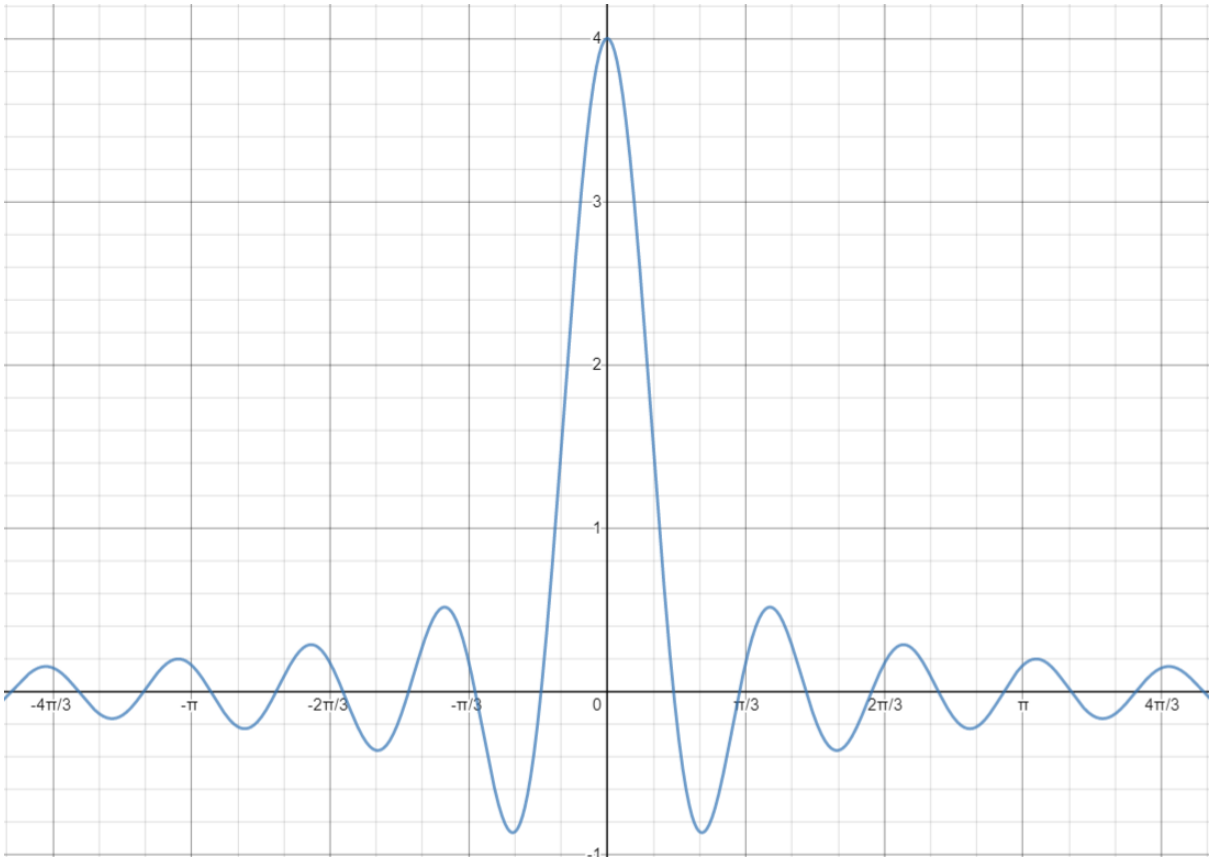
$$= \frac{1}{\pi f} \cdot \frac{2\left(1 - e^{-j4\pi f}\right)}{2j} = \frac{1}{\pi f} \cdot \frac{2 \cdot e^{-j2\pi f}\left(e^{j2\pi f} - e^{-j2\pi f}\right)}{2j}$$

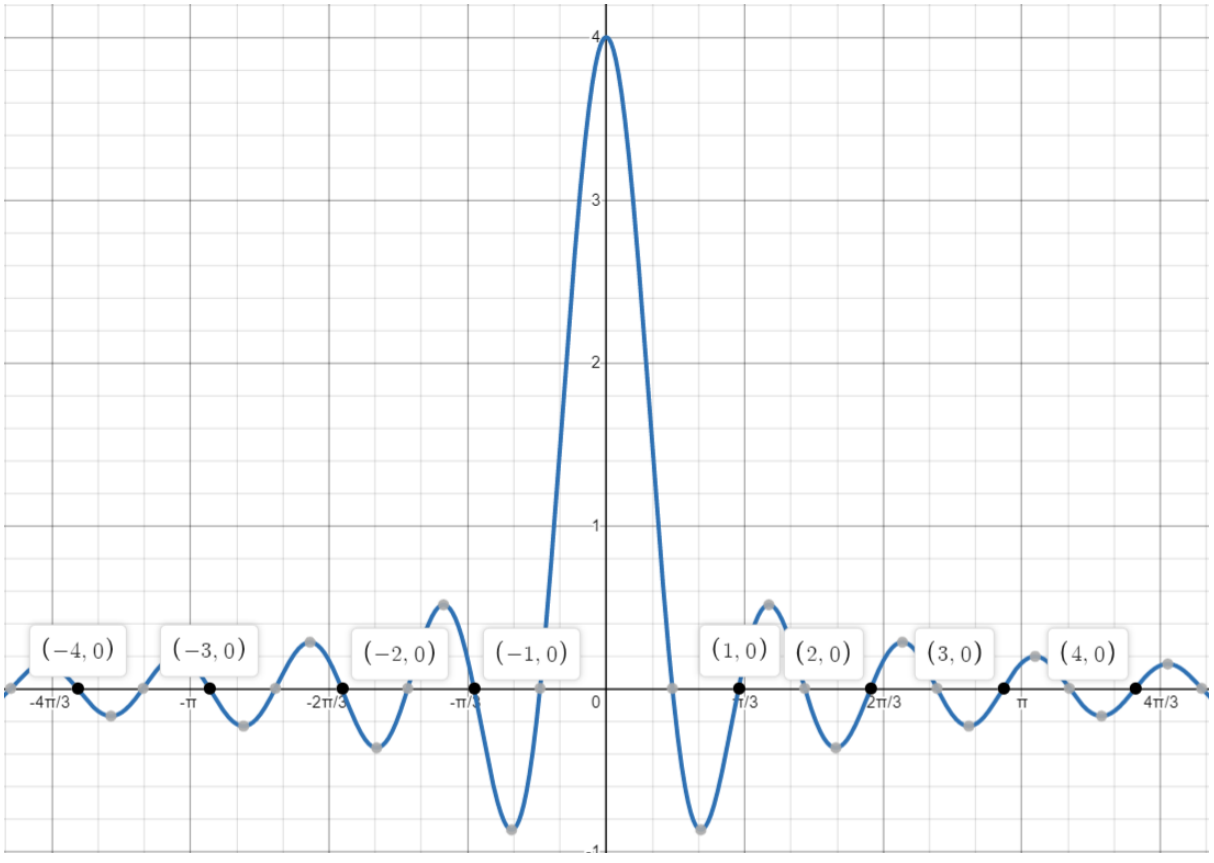
$$= \frac{1}{\pi f} \cdot 2 \cdot e^{-j2\pi f} \cdot \sin(2\pi f) = \frac{2\sin(2\pi f)}{\pi f} \cdot e^{-j2\pi f}$$

$$= \frac{4\sin(2\pi f)}{2\pi f} \cdot e^{-j2\pi f} = 4sinc(2f) \cdot e^{-j2\pi f}$$

$$(X(f) = \frac{\sin(\pi f)}{\pi f} = \text{sinc(f)})$$

$$X(0) = \int_{-\infty}^{\infty} x(t)\, dt = 4$$


4
3
2
1
-1
-4π/3
-π
-2π/3
-π/3
0
π/3
2π/3
π
4π/3


4
3
2
1
-1
(−4, 0)
(−3, 0)
(−2, 0)
(−1, 0)
(1, 0)
(2, 0)
(3, 0)
(4, 0)
-4π/3
-π
-2π/3
-π/3
0
π/3
2π/3
π
4π/3