Solutions to sample example (September 29)

1. For \( f > 0 \), \( \hat{X}(f) = X(f)(-\text{sgn}(f))(-\text{sgn}(f)) = X(f)(-j)(-j) = -X(f) \)
   
   And for \( f < 0 \), \( \hat{X}(f) = X(f)(-\text{sgn}(f))(-\text{sgn}(f)) = X(f) \cdot j \cdot j = -X(f) \)
   
   Hence, \( \hat{X}(f) = -X(f) \) for \( f \neq 0 \).

   \( \hat{x}(t) = \int_{-\infty}^{\infty} \hat{X}(f) \ast e^{2\pi ft} \, df = -x(t) \)

   When doing the integration (specifically, inverse-Fourier-transforming \( \hat{X}(f) \) back to the time domain), the value of a single point (specifically, \( f=0 \)) has no effect on the resultant integration.

2. Slide 2.13

3. 

\[ S(f) \]

\[ S(t) = \text{sinc}(t) \]
4. Use Parseval’s theorem

\[ \int_{-\infty}^{\infty} |\text{sinc}(2t)|^2 \, dt = \int_{-\infty}^{\infty} \left[ \frac{1}{2} \prod \left( \frac{f}{2} \right) \right]^2 \, df = \int_{-1}^{1} \frac{1}{4} \, df = \frac{1}{2} \]