

HW10 solutions (optional)

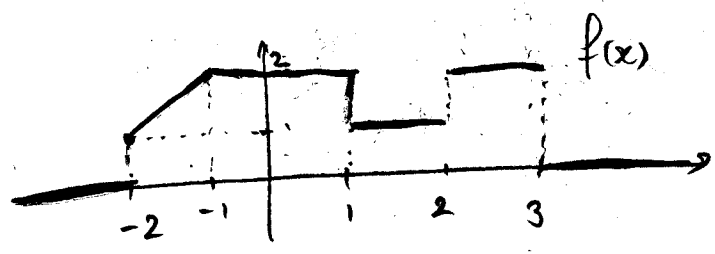
①

10 pts / exercise

7.8.2 $f'(x) = -\frac{1}{2} \delta_{-2}(x) + \frac{3}{2} \delta_{-1}(x) - \delta_0(x) + \delta_1(x) - \delta_2(x)$



7.8.14



7.8.18

$\phi(x) = \mathcal{U}_1(x) - \mathcal{U}_2(x)$
 $\phi'(x) = \delta_1(x) - \delta_2(x)$

$\rightarrow \langle \phi', f \rangle = f(1) - f(2)$



7.8.31 $\phi(x) = \text{sgn}(x) = 2\mathcal{U}_0(x) - 1$

$\phi'(x) = 2\delta_0(x)$

$i\omega \hat{\phi}(\omega) = \frac{2}{\sqrt{2\pi}} \Rightarrow \hat{\phi}(\omega) = -i\sqrt{\frac{2}{\pi}} \frac{1}{\omega}$



7.8.50 $\alpha, \beta \in \mathbb{R}$.

$\left(\left(\frac{1}{\sqrt{2\pi}} \delta_\alpha \right) * \mathcal{U}_\beta \right)(x) = \int_{-\infty}^{\infty} \delta_\alpha(y) \mathcal{U}_\beta(x-y) dy = \mathcal{U}_\beta(x-\alpha)$
 $= \mathcal{U}_0(x-\alpha-\beta) = \mathcal{U}_{\alpha+\beta}(x)$