

Homework # 4, due Fri, Sep 30th.

1. The sinc function $\text{sinc}(x) := \sin x/x$ is the Fourier transform of some compactly supported function. Identify that function.
2. Suppose a function f is in $L^2(\mathbb{R})$ together with its first three derivatives. What kind of decay should we expect from its Fourier transform $\hat{f}(\lambda)$ as $\lambda \rightarrow \pm\infty$?
3. Are the filters $L_1 f(t) := \int_{t-1}^t f(x) dx$, $L_2 f(t) := \int_0^1 x^2 f(t-x) dx$ (a) linear? (b) time-invariant? (c) causal?
4. Is the product $\sqrt{\Delta_a f \Delta_\alpha \hat{f}}$ preserved under a) dilation b) modulation c) translation of f ?