Signal Processing for the Earth Sciences

Homework 1; **Due September 20, 2024**

August 30, 2024

(1) Express $\delta(\alpha t)$ in terms of $\delta(t)$.

(2) Using the integral definition of convolution, show whether or not convolution obeys commutative, distributive (under addition) and associative laws. Numerically verify your conclusions using Matlab examples with illustrative functions.

(3) Analytically evaluate the following convolutions, where α is positive constants. Plot and check your analytic results using Matlab.

a. $f(t) * (5\delta(t) - 2\delta(t-3))$
b. $\prod(t) * \prod(t)$
c. $[\alpha \cos(\pi t) H(t)] * [\delta(t) - \delta(t-2)]$

(4) Compute the Fourier transform of

a. $\phi(t) = e^{-at} H(t)$
b. $\phi(t) = \sin(2\pi f_0 t)$