

Signal Processing for the Earth Sciences

Homework 1; **Due September 22, 2023**

September 1, 2023

- (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. $\Pi(t) * \Pi(t)$
 - 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. $\phi(t) = \sin(2\pi f_0 t)$