ECE 300
Signals and Systems
Homework 1

Due Date: Thursday September 8 at 1 PM

Reading: K & H, 1-17 and your course notes.

Problems

1. K & H, Problem 1.1, part **a** only (for all 5 figures). Use the **rect** function and the **triangle (Δ)** function.

   The **rect** function represents a rectangular pulse. To represent a pulse x(t) having amplitude 3, located (centered) at t=5, and width 4, we would write:

   $$x(t) = 3\,\mathrm{rect}\left(\frac{t-5}{4}\right)$$

   The triangle function represents a triangular pulse. To represent a triangle x(t) having amplitude 3, located (centered) at t = 5, and width 4, we would write

   $$x(t) = 3\Lambda\left(\frac{t-5}{4}\right)$$

2. K & H, Problem 1.4, parts **a**, **b**, and **c** only. It may be easier to do Problem 1.6 first.

3. K & H, Problem 1.6 (only parts **a**, **b**, and **c**)

4. K & H, Problem 1.7, part **a** only (for figures **a**, **b**, and **d**)

5. K & H, Problem 1.9

6. K & H, Problem 1.13, parts **a** and **b** only

7. K & H, Problem 1.14, for figures **a** and **b** only. Assume the signals go on for all time, and you are only looking at a snapshot.

8. For each of the following signals, determine E_∞ and P_∞ into 1 Ω. Classify each of the following signals as energy or power signals (or neither).
   a. $v(t) = 4$
   b. $v(t) = 3\cos(2\pi 10t + 15°)$
   c. $i(t) = 4\exp(-2|t|)$
   d. $x(t) = 4rect\left(\frac{t-2}{3}\right)$

9. Simplify the following as much as possible, giving numerical answers where possible

a) $\int_{-\infty}^{\infty} e^{-t}u(t-5)dt$

b) $\int_{-\infty}^{\infty} t^2\left[u(t-6)-u(t-5)\right]dt$

c) $\int_{-\infty}^{\infty} t^2\delta(t-2)dt$

d) $\int_{5}^{\infty} t^2\delta(t-2)dt$

e) $\int_{0}^{\infty} \sin(ty\pi)\delta(t-2)dt$

f) $\sin(ty\pi)\delta(t-2)$

g) $\int_{-\infty}^{\infty} \delta(t-3)\delta(t-4)dt$

h) $\int_{-\infty}^{\infty} u(t-3)\delta(t-4)dt$

i) $\int_{-\infty}^{\infty} u(t-x+5)\delta(t-4)dt$

j) $\int_{-\infty}^{3} u(t-x+5)\delta(t-4)dt$

k) $t\delta(t-2)+t^3\delta(t-1)$

l) $H(\omega)\delta(\omega-1)+A(\omega-x+1)\delta(\omega)$

m) $\int_{-9}^{10} u(t+3)u(t-2)dt$