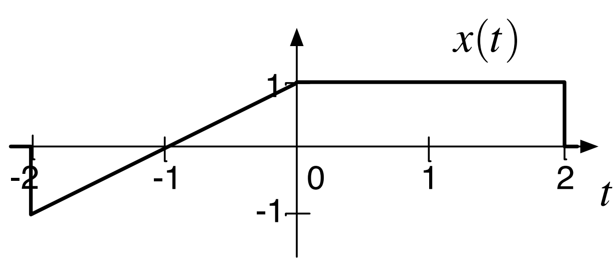
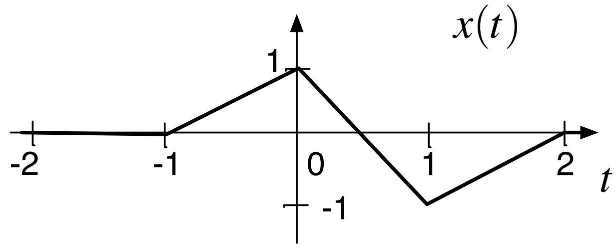
ELE 301 Sept. 19, 2011
Signals and Systems Handout #1

Homework #1
Due Sept. 22

1. *Complex numbers - polar.* Compute the magnitude and phase of the complex numbers:
   a. $3 + 2i$
   b. $1 + i$
   c. $e^{2-i\pi}$
2. *Complex numbers - rectangular.* Compute the real and imaginary parts of the complex numbers:
   a. e^{i}
   b. $e^{it}(\cos(3t) + sin(2t))$ (t is real)
   c. $1/(1 + i)$
3. *Energy.* What is the energy of these signals (where t is the independent variable):
   a. $x(t) = Ae^{-at}u(t)$ with $a > 0$.
   b. The unit area rectangular pulse of width a, $\Delta_a(t)$.
4. *Power.* What is the power of these signals:
   a. $x(t) = A_1 e^{i\omega t} + A_2 e^{-i\omega t}$.
   b. $x(t) = \sum_{k=-N}^{N} A_k e^{i\omega_0 kt}$.
5. *Even and odd parts.* Find the even and odd decomposition of this signal:



6. *Time shifting and scaling.* Given the signal $x(t)$ shown below



draw the following signals:

a. $x(-2(t-1))$

b. $x(t/2 + 1/2)$

7. If $y(t)$ is an even function, and $y(t-1)$ is also even, is $y(t)$ periodic?

8. A signal $y(t)$ is periodic with fundamental period T_0, and is the sum of two other signals

$$y(t) = x_1(t) + x_2(t).$$

Must $x_1(t)$ and $x_2(t)$ both be periodic?

9. Assume that the signal $x(t)$ is periodic with period T_0, and that $x(t)$ is odd (*i.e.* $x(t) = -x(-t)$). What is the value of $x(T_0)$?

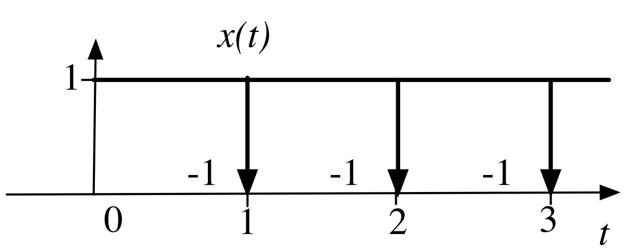
10. Two continuous-time sequences $x_1(t)$ and $x_2(t)$ are periodic with periods T_1 and T_2. Find values of T_1 and T_2 such that $x_1(t)+x_2(t)$ is aperiodic.

11. Sketch

$$x(t) = \frac{1}{\sqrt{t}} u(t-1)$$

and classify it as an energy or power signal or neither.

12. For the waveform $x(t)$ plotted below,



evaluate and draw the function

$$y(t) = \int_0^t x(\tau) d\tau.$$

The impulses are negative, and have strength 1. What would you name this waveform?

13.Evaluate these integrals

(a) $\int_{-\infty}^{\infty} f(t+1)\delta(t+1)\ dt$

(b) $\int_{-\infty}^{\infty} e^{j\omega T}\delta(t)\ dt$

(c) $\int_{0}^{\infty} f(t)\left(\delta(t-1)+\delta(t+1)\right)\ dt$

(d) $\int_{-\infty}^{\infty} f(\tau)\delta(t-\tau)\delta(t-2)d\tau.$