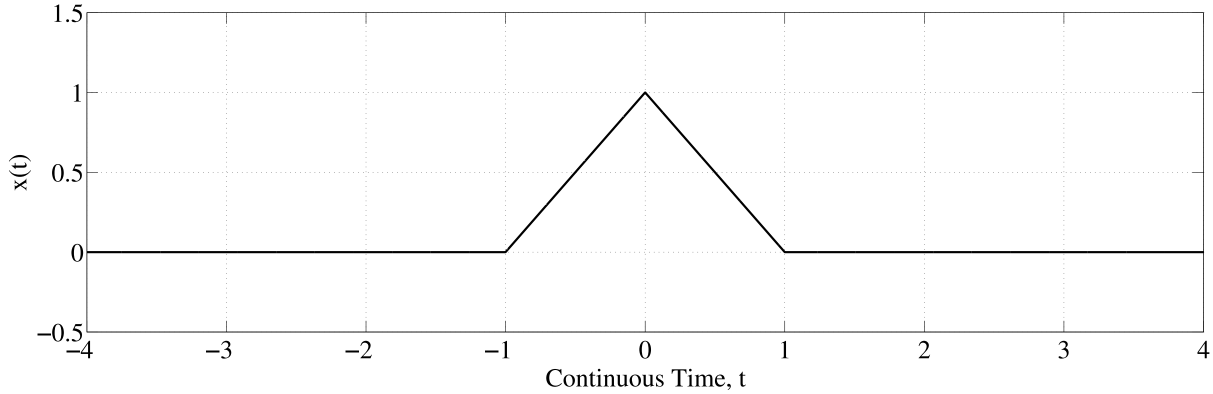
Name: SOLUTIONS

Quiz 1: 10 **/10** **ELEC 309 – Signals & Systems**

Consider the following signals $x(t)$ and $y(t)$ (on back):



(a) (1 point) The signal $x(t)$ is

A. an energy signal.

B. a power signal.

(b) (4 points) Determine the energy or time-averaged power of the signal $x(t)$.

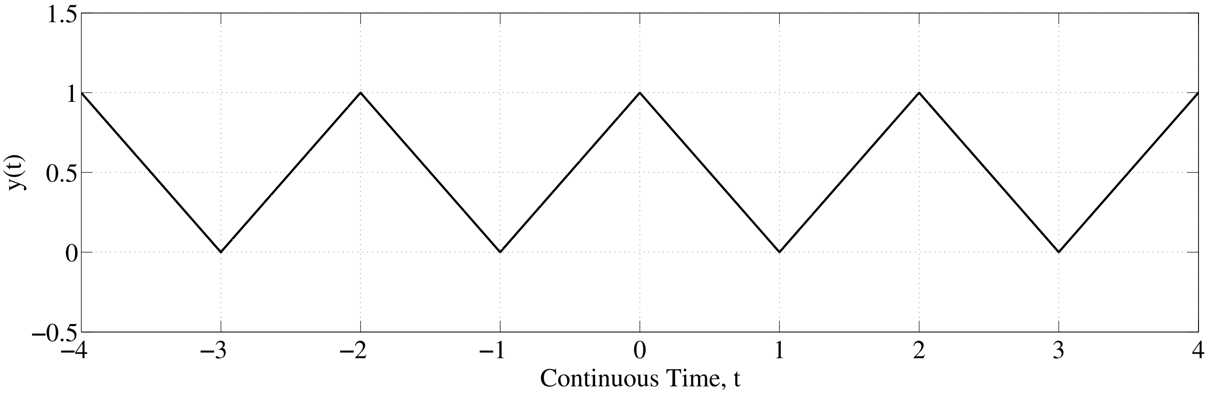
Note that the signal $x(t)$ is given by

$$x(t) = \begin{cases} t+1 & -1 \le t < 0 \\ 1-t & 0 \le t < 1 \\ 0 & \text{otherwise.} \end{cases}$$

$$E_x = \int_{-\infty}^{\infty} \left|x(t)\right|^2 dt = \int_{-1}^{0} (t+1)^2 dt + \int_0^1 (1-t)^2 dt$$

Using u-substitution with $u = t+1$, $du = dt$, $v = 1-t$, and $dv = -dt$, we have

$$E_x = \int_0^1 u^2 du - \int_1^0 v^2 dv = \int_0^1 u^2 du + \int_0^1 v^2 dv = 2\int_0^1 u^2 du = 2\frac{u^3}{3}\bigg|_0^1 = \boxed{\frac{2}{3}}.$$



(c) (1 point) The signal $y(t)$ is

A. an energy signal.

B. a power signal.

(d) (4 points) Determine the energy or time-averaged power of the signal $y(t)$.

Note that $y(t)$ is periodic with fundamental period $T_0 = 2$ and an energy content of $2/3$ per period (as seen in part (b)). Therefore, the power of $y(t)$ is given by

$$P_y = \lim_{T\to\infty} \frac{1}{T}\int_{-T/2}^{T/2} \left|y(t)\right|^2 dt = \frac{1}{T_0}\int_{-T_0/2}^{T_0/2} \left|y(t)\right|^2 dt = \frac{1}{2}\int_{-1}^{1} y^2(t)dt = \frac{1}{2}E_x = \boxed{\frac{1}{3}.}$$