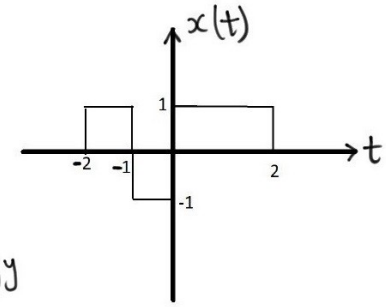
Signals and Systems

1. Consider the set of discrete-time signals $\exp\left(i\frac{2\pi acn}{b}\right)$, where a and b are fixed positive integers and c can be any integer. That is, $x(n)$ is parameterized by c. How many signals are there in this set?

2. Consider signal $x(t)$:



Let β be a positive constant greater than 1. What is the energy of the signal $x\left(\frac{t}{\beta} - 17\right)$?

3. In order to completely avoid aliasing, what is the minimum sampling rate of the signal $40\,\text{sinc}^5(999t) + 20\,\text{rect}\left(\frac{t}{7183}\right)$?

4. A continuous-time system has the input–output relationship:

$y(t) = x(\cos(t)) + x(\sin(t))$

Is the system causal? Bounded-input, bounded output (BIBO) stable? Time-invariant?

5. A linear, time-invariant (LTI) continuous-time system has an impulse response $u(t+2) - u(t-3)$, where $u(t)$ is the Heaviside unit-step function. Find the system's output in response to the input: $u(t-1) - u(t-7)$?