FEE321 – E.C.T IIA – Oct 2020

Lecture 4: Singularity functions (1 hr)

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28/10/2020

Overview

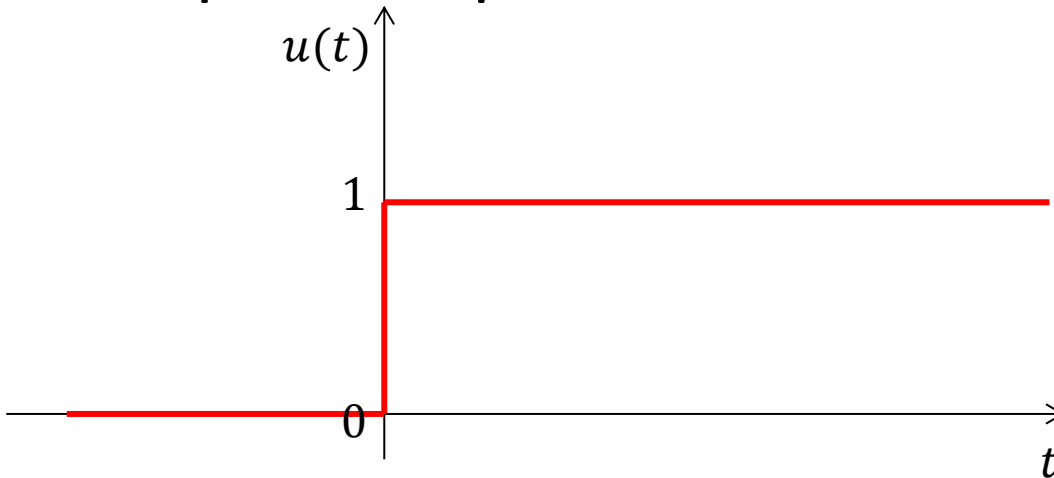Today's class starts on singularity functions

- Unit step, $u(t)$
  - Variants
  - Waveform Representations
    - Mathematical to graphical
    - Graphical to mathematical

Unit step function[1]

- Mathematical definition

$$u(t) = \begin{cases} 0 & t < 0 \\ undefined & t = 0 \\ 1 & t > 0 \end{cases}$$

- Graphical representation
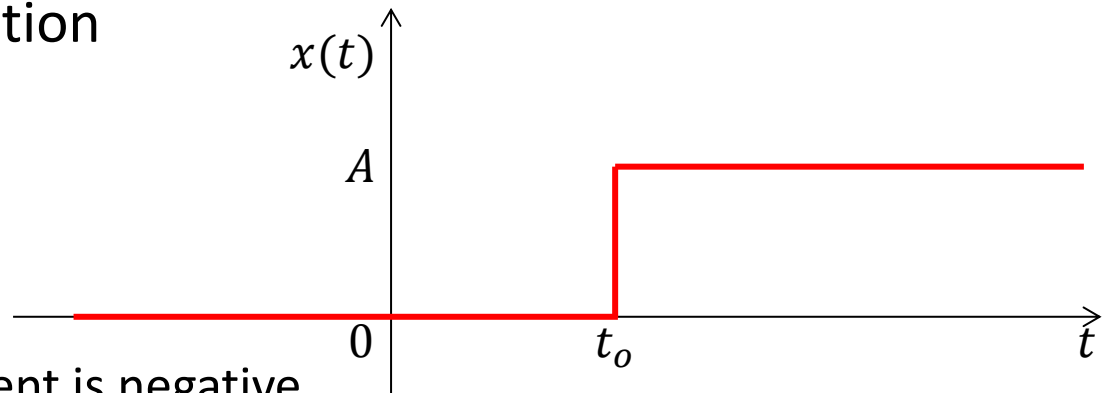
Unit step function[2]

- General step function mathematical form
$$x(t) = A \cdot u(t - t_o)$$
- Where
  - A – amplitude of non zero section
  - t_o – point of transition from zero value
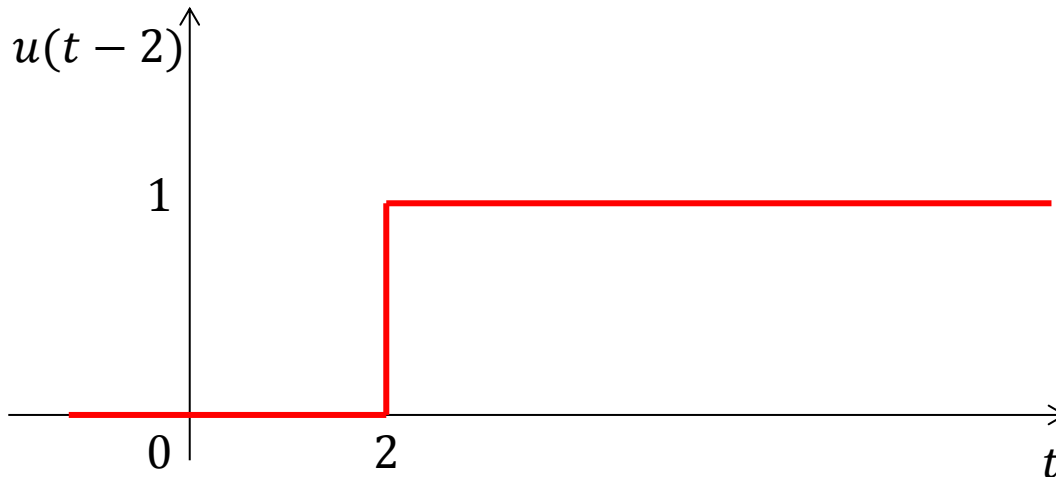- Graphical representation

- Note that $x(t)$
  - is zero when argument is negative
  - Transitions when argument is zero
  - Equals amplitude when argument is positive

Unit step function[3]

- Mathematical definition of sample variant

$$u(t-2) = \begin{cases} 0 & t < 2 \\ \text{undefined} & t = 2 \\ 1 & t > 2 \end{cases}$$

- Graphical representation
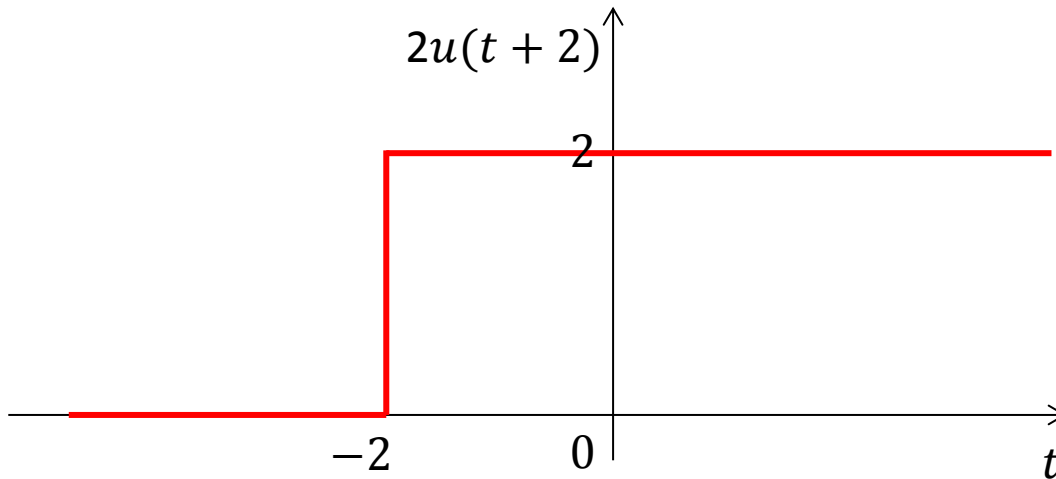
Unit step function[4]

- Mathematical definition of sample variant

$$2u(t+2) = \begin{cases} 0 & t < -2 \\ \text{undefined} & t = -2 \\ 2 & t > -2 \end{cases}$$
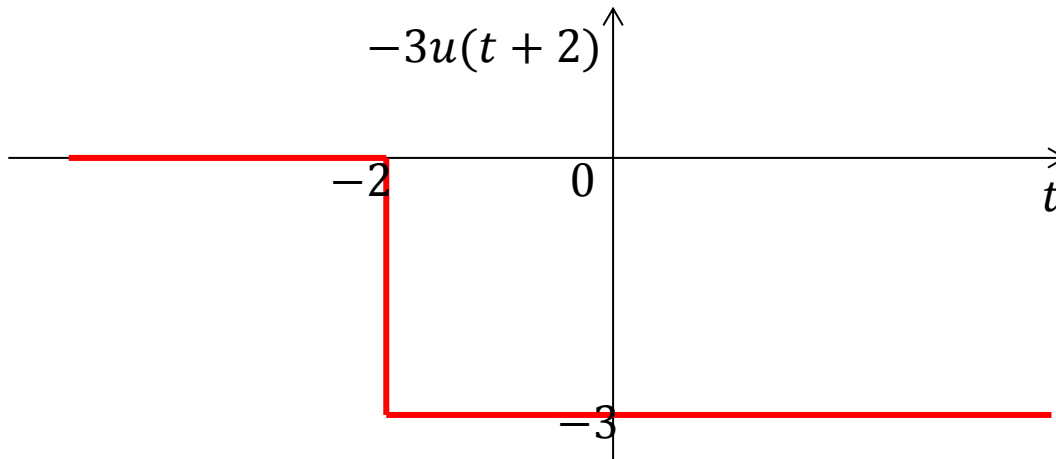
- Graphical representation

Unit step function[5]

- Mathematical definition of sample variant

$$-3u(t+2) = \begin{cases} 0 & t < -2 \\ \text{undefined} & t = -2 \\ -3 & t > -2 \end{cases}$$
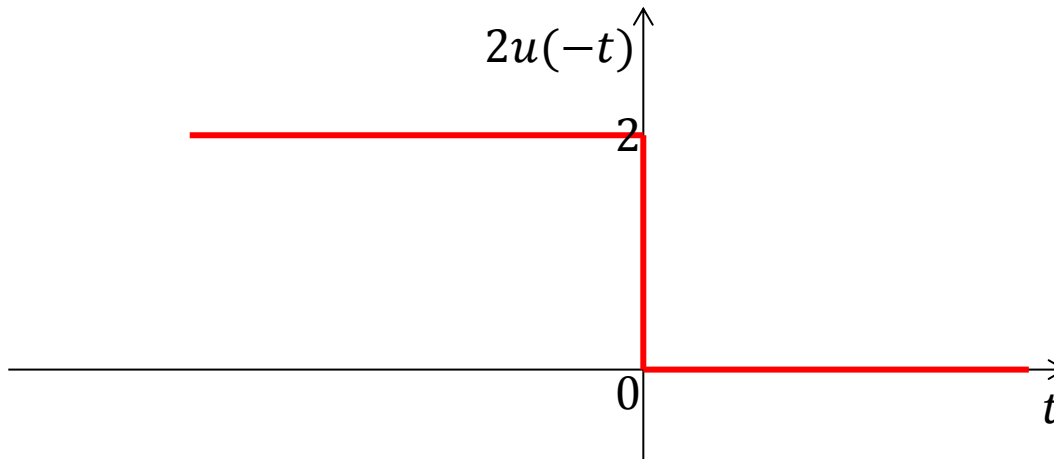
- Graphical representation

Unit step function[6]

- Mathematical definition of sample variant

$$2u(-t) = \begin{cases} 2 & t < 0 \\ \text{undefined} & t = 0 \\ 0 & t > 0 \end{cases}$$

- Graphical representation

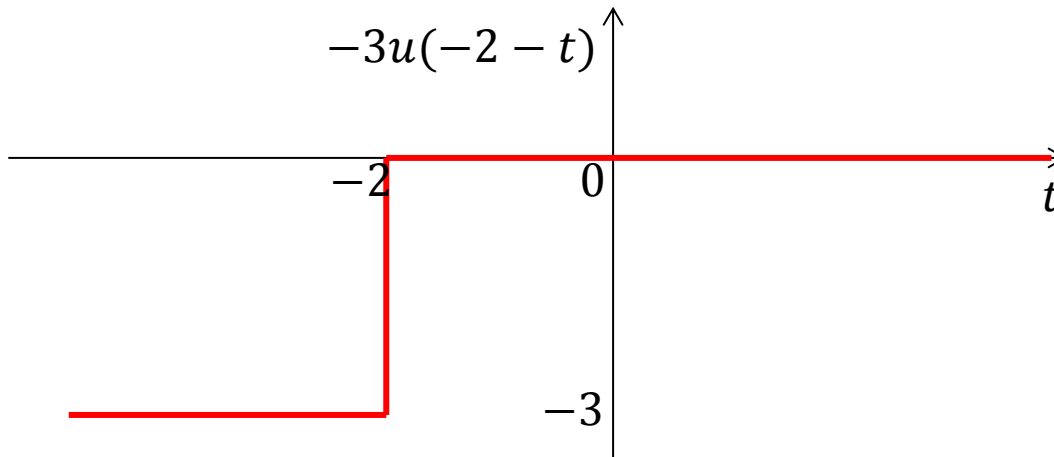# Unit step function[7]

- Mathematical definition of sample variant

$$-3u(-2 - t) = \begin{cases} -3 & t < -2 \\ \text{undefined} & t = -2 \\ 0 & t > -2 \end{cases}$$
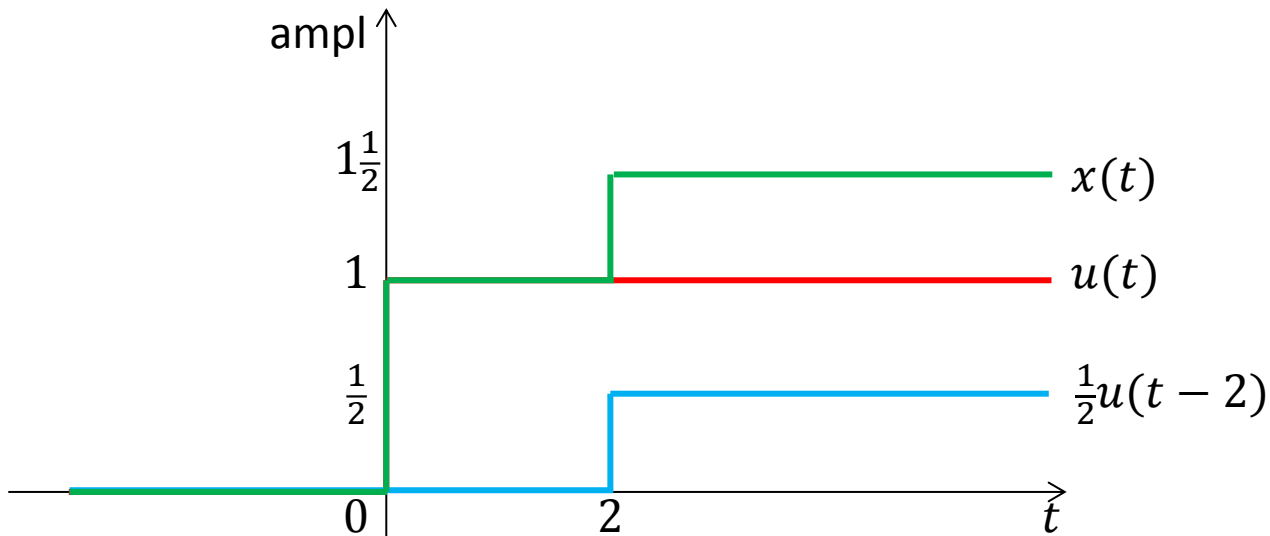
- Graphical representation

Unit step function[8]

- Mathematical definition

$$x(t) = u(t) + \frac{1}{2}u(t-2)$$
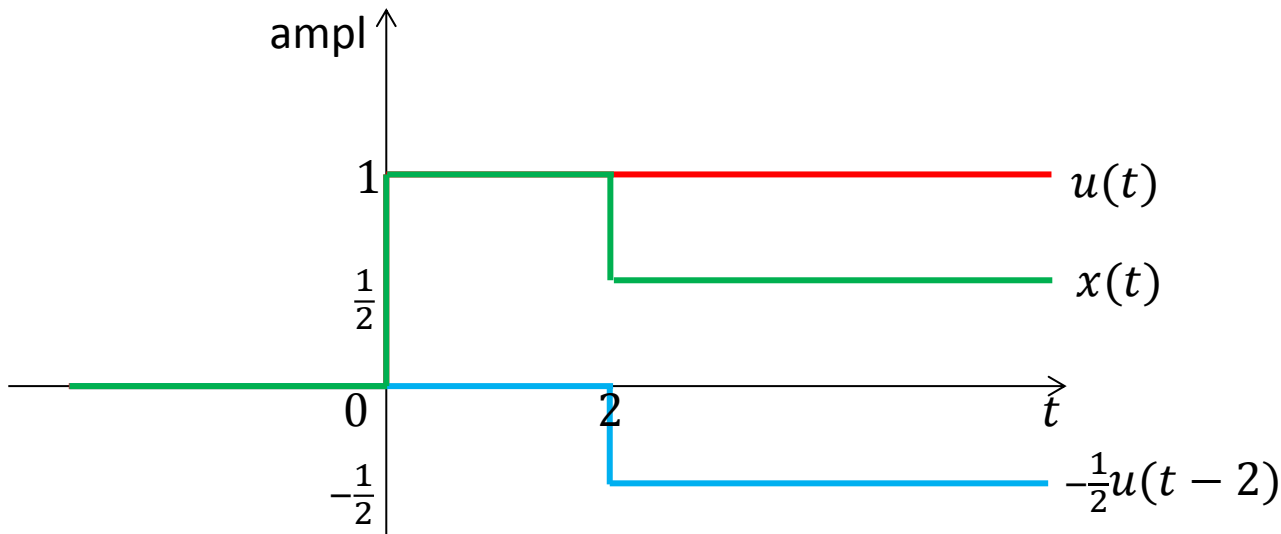
- Graphical representation

Unit step function[9]

- Mathematical definition

$$x(t) = u(t) - \frac{1}{2}u(t-2)$$
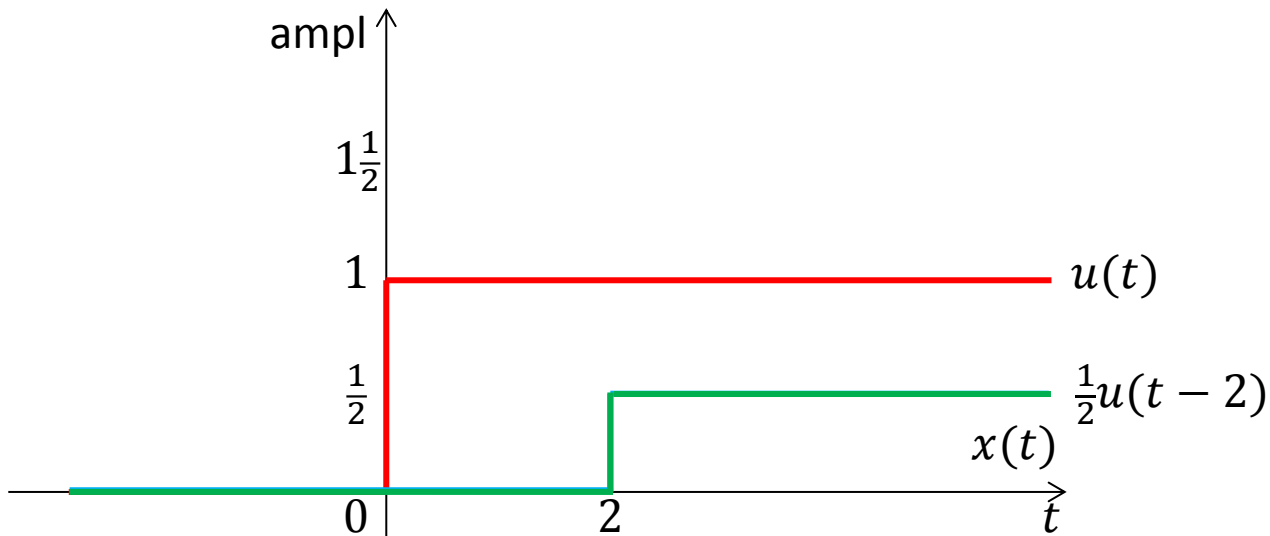
- Graphical representation

Unit step function[10]

- Mathematical definition
$$x(t) = u(t) \times \tfrac{1}{2}u(t-2)$$
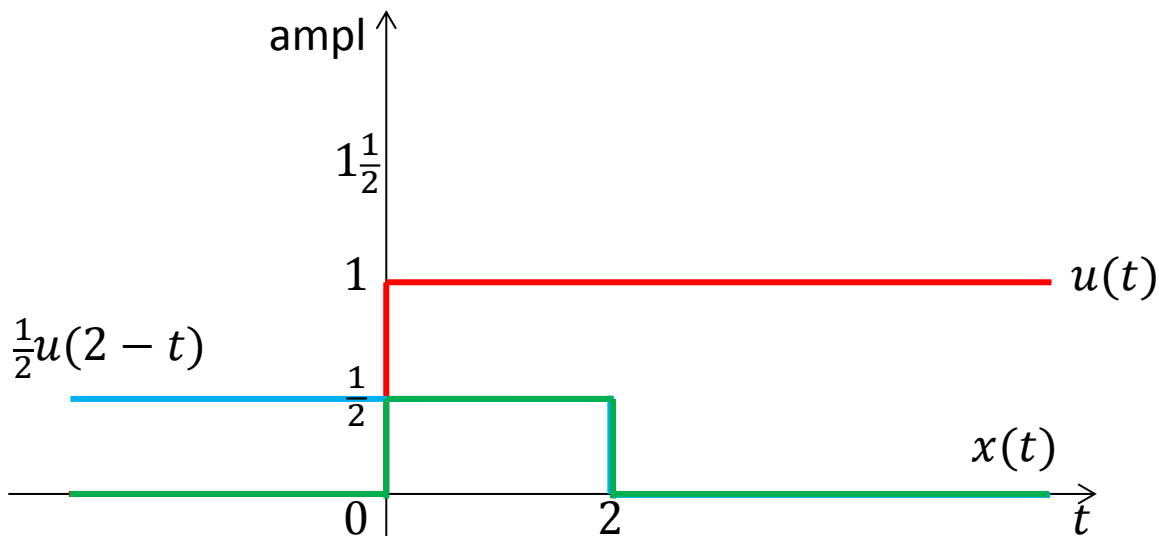
- Graphical representation

Unit step function[11]

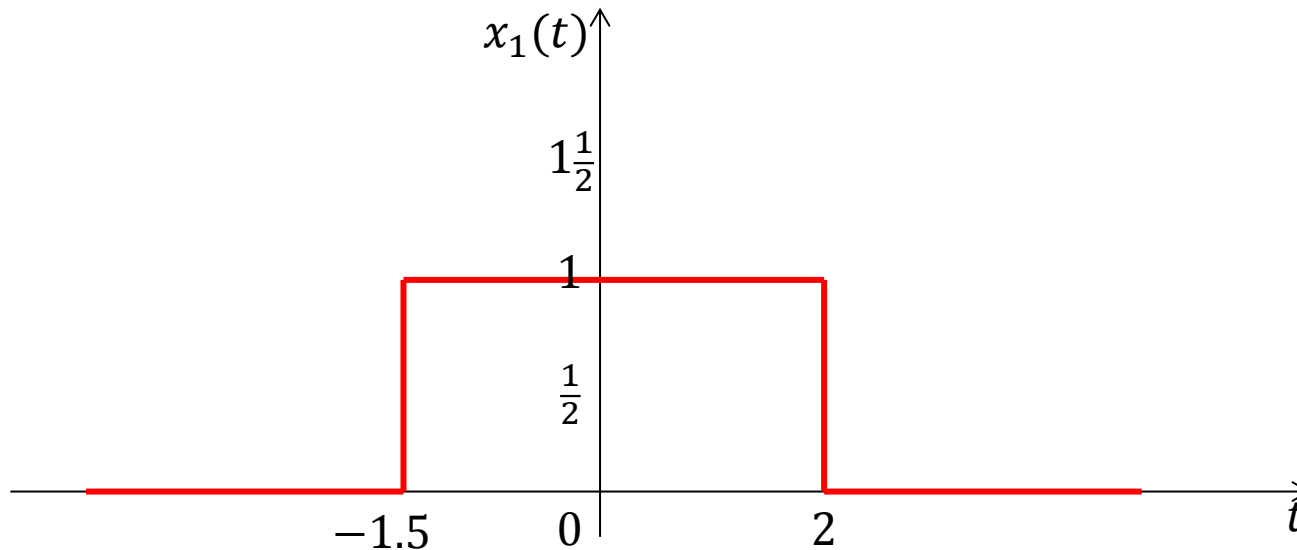- Mathematical definition

$$x(t) = u(t) \times \frac{1}{2}u(2 - t)$$

- Graphical representation
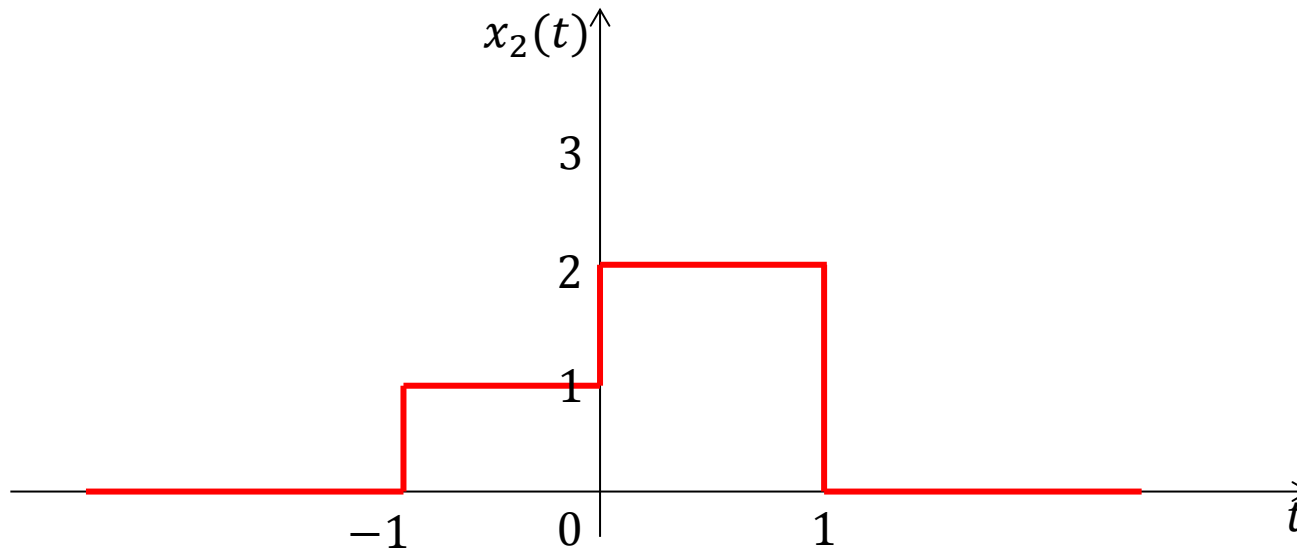
Unit step function[12]

Suggest the mathematical expression for $x_1(t)$

- $x_1(t) = u(t + 1.5) - u(t - 2)$
- $x_1(t) = u(2 - t) - u(-1.5 - t)$
- $x_1(t) = u(t + 1.5) \times u(2 - t)$

Unit step function[13]

Suggest the mathematical expression for $x_2(t)$

- $x_2(t) = u(t+1) + u(t) - 2u(t-1)$
- $x_2(t) = 2u(1-t) - u(-t) - u(-1-t)$

Summary

Today's class started on singularity functions

- Unit step, $u(t)$
  - Variants
  - Waveform Representations
    - Mathematical to graphical
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QUESTIONS?