

Signals & System

1. Introduction to Python
2. Basic Plotting of Signals
 - a. Unit Step
 - b. Unit Impulse
 - c. Ramp
 - d. Periodic Sinusoidal Sequences.
 - e. Periodic Rectangular Pulse
 - f. Asymmetric Sawtooth Waveform
 - g. Periodic Gaussian PulsePlot all the sequences.
3. Basic operation of signal
 - a. Addition & Subtraction
 - b. Multiplication & Division
 - c. Time reversal, Scaling, and Shifting

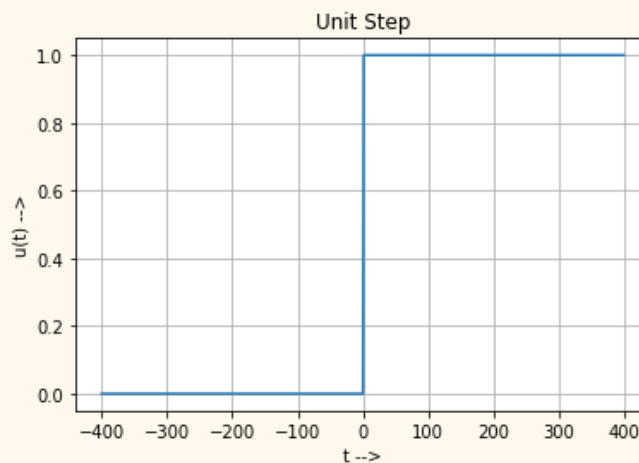
Lab 1. Introduction to Python

1. Basics: Input, Output
2. List: Slicing, Append, Length
3. Range
4. Loops
5. `sum()`, `items()`, `enumerate()`, `reversed()`, `sorted()`
6. Dictionary: Dictionaries are used to store data values in key:value pairs
7. Function: To declare a function : `def <function name>(parameter list):`
8. Numpy package:
 - a. Import numpy as np
 - b. `np.array()`, `np.sin()`, `np.cos()`, `np.exp()`, `np.arange()`, `np.sort()`
 - c. Dimension of array : `a.ndim`
 - d. Shape of array : `a.shape` -> (2,3)
 - e. Reshape an array : `a.reshape(4,3)`
9. Matplotlib function:
 - a. `import matplotlib.pyplot as plt`
 - b. `plt.plot(x, y)`
 - c. `plt.xlabel()`, `ylabel()`
 - d. `plt.title()`
 - e. `plt.xlim()`, `ylim()`
 - f. `plt.grid()`
 - g. `plt.figure(figsize = (20,20))`
 - h. `plt.subplot(total rows, total columns, plot no.)`
 - i. `plt.show()`
10. Codes of Unit Step and Unit impulse with different starting points.
11. Plot 2 graphs and then add them and show the graph.

Lab 2. Basic Plotting of Signals

1. Unit Step Function:

$$u(t) = \begin{cases} 1; t < 0 \\ 0; t \geq 0 \end{cases}$$

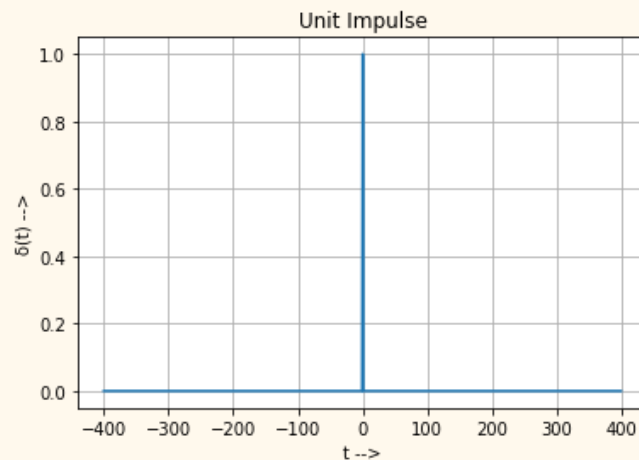


2. Unit Impulse Function:

$$\delta(t) = \begin{cases} 1; t = 0 \\ 0; t \neq 0 \end{cases}$$

or

$$\delta(t) = \frac{du(t)}{dt} = \lim_{\Delta t \rightarrow 0} \frac{u(t + \Delta t) - u(t)}{\Delta t}$$

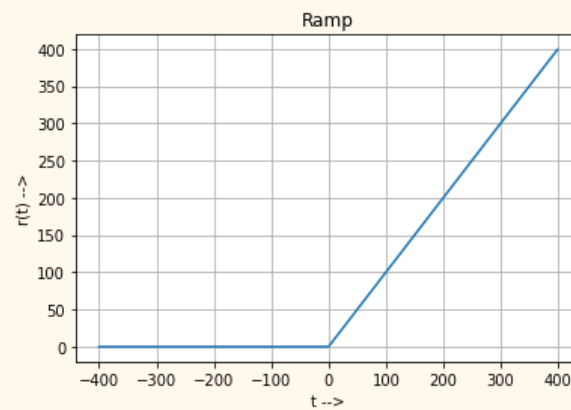


3. Ramp Function:

$$r(t) = \begin{cases} 1; & t \geq 0 \\ 0; & t < 0 \end{cases}$$

or

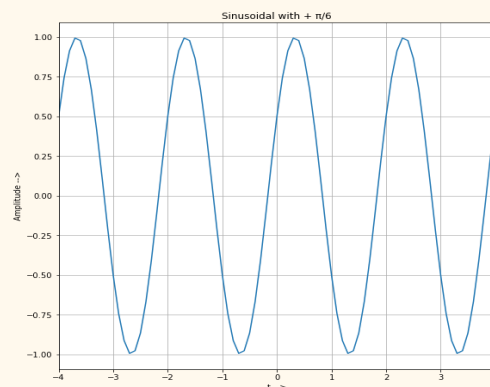
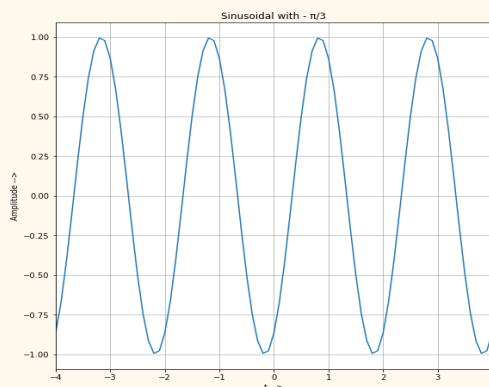
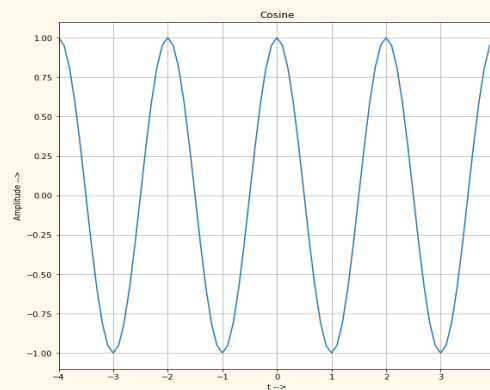
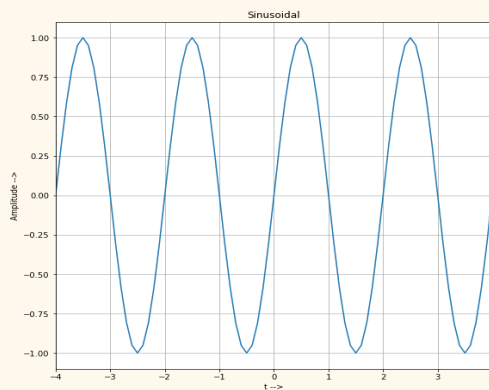
$$r(t) = \int_{-\infty}^t u(t) dt$$



4. Periodic Sinusoidal Sequences:

$$y = \sin(\omega t) \text{ or } \cos(\omega t)$$

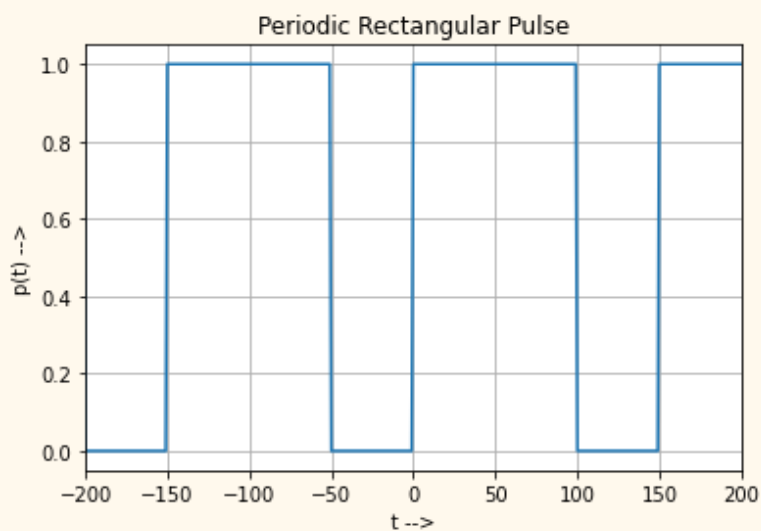
$$y = \sin(\omega t + \phi) \text{ or } \cos(\omega t + \phi)$$



5. Periodic Rectangular Pulse:

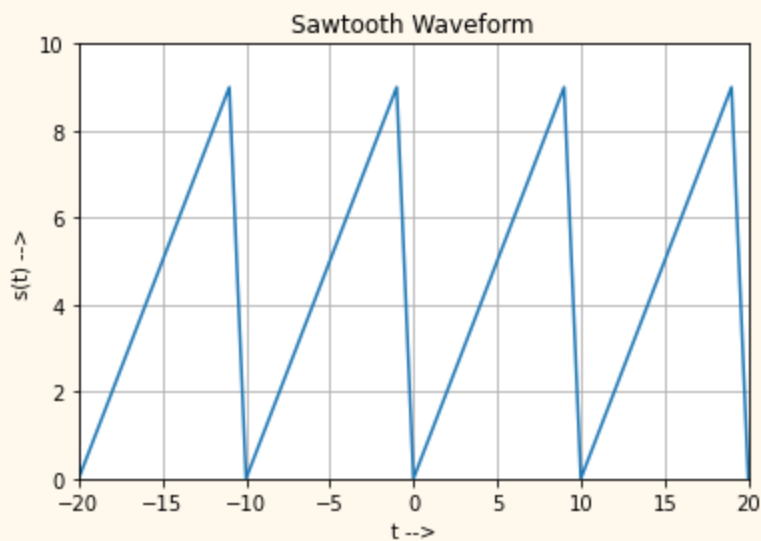
$$p(t) = \sum_{n=-\infty}^{\infty} A \cdot \text{rect}\left(\frac{t-nT}{T_p}\right) \text{ where}$$

$$\text{rect}(x) = \begin{cases} 1; & |x| \leq 0.5 \\ 0; & \text{otherwise} \end{cases}$$



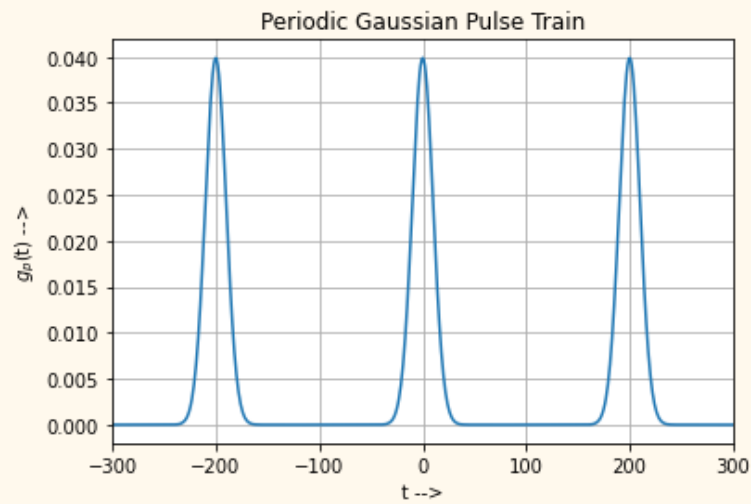
6. Asymmetric Sawtooth Waveform:

$$s(t) = A(t - nT) \text{ for } nT \leq t < (n + 1)T$$



7. Periodic Gaussian Pulse:

$$g_p(t) = \sum_{n=-\infty}^{\infty} A \cdot e^{-\frac{(t-nT)^2}{2\sigma^2}}$$



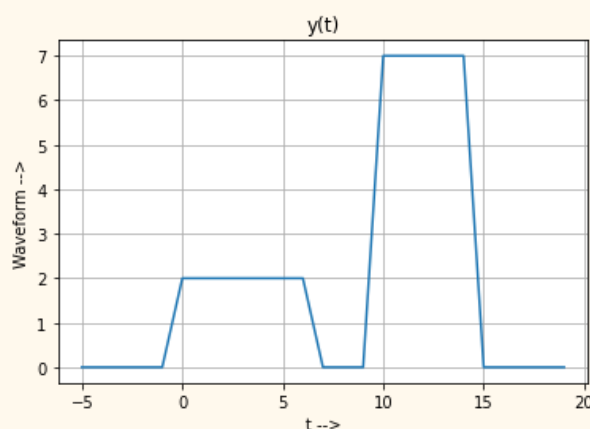
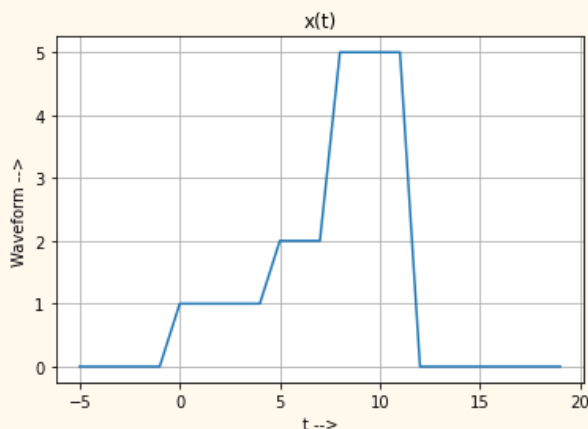
Lab 3. Basic Operation of Signal

$$x(t) = \begin{cases} 1, & 0 \leq t < 5 \\ 2, & 5 \leq t < 8 \\ 5, & 8 \leq t < 12 \\ 0, & t < 0 \text{ or } t \geq 12 \end{cases}$$

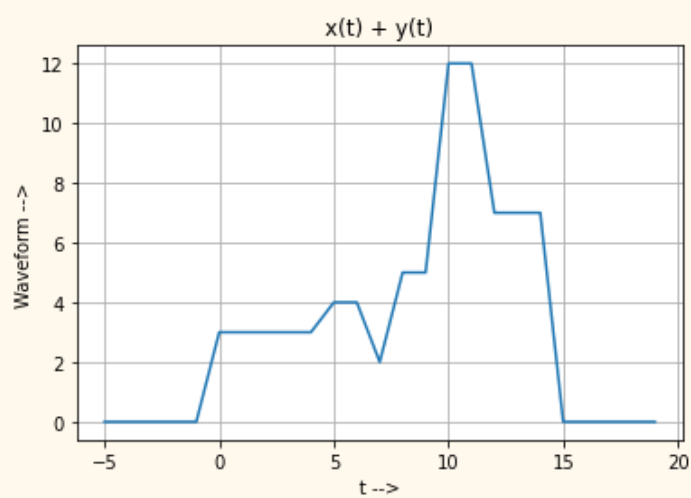
$$y(t) = \begin{cases} 2, & 0 \leq t < 7 \\ 0, & 7 \leq t < 10 \\ 7, & 10 \leq t < 15 \\ 0, & t < 0 \text{ or } t \geq 15 \end{cases}$$

1. Generate x and y and perform

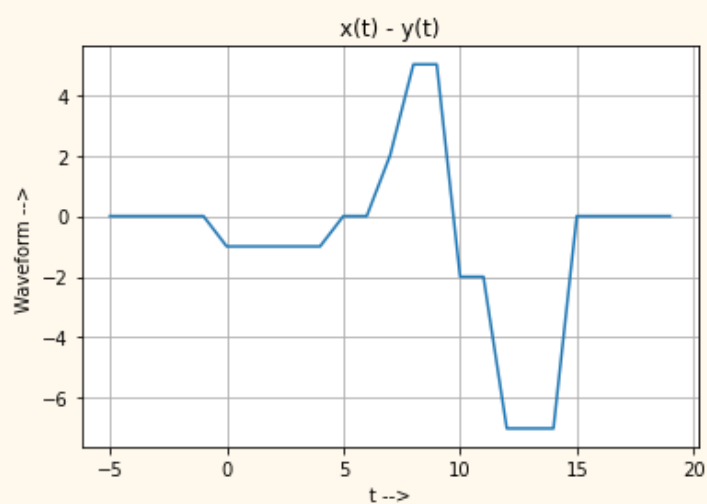
- $x(t) + y(t)$,
- $x(t) - y(t)$,
- $x(t) * y(t)$,
- $\frac{x(t)}{2} + \frac{y(t)}{3}$,
- $x(-t)$,
- $y(-t)$,
- $x(2t)$,
- $x(-2t + 5)$,
- $x(0.5t - 5)$
- $x(-0.5t - 5)$



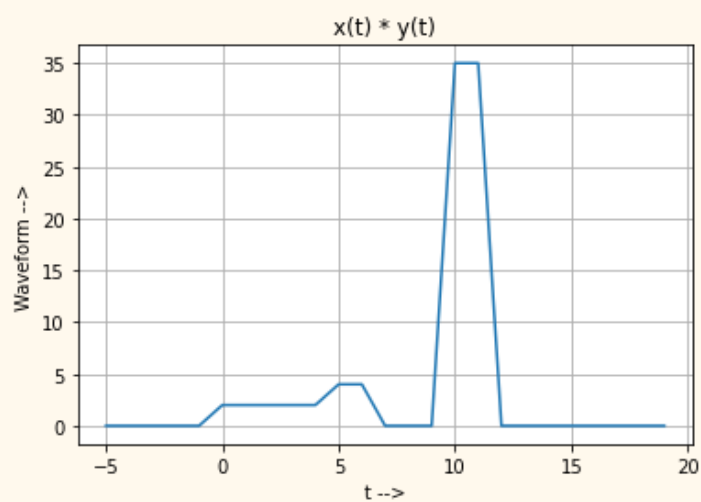
a.



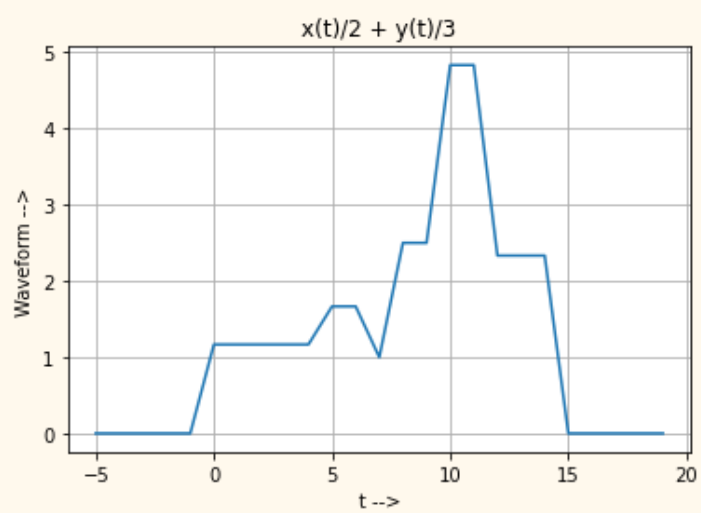
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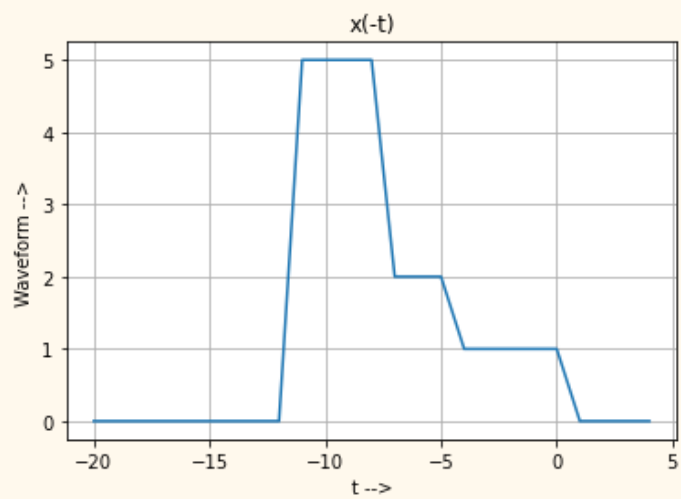
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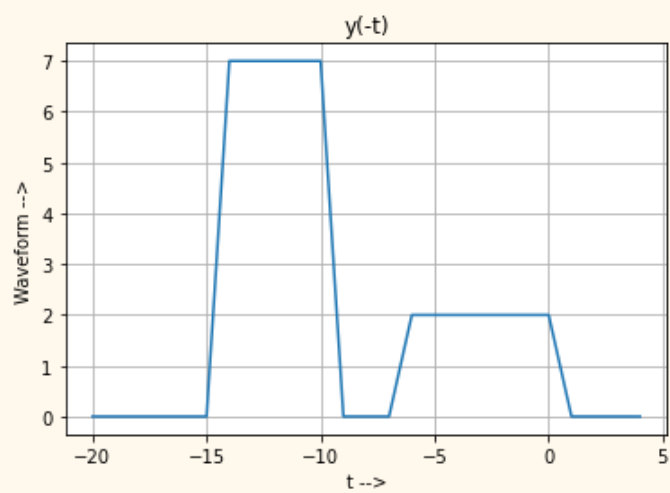
d.



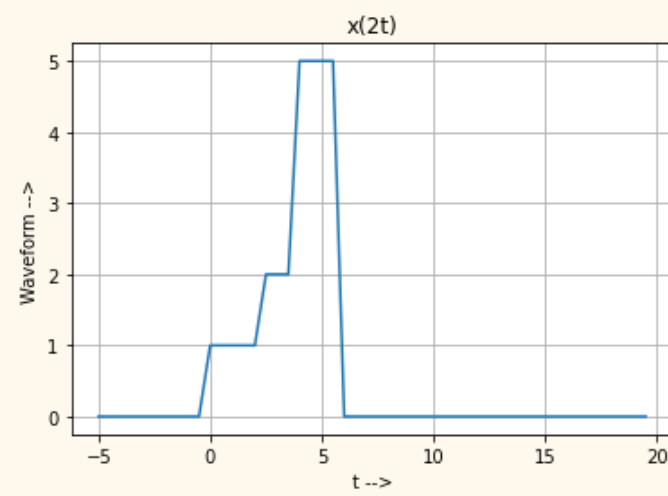
e.



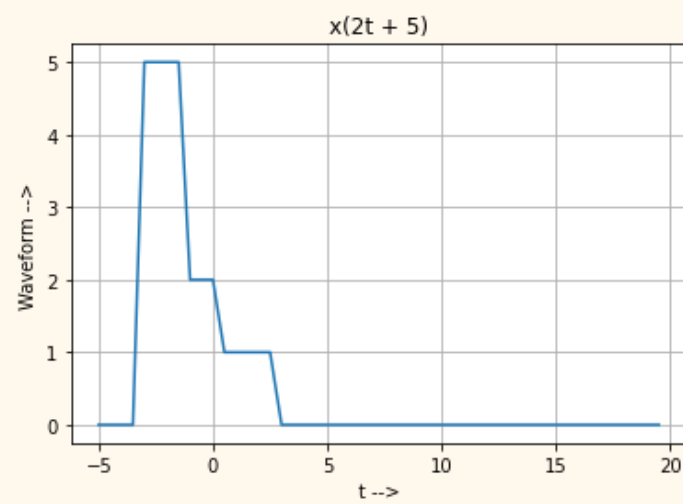
f.



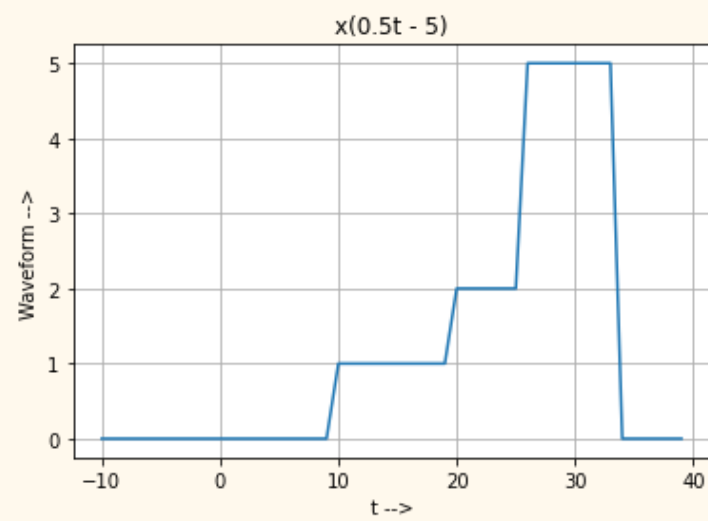
g.



h.



i.



j.

