

① Sketch the following signal:

(5 points < 2.5 points each)

②

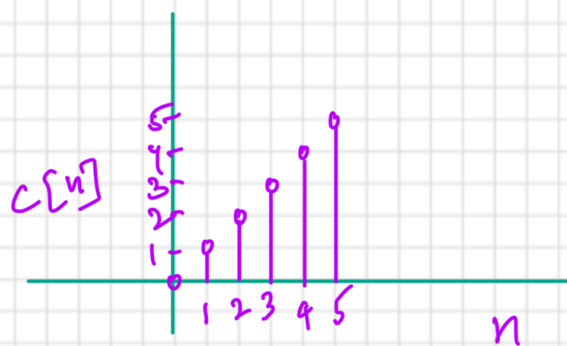
$$a[n] = u[n] - u[n-5]$$

Solution:



③ $c[n] = \sum_{k=1}^5 k \delta[n-k]$

Solution



② Find the even and odd components of the following discrete time signal:

$$x[n] = \begin{cases} 4-n & 0 \leq n \leq 4 \\ 0 & \text{otherwise.} \end{cases}$$

Solution:

the even component $x_e[n]$ is

$$x_e[n] = 0.5(x[n] + x[-n])$$

when $n=0$

$$x_e[0] = 0.5(x[0] + x[0]) = 0.5(4+4) = 4$$

$$4 \geq n \geq 1$$

$$\begin{aligned} x_e[n] &= 0.5 x[n] \quad (\text{as } x[-n] = 0) \\ &= 0.5 (4-n) \\ &= 2 - 0.5n \end{aligned}$$

$$-4 \leq n < 0$$

$$\text{or} \\ -4 \leq n \leq -1$$

$$\begin{aligned} x_e[n] &= 0.5 (x[n] + x[-n]) \\ &= 0.5 (0 + (4+n)) \\ &= 2 + 0.5n \end{aligned}$$

Hence,
$$x_e[n] = \begin{cases} 2 + 0.5n, & -4 \leq n \leq -1 \\ 4, & n = 0 \\ 2 - 0.5n, & 1 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$

For odd component:

$$x_o[n] = 0.5 (x[n] - x[-n])$$

$$n = 0$$

$$x_o[n] = 0.5 (x[0] - x[0]) = 0$$

$$4 \geq n \geq 1$$

$$\begin{aligned} x_o[n] &= 0.5 (x[n] - x[-n]) \quad \rightarrow 0 \text{ for negative } n. \\ &= 0.5 (4-n-0) = 2 - 0.5n \end{aligned}$$

$$-4 \leq n \leq -1$$

$$\begin{aligned} x_o[n] &= 0.5 (x[n] - x[-n]) \quad \rightarrow 0 \text{ for negative } n. \\ &= 0.5 (-(-4+n)) \\ &= -2 - 0.5n \end{aligned}$$

Hence
$$x_o[n] = \begin{cases} -2 - 0.5n, & -4 \leq n \leq -1 \\ 0, & n = 0 \\ 2 - 0.5n, & 1 \leq n \leq 4 \\ 0, & \text{otherwise} \end{cases}$$