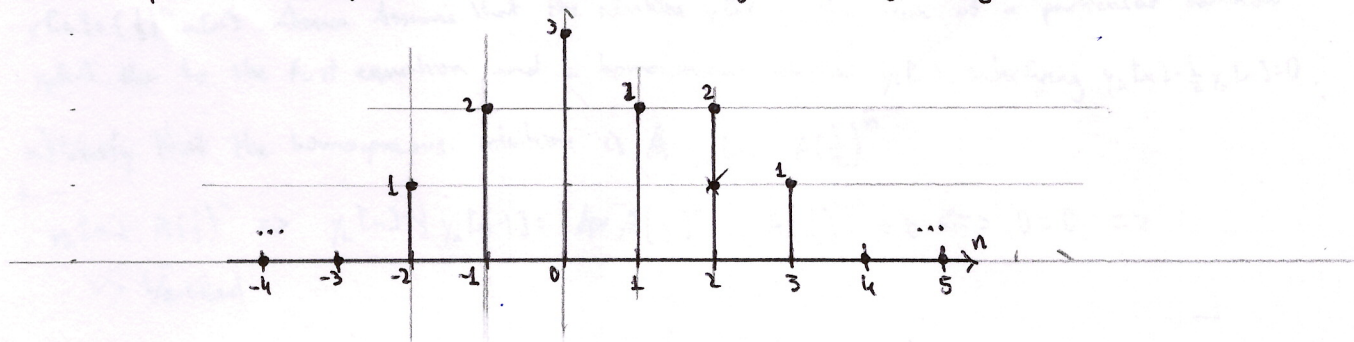


2.34. Consider the LTI system initially at rest and described by $y[n] + 2y[n-1] = x[n] + 2x[n-2]$,

Find the response of this system to the sketched input by recursively solving the equation.



$$y[n] = 0 \quad \forall n \leq -3 \Leftarrow x[n] = 0 \quad \forall n \leq -3$$

$$y[-2] = x[-2] + 2x[-4] - 2y[-3] = x[-2] = 1$$

$$y[-1] = x[-1] + 2x[-3] - 2y[-2] = 2 + 0 - 2 \cdot 1 = 0$$

$$y[0] = x[0] + 2x[-2] - 2y[-1] = 3 + 2 \cdot 1 - 2 \cdot 0 = 5$$

$$y[1] = x[1] + 2x[-1] - 2y[0] = 2 + 2 \cdot 2 - 2 \cdot 5 = -4$$

$$y[2] = x[2] + 2x[0] - 2y[1] = 2 + 2 \cdot 3 - 2 \cdot (-4) = 16$$

$$y[3] = x[3] + 2x[1] - 2y[2] = 1 + 2 \cdot 2 - 2 \cdot 16 = -27$$

$$y[4] = x[4] + 2x[2] - 2y[3] = 0 + 2 \cdot 2 - 2 \cdot (-27) = 58$$

$$y[5] = x[5] + 2x[3] - 2y[4] = 0 + 2 \cdot 1 - 2 \cdot (58) = -114$$

$$y[6] = x[6] + 2x[4] - 2y[5] = -2y[5] = 228$$

$$y[n] = -2y[n-1] \quad \forall n \geq 6 \Rightarrow y[n] = (-2)^{n-5} y[5] \quad \forall n \geq 6 = (-2)^{n-5} \cdot 228 \quad \forall n \geq 6$$