2.16 For each of the following difference equations

(iii) $y[n+1] - 0.8y[n] = x[n]$

use the method of recursion to solve the following problems:

(a) Compute $y[n]$ for $n = 0, 1, 2$, when $x[n] = 0$ for all n and $y[-1] = 2$.

(b) Compute $y[n]$ for $n = 0, 1, 2$, when $x[n] = u[n]$ and $y[-1] = 0$.

(c) Compute $y[n]$ for $n = 0, 1, 2$, when $x[n] = u[n]$ and $y[-1] = 2$.

- Do problem manually. [Hint: Exploit time-invariance to re-index I/O difference equation.]

Use time-invariance to re-index the difference equations, i.e., $n \rightarrow n-1$.

$$y[n] - 0.8y[n-1] = x[n-1]$$

$$\boxed{y[n] = 0.8y[n-1] + x[n-1]}$$

a) Given $x[n] = 0$ and $y[-1] = 2$

$n=0$ $y[0] = 0.8y[-1] + 0 = 0.8(2) = \underline{1.6}$

$n=1$ $y[1] = 0.8y[0] + 0 = \underline{1.28}$ ($y[0] \rightarrow 1.6$)

$n=2$ $y[2] = 0.8y[1] + 0 = \underline{1.024}$ ($y[1] \rightarrow 1.28$)

b) Given $x[n] = u[n]$ & $y[-1] = 0$

$n=0$ $y[0] = 0.8y[-1] + u[-1] = \underline{0}$ ($y[-1] \rightarrow 0$, $u[-1] \rightarrow 0$)

$n=1$ $y[1] = 0.8y[0] + u[0] = \underline{1}$ ($y[0] \rightarrow 0$, $u[0] \rightarrow 1$)

$n=2$ $y[2] = 0.8y[1] + u[1] = \underline{1.8}$ ($y[1] \rightarrow 1$, $u[1] \rightarrow 1$)

c) Given $x[n] = u[n]$ and $y[-1] = 2$

$n=0 \quad y[0] = 0.8\,y[-1] + u[-1] = \underline{1.6}$ ($y[-1] \to 2$)

$n=1 \quad y[1] = 0.8\,y[0] + u[0] = \underline{2.28}$ ($y[0] \to 6$, $u[0] \to 1$)

$n=2 \quad y[2] = 0.8\,y[1] + u[1] = \underline{2.824}$ ($y[1] \to 2.28$, $u[1] \to 1$)