1-a) $X_I(s) = \int_0^{\infty} 1\, e^{-st}\, dt = \frac{1}{s}$, $Re(s) > 0$

b) $X_I(s) = \int_0^{\infty} \left(\underbrace{\delta(t+1)}_{0} + \underbrace{\delta(t)}_{1} + e^{-2(t+3)} u(t+1) \right) e^{-st}\, dt$

$= 1 + \int_0^{\infty} e^{-2(t+3)} e^{-st}\, dt = 1 + \frac{e^{-6}}{s+2}$ $\quad Re(s) > -2$

c) $x(t) = \underbrace{8\cos(\pi t/2)u(t)}_{x_1(t)} * \underbrace{[u(t) - u(t-1)]}_{x_2(t)}$

$X_{I_1}(s) = \frac{8s}{s^2 + \frac{\pi^2}{4}}$ $\quad X_{I_2}(s) = \frac{1}{s} - \frac{e^{-s}}{s} = \frac{1-e^{-s}}{s}$

$X_I(s) = X_{I_1}(s) \cdot X_{I_2}(s) = \frac{8s}{s^2 + \frac{\pi^2}{4}} \cdot \frac{1-e^{-s}}{s} = \frac{8(1-e^{-s})}{s^2 + \frac{\pi^2}{4}}$ $\quad Re(s) > 0$

2) $x(t) = e^{s_k t}$ $\quad y(t) = H(s_k) e^{s_k t}$

$\left. \begin{array}{l} x(t) = e^{2t} \\ y(t) = \frac{1}{6} e^{2t} \end{array} \right\}$ $H(2) = \frac{1}{6}$ //

$sH(s) + 2H(s) = \frac{1}{s+4} + \frac{b}{s}$
$\quad (s) \quad (s+4)$

$H(s)(s+2) = \frac{s + b(s+4)}{s.(s+4)}$ $\quad H(s) = \frac{s+b(s+4)}{s.(s+4)(s+2)} \Rightarrow H(2) = \frac{2+b(6)}{2.6.4}$

$H(2) = \frac{1}{6}$

$\frac{2+6b}{2 \cdot \cancel{6} \cdot 4} = \frac{1}{\cancel{6}}$ $\quad 2 + 6b = 8$ $\quad b = 1$ //

$H(s) = \frac{2(s+2)}{s(s+4)(s+2)} = \frac{2}{s(s+4)}$ //

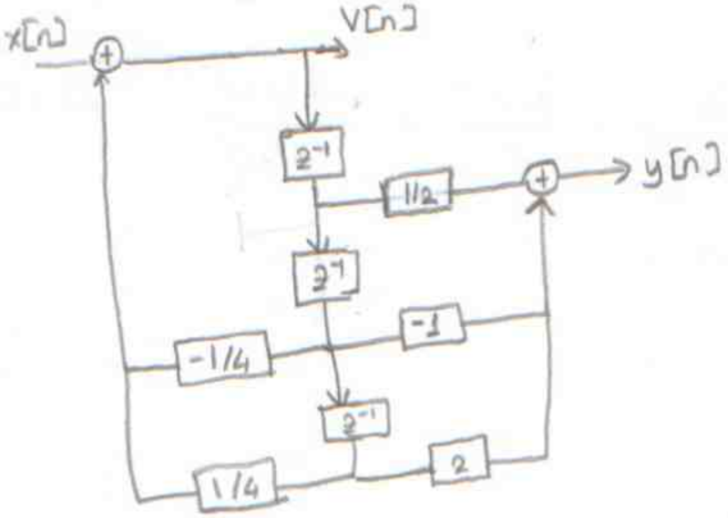
3) a) $H(z) = \dfrac{z^2-2z+4}{(z-\frac{1}{2})(2z^2+z+1)} = \dfrac{z^2-2z+4}{2z^3+z^2+z-z^2-\frac{1}{2}z-\frac{1}{2}}$

$$H(z) = \frac{z^2-2z+4}{2z^3+\frac{1}{2}z-\frac{1}{2}} = \frac{\frac{1}{2}z^{-1}-1z^{-2}+2z^{-3}}{1+\frac{1}{4}z^{-2}-\frac{1}{4}z^{-3}}$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{V(z)}{X(z)}\cdot\frac{Y(z)}{V(z)} = \left(\frac{1}{1+\frac{1}{4}z^{-2}-\frac{1}{4}z^{-3}}\right)\left(\frac{1}{2}z^{-1}-1z^{-2}+2z^{-3}\right)$$

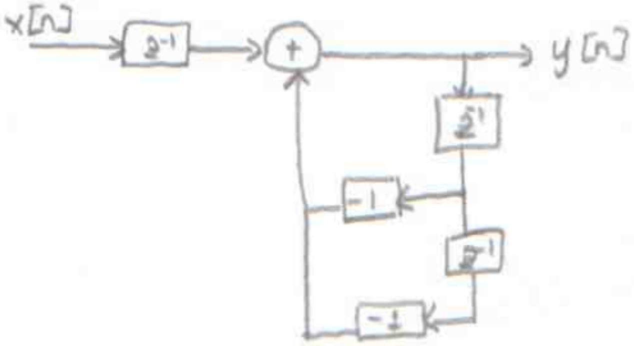
$v[n]\left(1+\frac{1}{4}z^{-2}-\frac{1}{4}z^{-3}\right) = x[n]$ $\qquad$ $y[n] = v[n]\left(\frac{1}{2}z^{-1}-1z^{-2}+2z^{-3}\right)$

$v[n] = x[n] - \frac{1}{4}v[n-2] + \frac{1}{4}v[n-3]$ $\qquad$ $y[n] = \frac{1}{2}v[n-1] - v[n-2] + 2v[n-3]$



b) $H(z) = \dfrac{z}{z^2+z+1} = \dfrac{z^{-1}}{1+z^{-1}+z^{-2}}$ $\qquad$ $y[n]+y[n-1]+y[n-2] = x[n-1]$

$y[n] = x[n-1]-y[n-1]-y[n-2]$



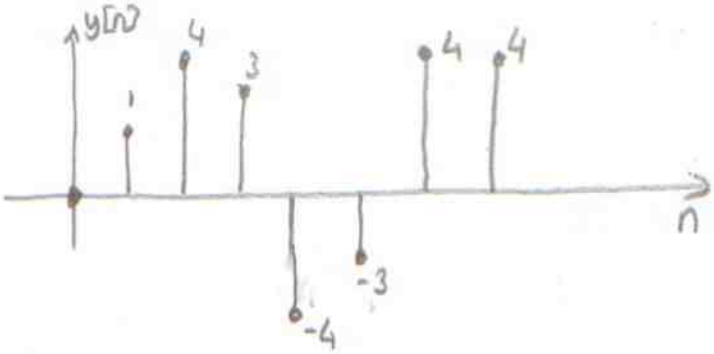
4) $Y(z) = X(z)\,H(z)$

$$X(z) = \sum_{n=-\infty}^{\infty} x[n] z^{-n} \longrightarrow \quad X(z) = 1 + 2z^{-1} - z^{-2} - 2z^{-3} + z^{-4} + 2z^{-5}$$

$$H(z) = z^{-1} + 2z^{-2}$$

$$Y(z) = X(z)H(z)$$

$$= z^{-1} + 4z^{-2} + 3z^{-3} - 4z^{-4} - 3z^{-5} + 4z^{-6} + 4z^{-7}$$



5) a) $H(z) = \dfrac{2(z+1)}{(z-\frac{1}{3})(z-2)(z-3)} = \dfrac{A}{z-\frac{1}{3}} + \dfrac{B}{z-2} + \dfrac{C}{z-3}$

$$A = \frac{2.(4/3)}{(-5/3)(-8/3)} = \frac{3}{5}$$

$$B = \frac{2.(3)}{(5/3)(-1)} = -\frac{18}{5} \qquad 8$$

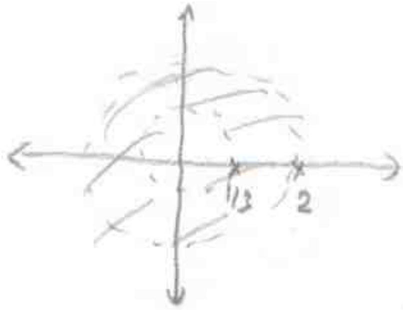
$$C = \frac{2.(4)}{(8/3)(1)} = 3$$

$\frac{1}{3} < |z| < 2 \quad \rightarrow$ birim çemberi içermelidir

$$h[n] = \left(\frac{3}{5}\right)\left(\frac{1}{3}\right)^n u[n] - \left[3(3)^n - \frac{18}{5}(2)^n\right] u[-n-1] \qquad 7$$

b) sistem nedensel değildir, kararlıdır. 5

b)



nedensel değil, kararlı

↑ sol taraflı işaret içerdiği için

↑ birim çemberi içerdiği için

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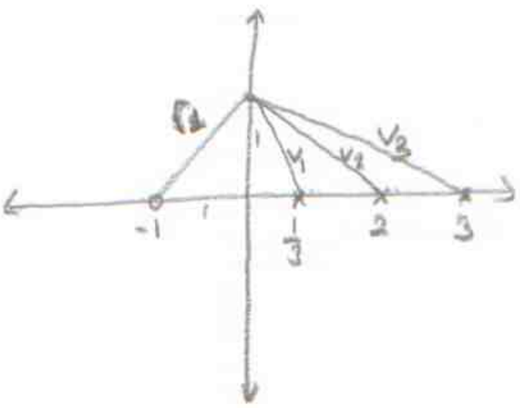
c) $$H(e^{jw}) = \frac{2\,(e^{jw}+1)}{(e^{jw}-\frac{1}{3})\,(e^{jw}-2)\,(e^{jw}-3)}$$

$$|H(e^{jw})| = \frac{|2|\sqrt{(\cos w+1)^2+\sin^2 w}}{\sqrt{(\cos w-\frac{1}{3})^2+\sin^2 w}\;\sqrt{(\cos w-2)^2+\sin^2 w}\;\sqrt{(\cos w-3)^2+\sin^2 w}}$$

$$\angle H(e^{jw}) = \text{arctg}\left(\frac{\sin w}{\cos w+1}\right) - \left[\text{arctg}\left(\frac{\sin w}{\cos w-\frac{1}{3}}\right) + \text{arctg}\left(\frac{\sin w}{\cos w-2}\right) + \text{arctg}\left(\frac{\sin w}{\cos w-3}\right)\right.$$

$$|H(e^{j\frac{\pi}{2}})| = \frac{(2)\sqrt{1+1}}{\sqrt{\frac{1}{9}+1}\;\sqrt{10}\;\sqrt{5}} = \frac{|2|\sqrt{2}}{\sqrt{\frac{10}{9}}\sqrt{5}\sqrt{10}} = \frac{6\sqrt{2}}{10\sqrt{5}} = 0{,}379$$

10



$r_1 = \sqrt{1+1} = \sqrt{2}$

$v_1 = \sqrt{(\frac{1}{3})^2+1} = \sqrt{\frac{10}{9}}$

$v_2 = \sqrt{(2)^2+1} = \sqrt{5}$

$v_3 = \sqrt{3^2+1} = \sqrt{10}$

$$|H(e^{j\frac{\pi}{2}})| = \frac{2\sqrt{2}}{\sqrt{\frac{10.10}{9}.5}} = \frac{6\sqrt{2}}{10\sqrt{5}} = 0{,}379$$