

$$3a.) \frac{Y(z)}{X(z)} = H(z) = \frac{1+z^{-1}}{1-\frac{3}{5}z^{-1}+\frac{2}{25}z^{-2}}$$

$$Y(z) = \frac{3}{5} Y(z) z^{-1} + \frac{2}{25} z^{-2} Y(z) = X(z) + X(z) z^{-1}$$

inverse transform

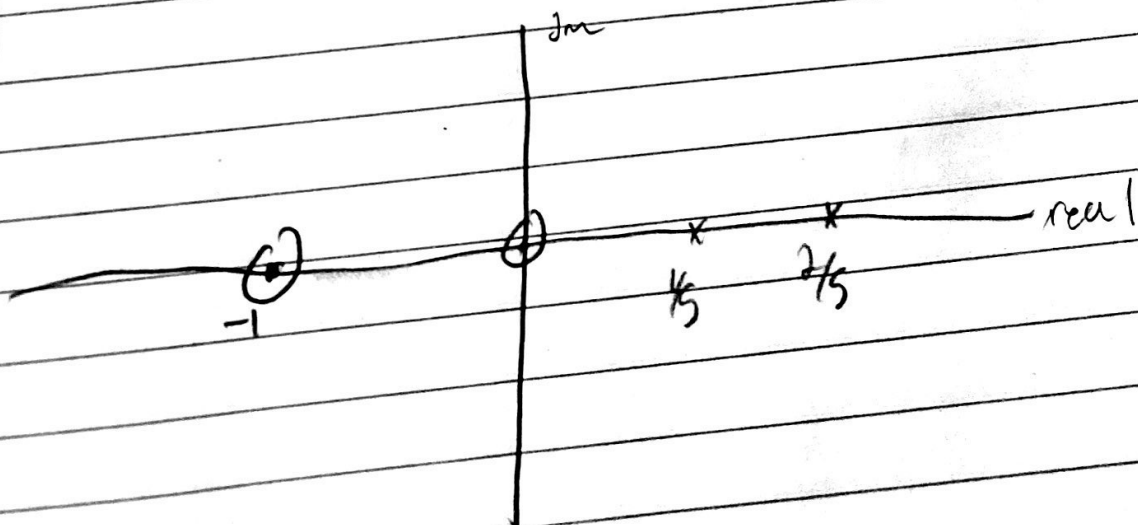
$$y(n) = \frac{3}{5} y(n-1) + \frac{2}{25} y(n-2) = x(n) + x(n-1)$$

$$3) b.) \text{ gain} = \frac{201}{403} = \frac{1}{6}$$

3) c.) re write

$$H(z) = \frac{(z+1)z}{(25z^2-15z+2)} = \frac{(z+1)z}{(5z-1)(5z-2)}$$

zeros at  $-1, 0$   
poles at  $\frac{1}{5}, \frac{2}{5}$



$$3d.) \quad H(z) = \frac{1+z^{-1}}{1-\frac{3}{9}z^{-1} + \frac{2}{29}z^{-2}}$$

$$H(z) = \frac{z^2(z+1)}{z^2[3z - \frac{3}{9} + \frac{2}{29}z]} = \frac{z^2(z+1)}{3z^2 - \frac{3}{9}z + \frac{2}{29}z^2}$$

$$H(z) = \frac{z^2(z+1)}{z^2 - \frac{3}{9}z + \frac{2}{29}z^2} = \frac{z^2(z+1)}{z^2 - 0.62z + 0.08}$$

$$H(z) = \frac{(z^2 - 0.62z + 0.08)(z+1)}{z^2 - 0.62z + 0.08}$$

$$H(z) = \frac{1 + 1.62z - 0.48}{z^2 - 0.62z + 0.08}$$

$$H(z) = \frac{1 + 1.62z - 0.48}{(z^2 - 0.4)(z - 0.2)} \rightarrow \frac{1.62z - 0.48}{(z - 0.4)(z - 0.2)}$$

Roc is  $|z| > 0.2$

3e)  $H(z) = \frac{1-0.5}{z-0.4} + \frac{2.4}{z-0.2}$  inverse Z transform

$$h(n) = 0.8(n-1) + 2.4(0.2)^{n-1} u(n-1)$$

$$h(n) = \frac{1+0.8}{(1-0.4)} + 2.4 \left[ \frac{1}{1-0.2} \right] + 1.32 - 0.48$$

$$= 1 - \frac{.8}{.6} + \frac{2.4}{.8} + .32 - .41$$

$$\Rightarrow \frac{96 - 4}{25 \cdot 5}$$

$$h(n) = 2.606 < a \quad \boxed{\therefore \text{stable}}$$

$$3f.) \quad y(n) = 2\left(\frac{2}{3}\right)^n u(n) - \left(\frac{1}{3}\right)^n u(n)$$

$$y(z), \quad \frac{2z}{z-.4} - \frac{z}{z-.2}$$

$$z \left[ \frac{2z-.4}{z-.4} - \frac{z}{z-.2} \right]$$

$$= z \left[ \frac{2}{z-.4} - \frac{1}{z-.2} \right]$$

$$= z \left[ \frac{2z-.4}{(z-.4)(z-.2)} - \frac{z}{(z-.4)(z-.2)} \right]$$

$$y(z) = \frac{z(z)}{(z-.4)(z-.2)} \quad \rightarrow y(z) = H(z) \cdot x(z)$$

$$\frac{z^2}{(z-.4)(z-.2)} = \frac{z^2+z}{(z-.4)(z-.2)} \cdot x(z)$$

$$x(z) = \frac{z^2}{z^2+z}$$

$$x(z) = \frac{z}{z+1}$$

$z+1$   $\rightarrow$   $z$ -transform

$$x(n) \cdot (-1)^n u(n)$$