1a. $Y(z)-5(z^{-1}Y(z)+y[-1])+6(z^{-2}Y(z)+z^{-1}y[-1]+y[-2])=\frac{4z}{z-1}$. Substitute $y[-1]=y[-2]=1$:

$Y(z)(1-5z^{-1}+6z^{-2})=\frac{4z}{z-1}-[(6-5)+6z^{-1}]\frac{z-1}{z-1} \rightarrow Y(z)=\frac{3z^3-5z^2+6z}{(z-2)(z-3)(z-1)}$.

$\frac{Y(z)}{z}=\frac{3z^2-5z+6}{(z-1)(z-2)(z-3)}=\frac{2}{z-1}-\frac{8}{z-2}+\frac{9}{z-3} \rightarrow y[n]=\boxed{[2-8(2)^n+9(3)^n]u[n]}=\{\underline{3},13,51,181,603\ldots\}$

1b. `Y(1)=1;Y(2)=1;for I=3:7;Y(I)=4+5*Y(I-1)-6*Y(I-2);end;Y`→same answer.

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

2b. ZEROS: -1; POLES: -2. (2c) $h[n]=\boxed{3(-2)^n u[n]+3(-2)^{n-1}u[n-1]}$.

2d. $\frac{Y(z)}{X(z)}=H(z)=3\frac{z+1}{z+2}$. Cross-multiply→$\boxed{y[n]+2y[n-1]=3x[n]+3x[n-1]}$.

3a. $6=H(0)=C\frac{(0-3)(0-4)}{(0-1)(0-2)} \rightarrow C=1$. $H(z)=\boxed{\frac{z^2-7z+12}{z^2-3z+2}}$.

3b. $Y(z)=H(z)X(z)=\frac{z^2-7z+12}{z^2-3z+2}\frac{z^2-3z+2}{z^2}=\frac{z^2-7z+12}{z^2} \rightarrow \boxed{\{\underline{1},-7,12\}}$

3c. $\frac{H(z)}{z}=\frac{z^2-7z+12}{z(z-1)(z-2)}=\frac{6}{z}-\frac{6}{z-1}+\frac{1}{z-2} \rightarrow h[n]=\boxed{6\delta[n]-6u[n]+(2)^n u[n]}$.

3d. $\frac{Y(z)}{X(z)}=H(z)=\frac{z^2-7z+12}{z^2-3z+2} \rightarrow \boxed{y[n]-3y[n-1]+2y[n-2]=x[n]-7x[n-1]+12x[n-2]}$.

4a. Because this difference equation is $\boxed{\text{unstable}}$, since poles $\{3,4\}$ outside the unit circle..

4b. $G(z)=\frac{1}{H(z)}=\frac{z^2}{(z-3)(z-4)}$. $\frac{G(z)}{z}=\frac{4}{z-4}-\frac{3}{z-3} \rightarrow g[n]=\boxed{3(3)^n u[-n-1]-4(4)^n u[-n-1]}$.

4c. $g[n]=\{\ldots 3^{-9}-4^{-9},3^{-8}-4^{-8}\ldots 3^{-1}-4^{-1},0,\underline{0}\}$. Delay this by 10.

`N=-10:-1;G=3.^(N+1)-4.^(N+1);conv(G,[1 -7 12])`. Output≈0 except at index=11.

5a. A reverbed "Matlab–Breakfast of Champions" (sounds like a science fiction film).

5b. Z-transform: $Y(z)=X(z)(1+(0.8)z^{-3(1024)}+(0.8)^2z^{-6(1024)}+(0.8)^3z^{-9(1024)}+\ldots)$

$=\frac{X(z)}{1-0.8z^{-3072}} \rightarrow H(z)=\boxed{\frac{1}{1-0.8z^{-3072}}}$. Minimum phase→stable & causal g[n] exists.

5c. $G(z)=\frac{1}{H(z)}=1\text{-}0.8z^{-3072} \rightarrow \boxed{x[n]=y[n]-0.8y[n-3072]}$. Obvious once you see it.

5d. `Y=filter([1 zeros(1,3071) -0.8],[1],X)`. 3 nonzero numbers (two are ones).

`X` is from `X=filter([1],[1 zeros(1,3071) -0.8],X1)`; `X1` is from `p1.mat`.