Solution to problem 5 of HW3

5)

y[n]-0.3y[n-1]-0.04y[n-2]=x[n]+2x[n-1]

for homogeneous solution let $y_h[n] = \lambda^n$. Thus the charecteristic function is

$$\lambda^n - 0.3\lambda^{n-1} - 0.04\lambda^{n-2} = 0$$
$$\lambda^{n-2}(\lambda^2 - 0.3\lambda^1 - 0.04) = 0$$
$$\lambda^{n-2}(\lambda - 0.4)(\lambda + 0.1) = 0$$

thus, $y_h[n] = c_1(0.4)^n + c_2(-0.1)^n$

for impulse response, we let $x[n] = \delta[n]$ and $y_p[n] = k\delta[n]$ for n>0

because for n>0 $\delta[n] = 0$, thus our solution is only of the homogeneous one ,i.e. $y[n] = h[n] = y_h[n]$.

n=0 : y[0]-0.3y[-1]-0.04y[-2]=x[0]+2x[-1]
y[0]+0 +0 = 1 +0 ➔ y[0]=1

n=1 : y[1]-0.3y[0]-0.04y[-1]=x[1]+2x[0]
y[1]-0.3y[0] +0 = 0 + 2 ➔ y[1]=2.3

solve for c_1 and c_2 by plugging y[0]=1 and y[1]=2.3 in $y\ [n] = c_1(0.4)^n + c_2(-0.1)^n$

we get $c_1 = 4.8$ and $c_2 = -3.8$