PROBLEM:

Suppose that a system is defined by the following operator

$$H(z) = (1 + z^{-1})\frac{1 + z^{-2}}{1 + 0.5z^{-1}}$$

(a) Write the time-domain description of this system—in the form of a difference equation.

(b) This system can "null" certain input signals. Determine *all* input frequencies $\hat{\omega}_\circ$, for which the response to $x[n] = \cos(\hat{\omega}_\circ n)$ is equal to zero.

(c) When the input to the system is the unit-step signal $x[n] = u[n]$ determine the output signal $y[n]$ in the form:

$$y[n] = K_1\alpha^n u[n] + K_2 u[n] + K_3\delta[n-1]$$

Give numerical values for the constants K_1, K_2 and α. Verify that K_2 is equal to $H(z)$ at $z = 1$. Hint: this system is stable, so the value for $|\alpha|$ must be less than one. Thus, $y[n] \to K_2$, as $n \to \infty$