PROBLEM:

In the following cascade of systems, all of the individual transfer functions are known.

$$x[n] \longrightarrow \boxed{H_1(z)} \xrightarrow{v_1[n]} \boxed{H_2(z)} \xrightarrow{v_2[n]} \boxed{H_3(z)} \xrightarrow{y[n]}$$

$$H_1(z) = z^{-2} + z^{-3} \qquad H_2(z) = 4 - 3z^{-1} \qquad H_3(z) = \frac{10}{8 - 10z^{-1} + 3z^{-2}}$$
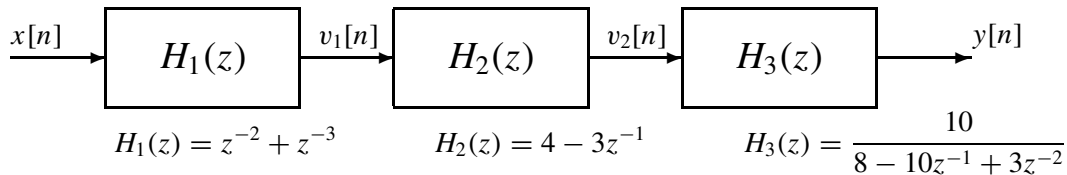
(a) Find the second output $v_2[n]$ when the input signal $x[n]$ is an impulse, i.e., $x[n] = \delta[n]$. Give a general formula in terms of α and β for $n \geq 0$.

(b) Determine $H(z)$ the z-transform of the cascaded system. Simplify $H(z)$ by factoring the numerator and denominator.

(c) Consider the impulse response of the cascaded system, i.e., the response $y[n]$ when the input is $x[n] = \delta[n]$. Prove that the impulse response has the form $h[n] = G\,\alpha^n$ for $n \geq 4$. Find values for α and G.