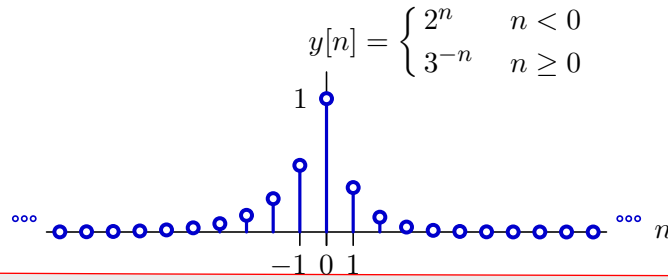## Find the Coefficients

Find constants c_1, c_2, and c_3 so that the solution to the difference equation

$$c_1 y[n-1] + c_2 y[n] + c_3 y[n+1] = \delta[n]$$

is equal to the signal $y[n]$ shown below.

$$y[n] = \begin{cases} 2^n & n < 0 \\ 3^{-n} & n \geq 0 \end{cases}$$

The difference equation must be true for all n.

If $n = 0$, the difference equation requires $\frac{1}{2}c_1 + c_2 + \frac{1}{3}c_3 = 1$.

If $n = -1$, the difference equation requires $\frac{1}{4}c_1 + \frac{1}{2}c_2 + c_3 = 0$. Notice that this same constraint on c_1, c_2, and c_3 results for all values of $n < 0$.

If $n = 1$, the difference equation requires $c_1 + \frac{1}{3}c_2 + \frac{1}{9}c_3 = 0$. Notice that this same constraint on c_1, c_2, and c_3 results for all values of $n > 0$.

Solving these equations yields a single unique solution, $c_1 = -2/5$, $c_2 = 7/5$, and $c_3 = -3/5$.