Problem Wk.5.4.1: System behavior

Part 1: Stable?

We say that a system is **stable** if, for a bounded, transient input, its output converges to zero as n goes to infinity.

The systems below are specified either as a difference equation or as a system function.

Enter the **magnitude** of the dominant pole for each system and then enter whether the system is stable (type **yes** or **no**) and whether its response is oscillatory (type **yes** or **no**).

Note that strictly alternating signal corresponds to an oscillation of period 2.

Hint: use the `SystemFunction` class from lab. But, be careful about integer division when defining the coefficients, use 5.0/6, not 5/6.

1. $y[n] = \frac{5}{6}y[n-1] + y[n-2] + x[n]$

   dominant pole magnitude:

   stable?:

   oscillatory?:

2. $\frac{1}{1 + \frac{5}{4}R + \frac{3}{8}R^2}$

   dominant pole magnitude:

   stable?

   oscillatory?

3. $y[n] = -\frac{3}{2}y[n-1] - \frac{9}{8}y[n-2] + x[n]$

   dominant pole magnitude:

   stable?

   oscillatory?

4. $\frac{1}{1 + R + \frac{1}{2}R^2}$

   dominant pole magnitude:

   stable?

oscillatory?

Part 2: DiffEq Behavior

For the four sequences given in the following four plots, which difference equation (A,B, C, or D) could have generated the sequence (given a unit sample input). Hint: Think about the poles of the corresponding systems.

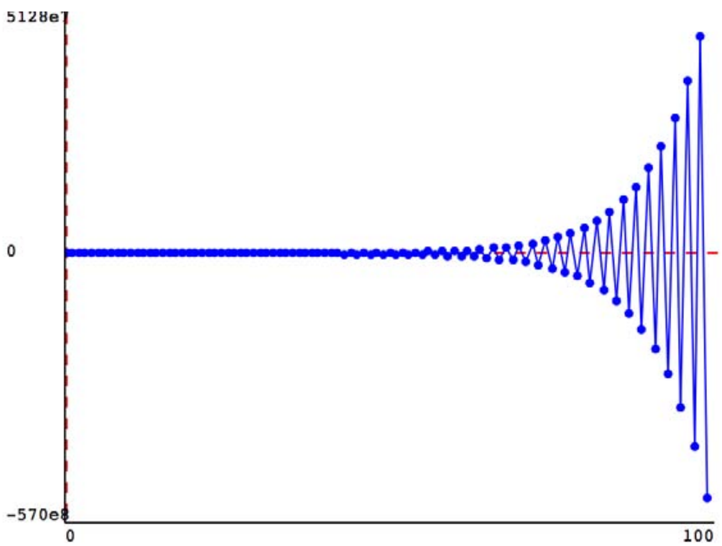
Assume the input `x[n]= 0` for `n > 1` .

A. $y[n] = \frac{13}{8} y[n-1] - \frac{42}{64} y[n-2] + x[n]$

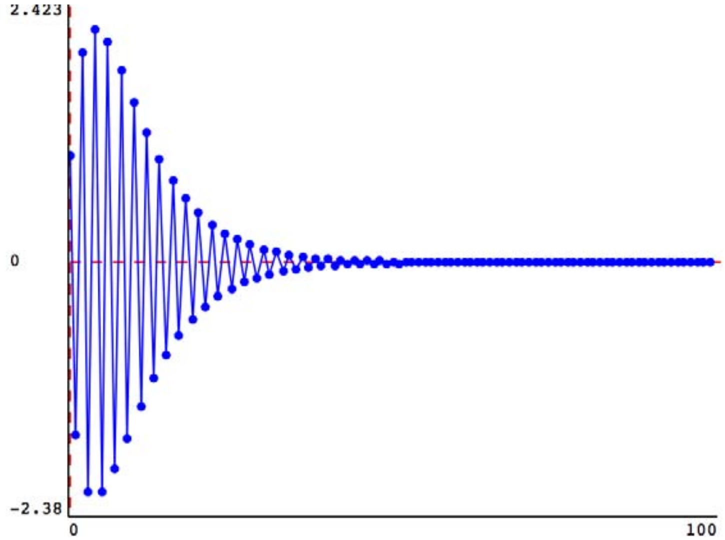
B. $y[n] = -\frac{13}{8} y[n-1] - \frac{42}{64} y[n-2] + x[n]$

C. $y[n] = -\frac{16}{8} y[n-1] - \frac{63}{64} y[n-2] + x[n]$

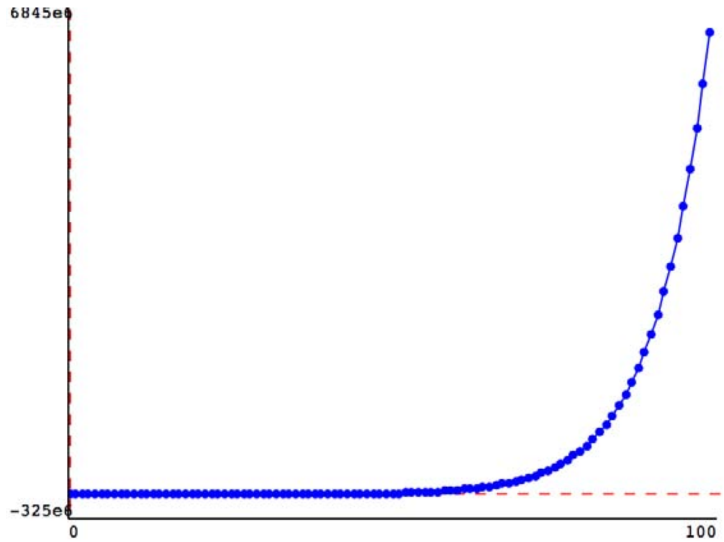
D. $y[n] = \frac{2}{8} y[n-1] + \frac{63}{64} y[n-2] + x[n]$

1. 

2.



3.



4.