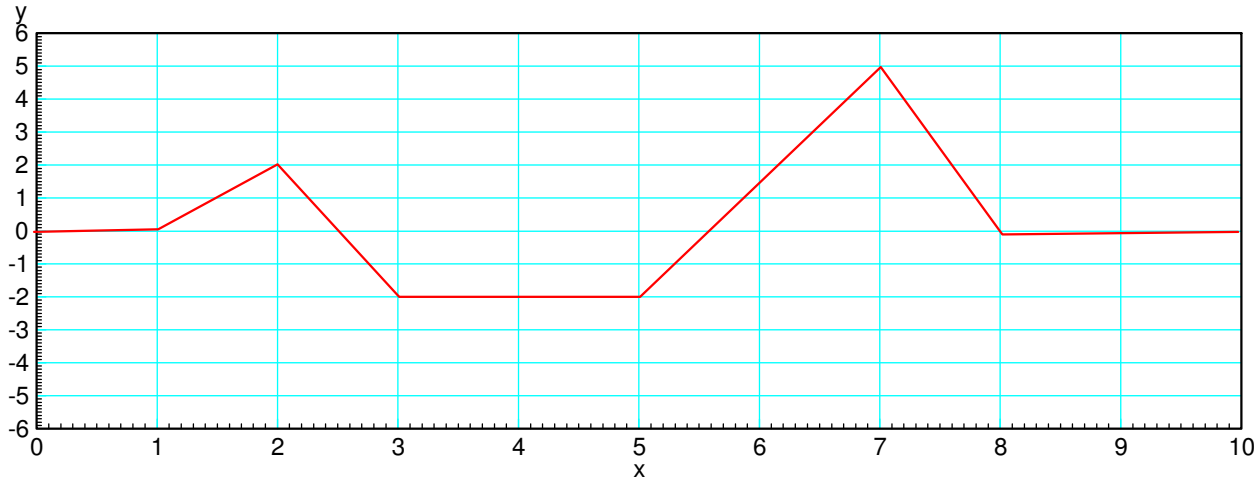
ECE 111 - Homework #7

Week #7: ECE 311 Circuits II - Due Tuesday, February 28th

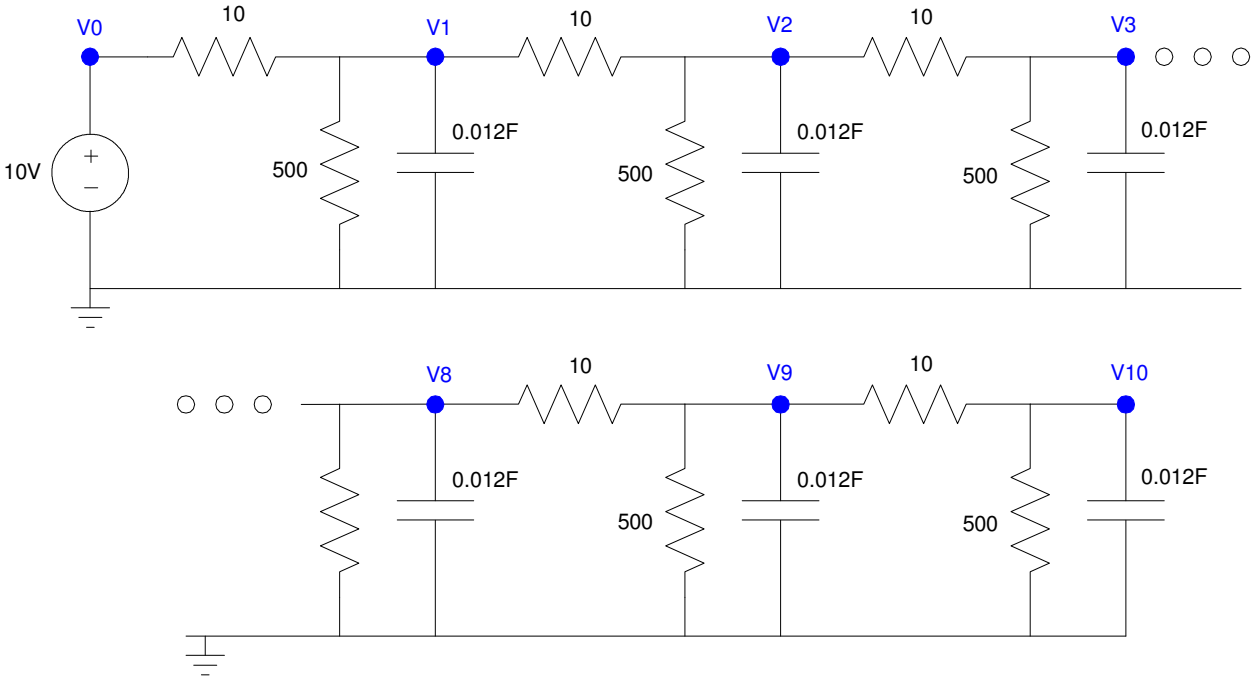
Please email to jacob.glower@ndsu.edu, or submit as a hard copy, or submit on BlackBoard

1) Assume the current flowing through a one Farad capacitor is shown below. Sketch the voltage. Assume V(0) = 0. The voltage is the integral of the current (capacitors are integrators)

$$V = \frac{1}{C}\int I \cdot dt$$



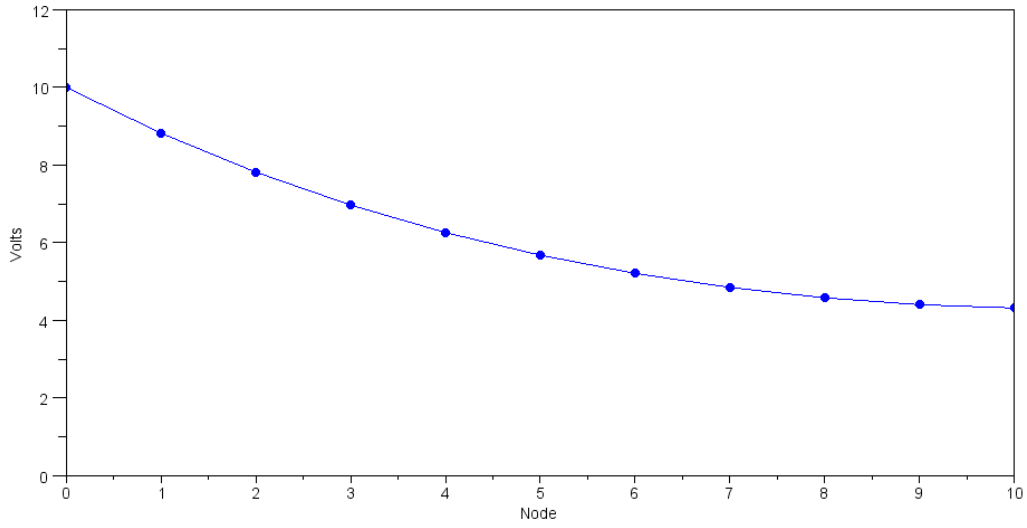
Problem 2-5: Assume a 10-stage RC filter (V0 .. V10)



Problem 2) Write the dynamics for this system as a set of ten coupled differential equations:

$$I_1 = C\frac{dV_1}{dt} = \sum(\text{current to node} V_1)$$

Forced Response for a 10-Node RC Filter (heat.m):



Problem 3) Using Matlab, solve these ten differential equations for $0 < t < 5$ s assuming

- The initial voltages are zero, and
- V0 = 10V.

Problem 4) Using CircuitLab, find the response of this circuit to a 10V step input. *note: It's OK if you only build this circuit to 3 nodes...*

Natural Response

Problem 5) Assume V0 = 0V. Determine the initial conditions of V1..V10 so that

- The maximum voltage is 10V and
- 5a) The voltages go to zero as slow as possible
- 5b) The voltages go to zero as fast as possible.

Simulate the response for these initial conditions in Matlab.

Problem 6) Assume Vin = 0V. Pick random voltages for V1 .. V10 in the range of (0V, 10V):

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V = 10 * rand(10,1)
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Plot the votlages at t = 2. Which eigenvector does it look like?