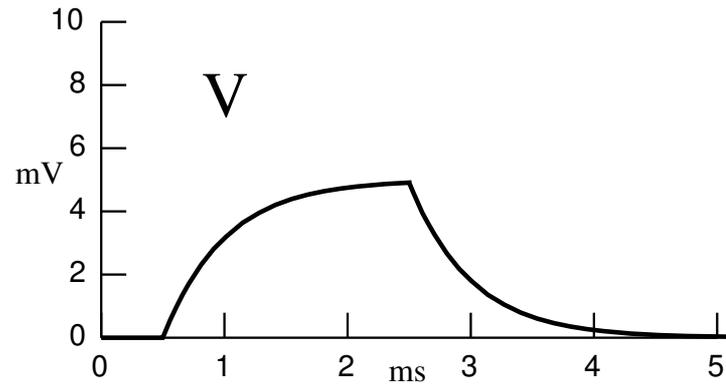
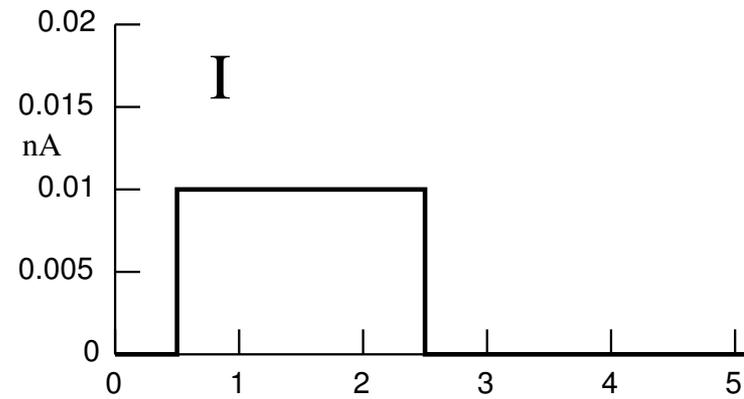
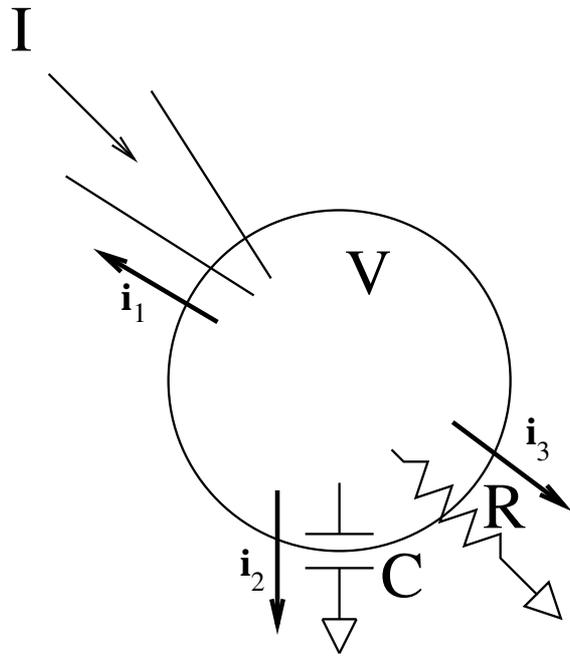


# Compartmental Modeling

Not much mathematics required.

Good judgment essential!



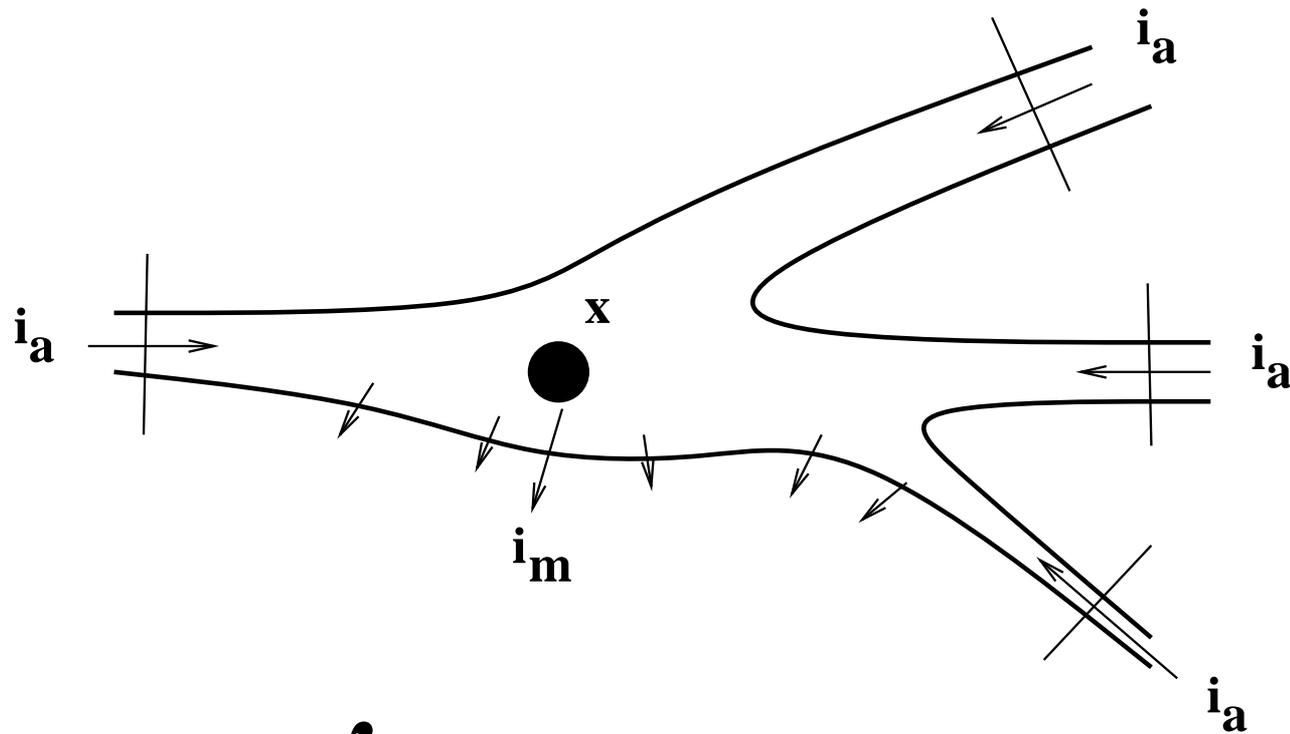
$$i_1 = -I$$

$$i_1 + i_2 + i_3 = 0$$

$$i_2 = C \, dV / dt$$

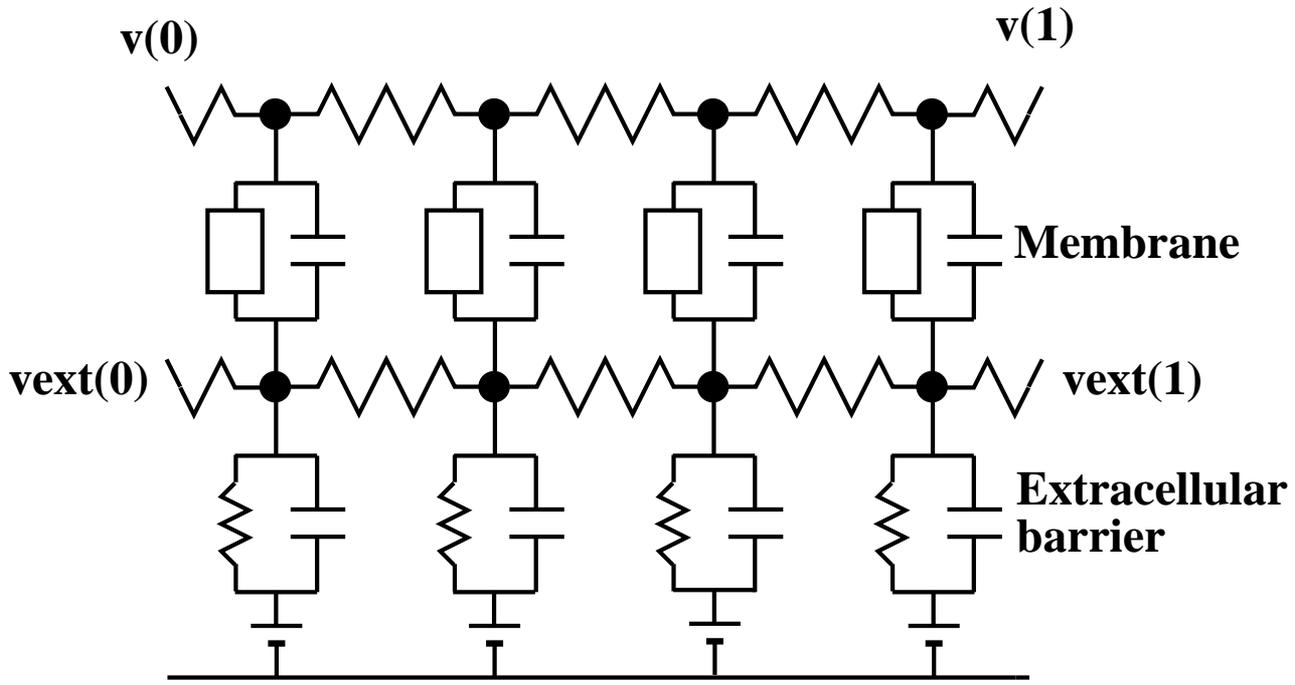
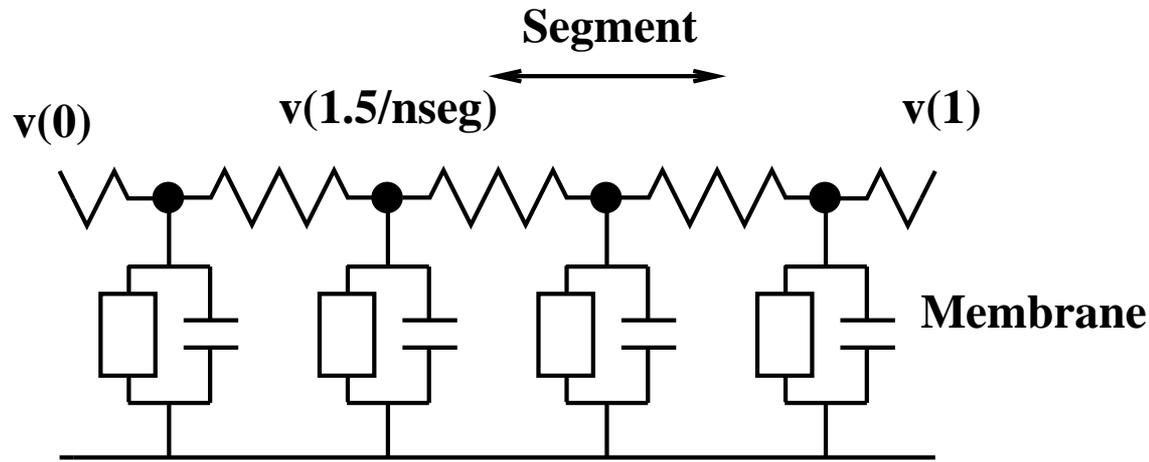
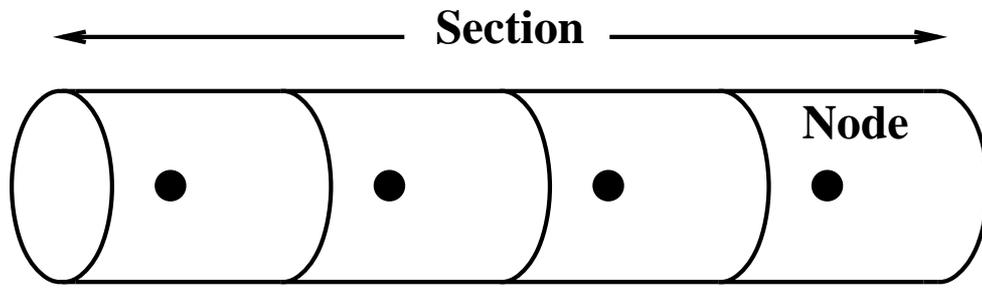
$$i_3 = V / R$$

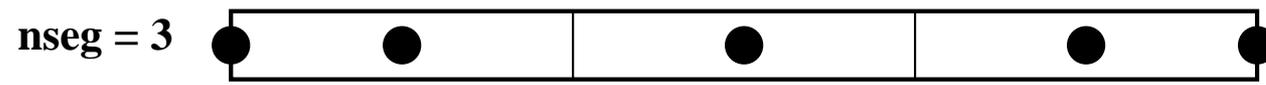
$$C \, dV / dt + g \, V = I$$



$$\int \mathbf{i}_m = \sum \mathbf{i}_a$$

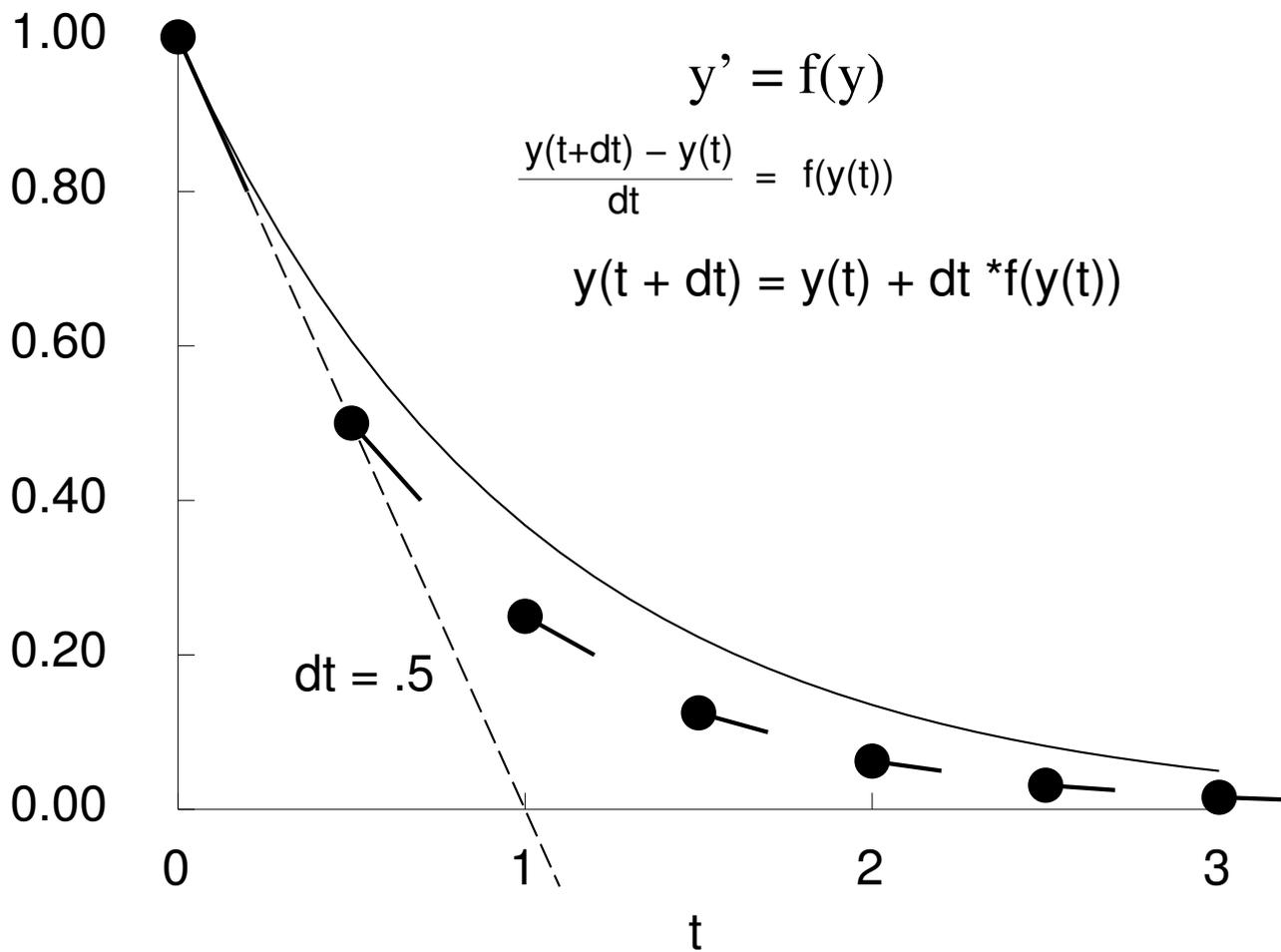
$$\mathbf{c}_j \frac{d\mathbf{v}_j}{dt} + \mathbf{i}_j = \sum_{\mathbf{k}} \frac{\mathbf{v}_k - \mathbf{v}_j}{\mathbf{r}_{jk}}$$

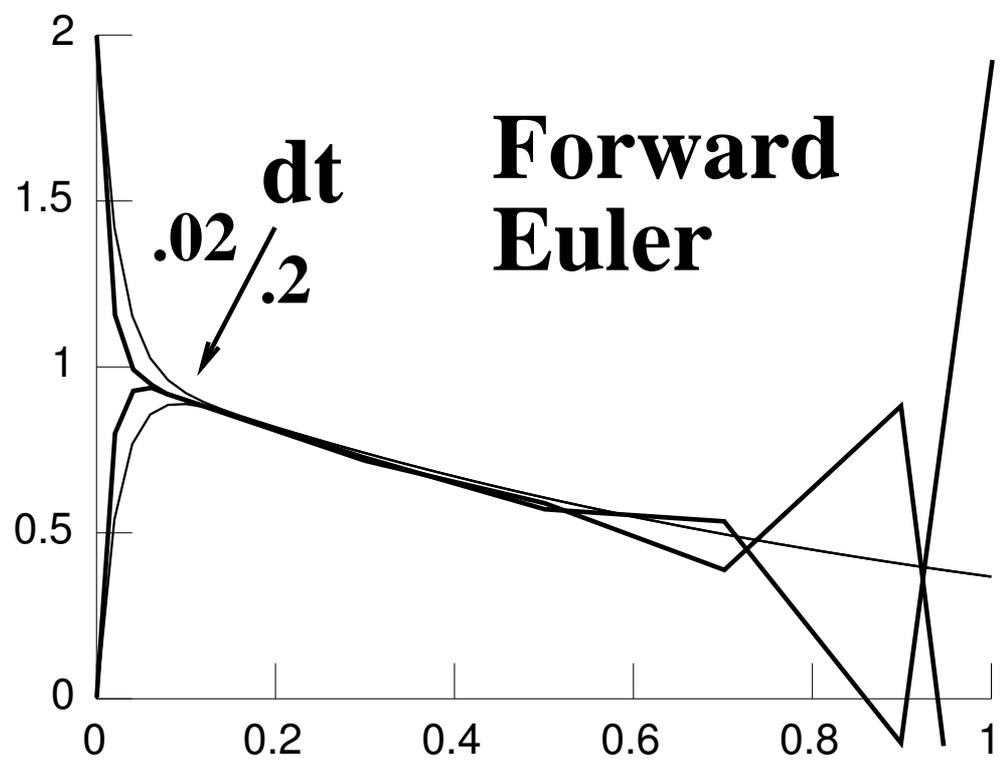
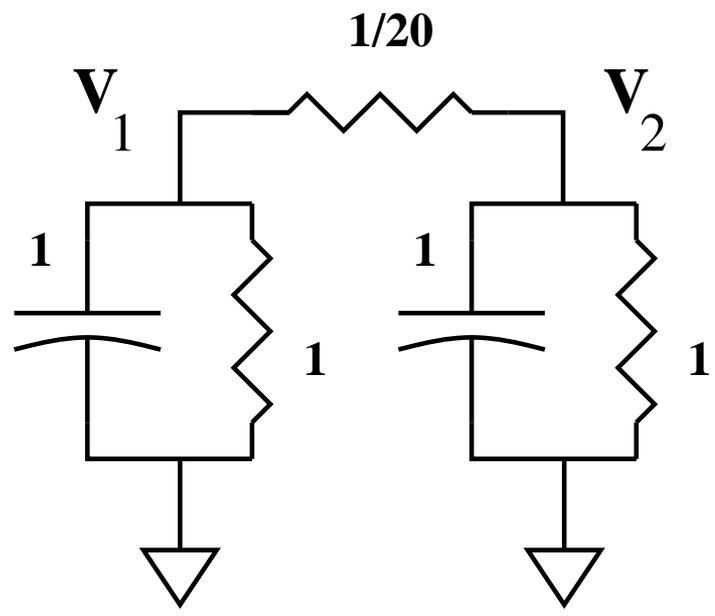




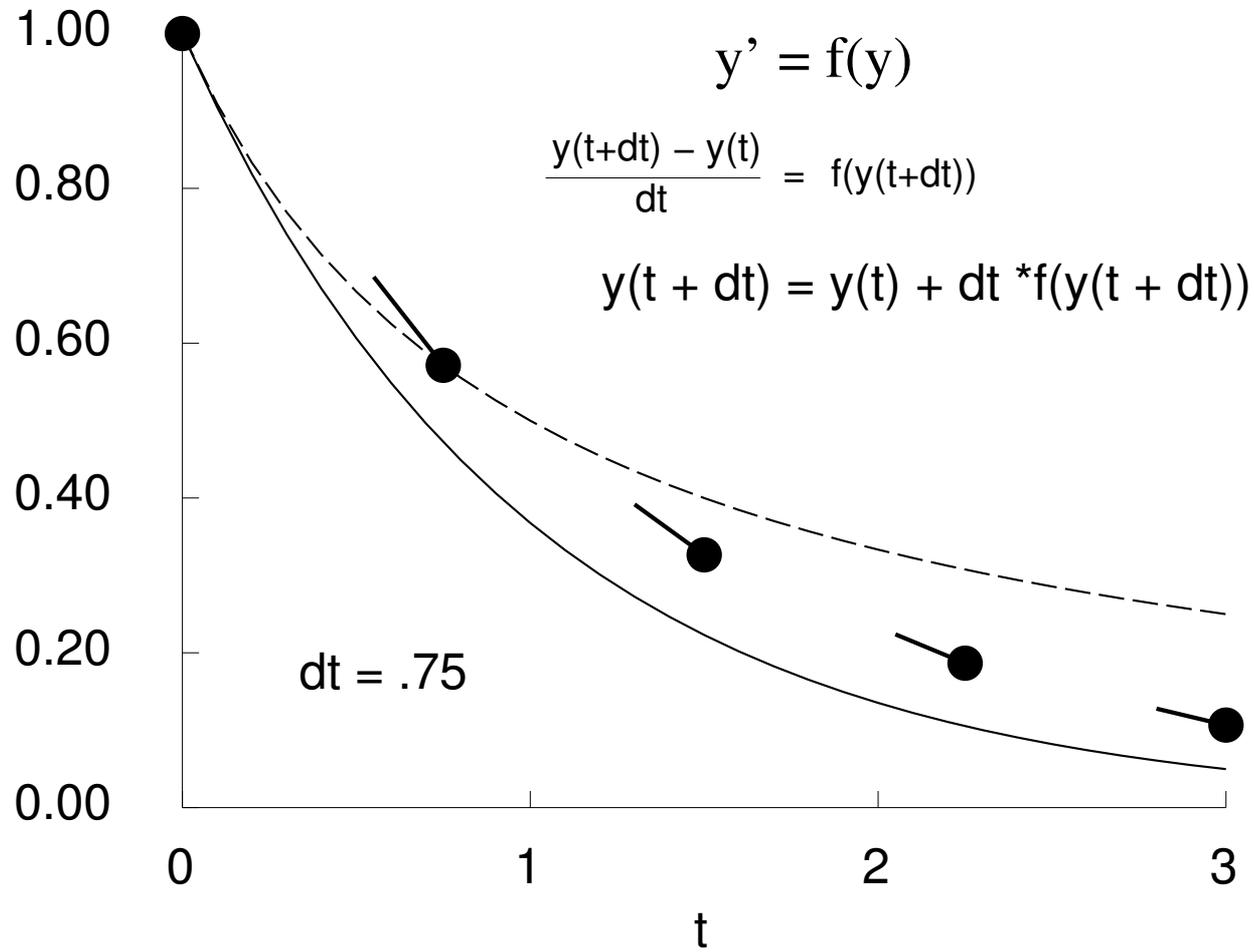
forall nseg \*= 3

# Forward Euler

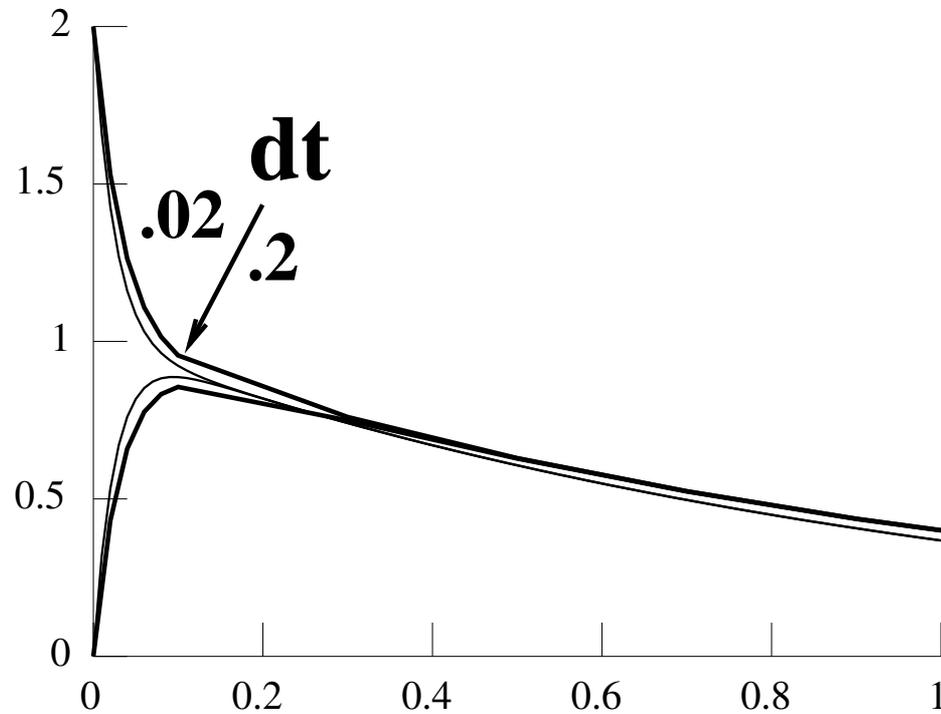
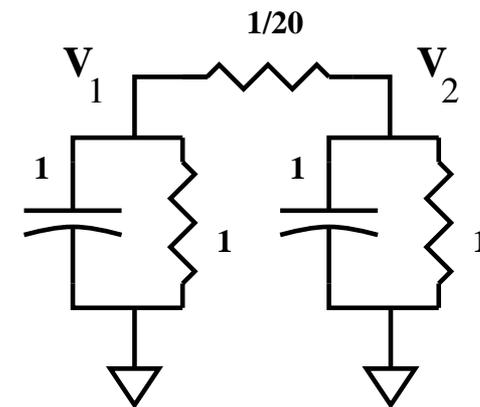
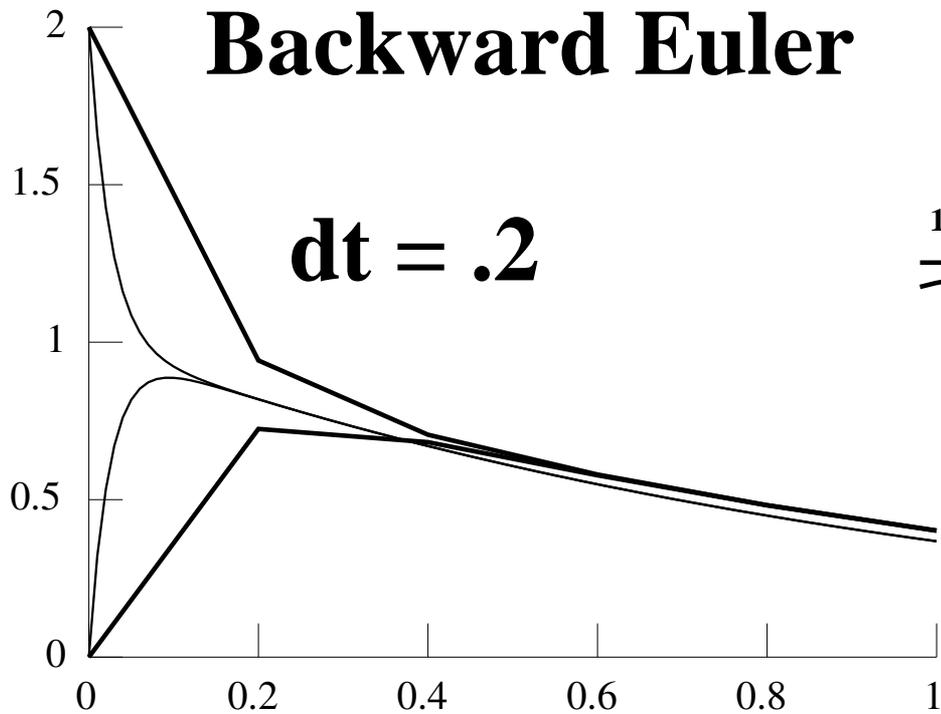




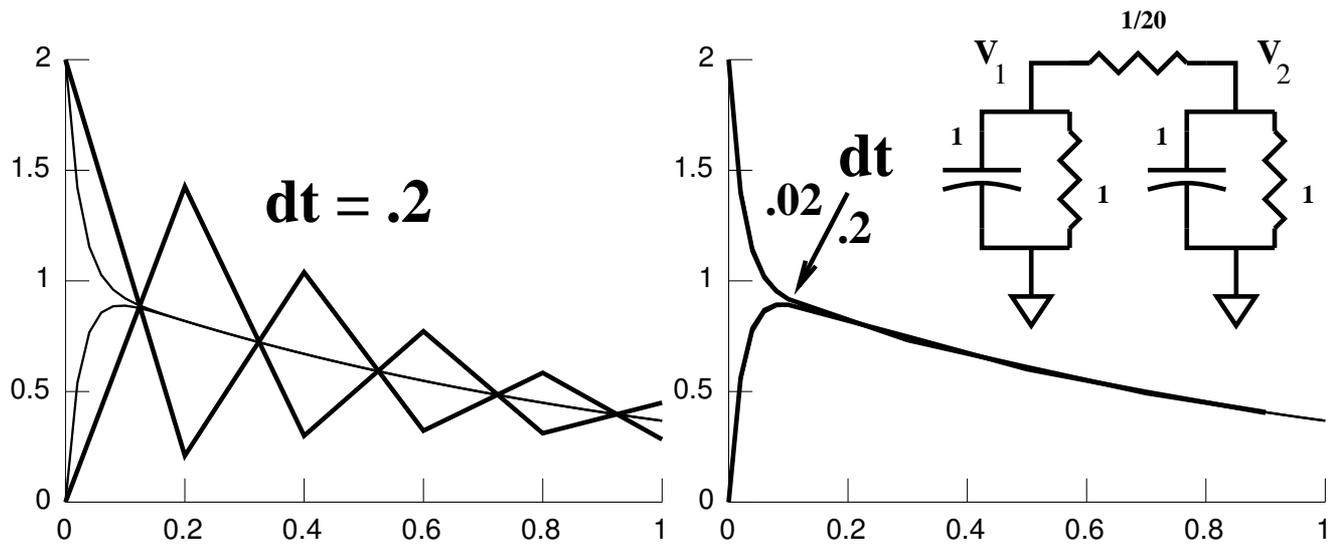
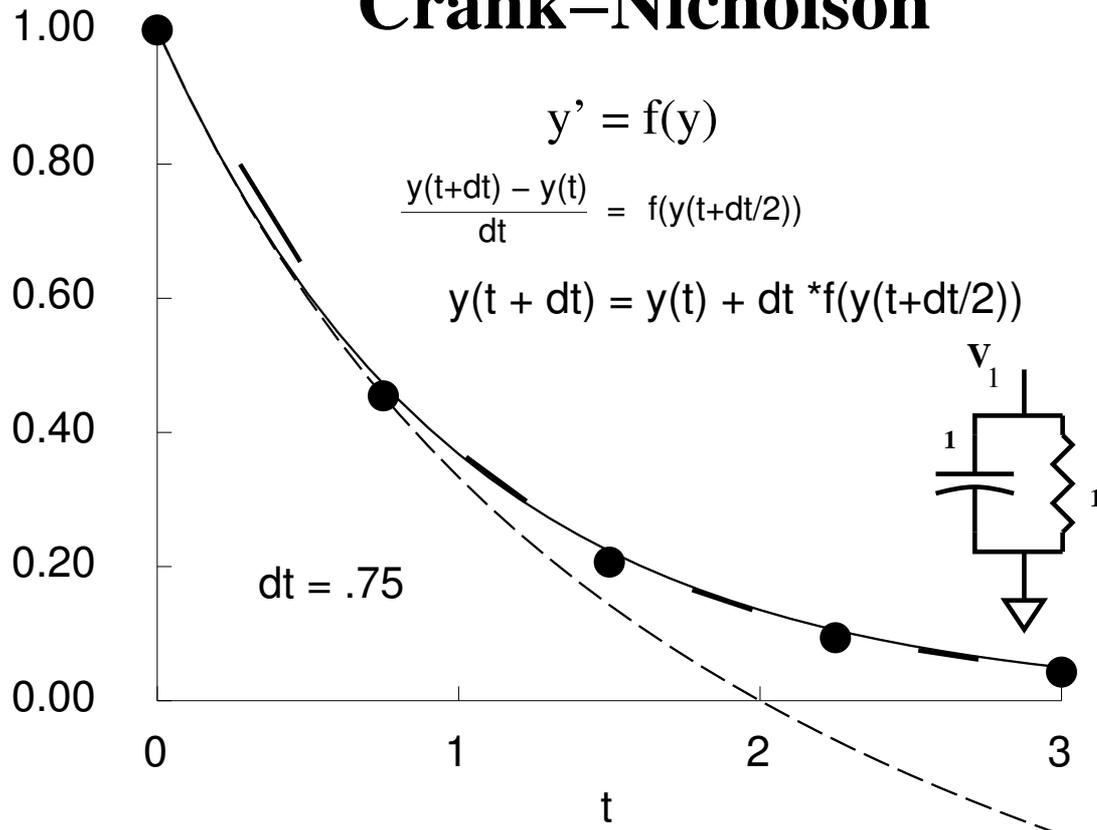
# Backward Euler



# Backward Euler

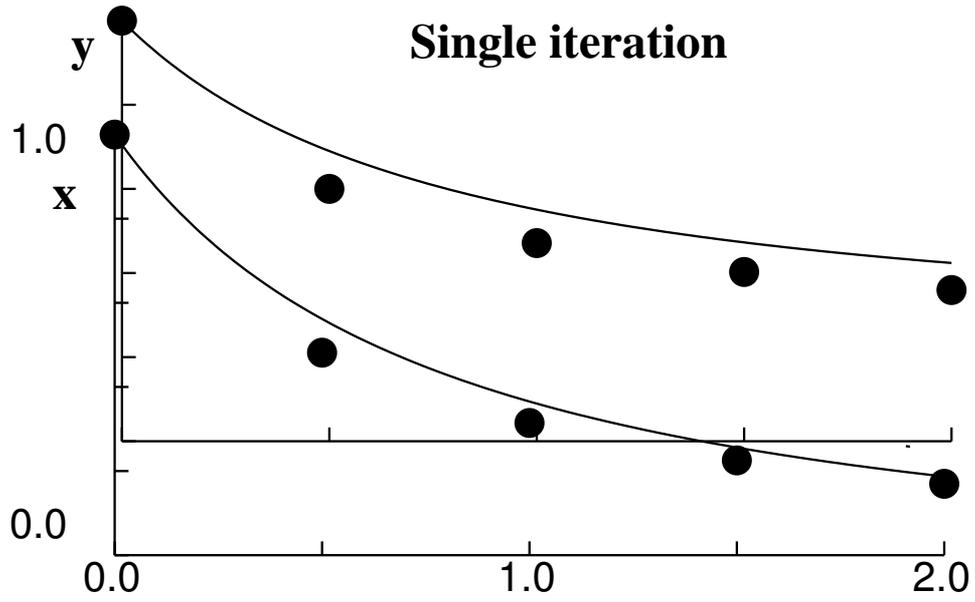


# Crank–Nicholson

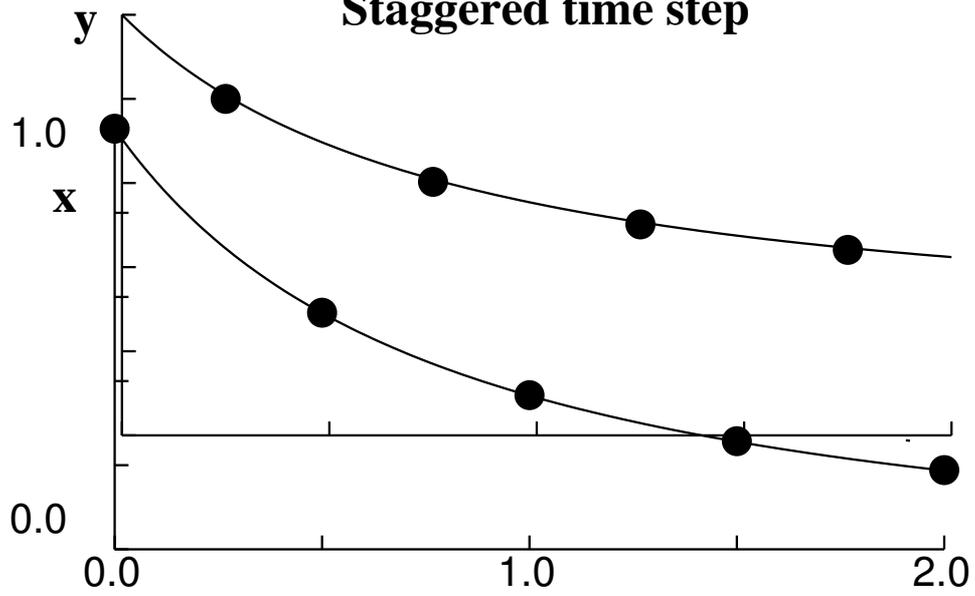


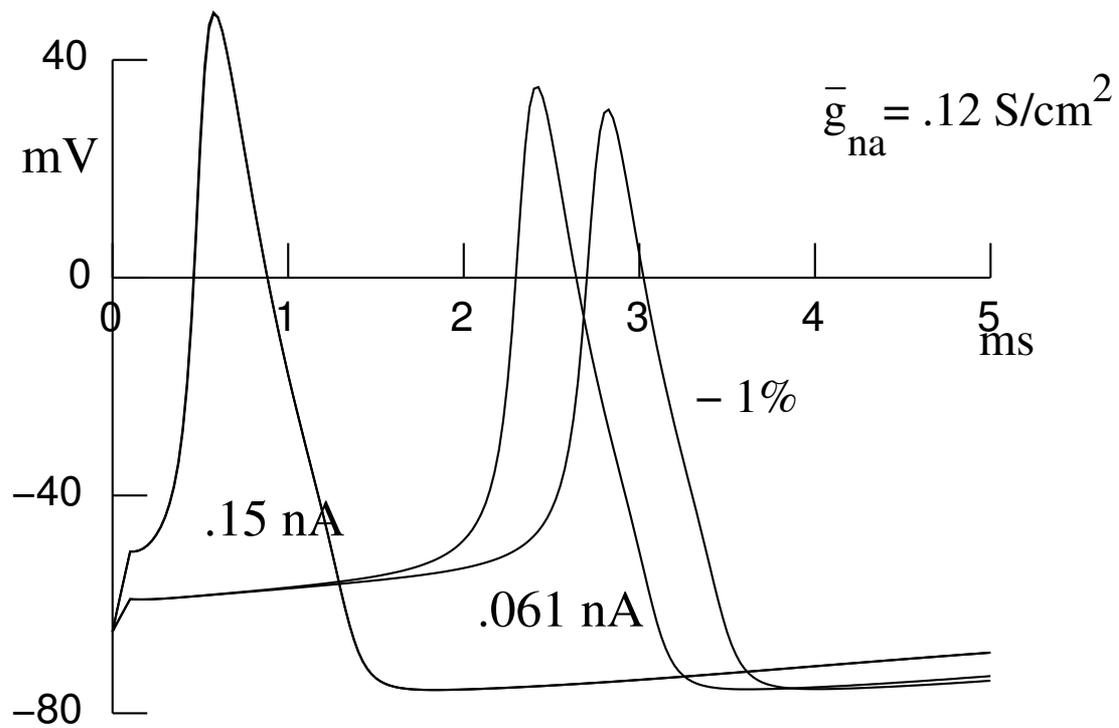
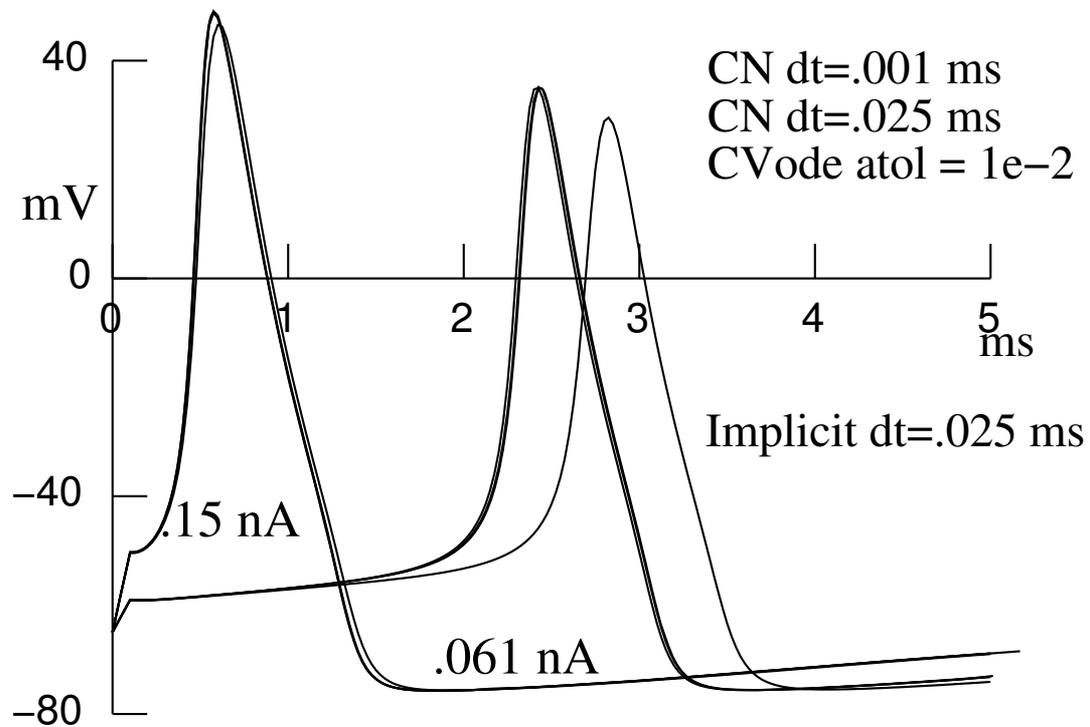
$$\begin{aligned}x' &= -1.4xy \\ y' &= -xy\end{aligned}$$

Single iteration



Staggered time step





## Global Step

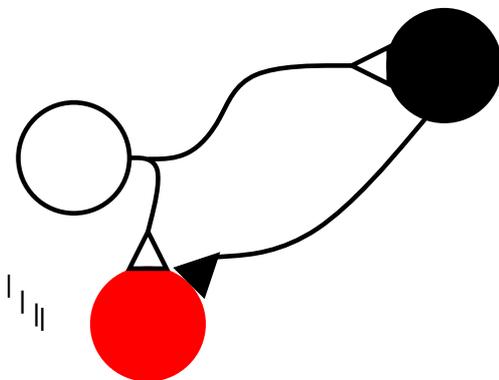
113 points  
107 advance  
5 interpolate  
4 init  
177 f(y)

## Local Step

78 points  
76 advance  
1 interpolate  
2 init  
138 f(y)

71 points  
68 advance  
2 interpolate  
3 init  
115 f(y)

$$(177*8)/(138*4 + 115*4) = 1.4$$



# One integrator instance per cell

**t0**      **t\_** **tn**  
○      ●      ●

**advance**      ○      ●

○      ●      ●      **interpolate**

**init**      ●

