

$$\begin{aligned}\frac{dv}{dt} &= -v + I \\ \rightarrow \frac{v(t+\Delta t)-v(t)}{\Delta t} &= -v(t) + I \\ v(t+\Delta t) - v(t) &= \Delta t(-v(t) + I)\end{aligned}$$

$$v(t+\Delta t) = v(t) + \Delta t(-v(t) + I)$$

we could say:

$$t = n\Delta t$$

Hence:

$$v((n+1)\Delta t) = v(n\Delta t) + \Delta t(-v(n\Delta t) + I)$$

For having a simpler formula:

$$v_{n+1} = v_n + \Delta t(-v_n + I)$$