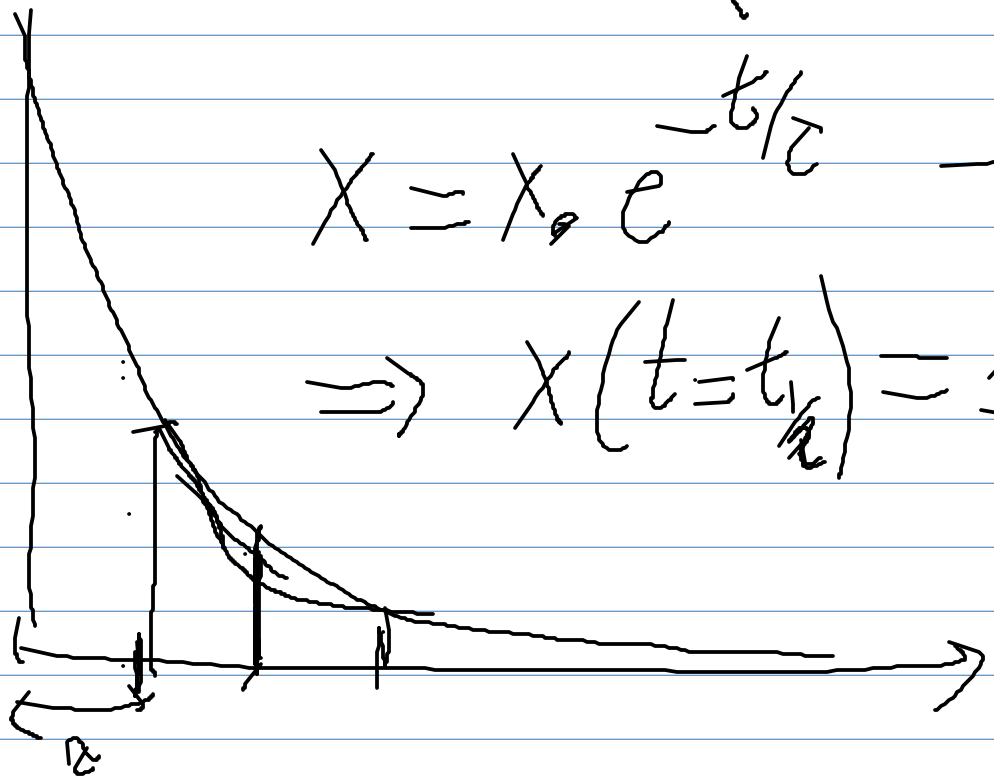
$$V(t) = V_{c_0} e^{-t/\tau} \Rightarrow \left(V_c - 0\right) e^{-t/\tau}$$

$t = \tau$

$$\Rightarrow V(t=\tau) = V_{c_0} \times \frac{1}{e} \qquad \frac{1}{e} \simeq 37\%$$

$$V(t = 2\tau) = \left(V_{c_0} \times \frac{1}{e}\right) \times \frac{1}{e}$$



$$X = X_0 e^{-t/\tau} \longrightarrow e^{-\frac{t_{1/2}}{\tau}} = \frac{1}{2}$$

$$\Rightarrow X\left(t = t_{1/2}\right) = \frac{X_0}{2}$$

$$\frac{1}{2} = e^{\frac{-t_{1/2}}{\tau}}$$

$$-\ln 2 = -t_{1/2}/\tau$$

$$\boxed{t_{1/2} = \tau \cdot \ln 2}$$

$\alpha > 0$ growth

$\alpha < 0$ decay

$$\Delta N \propto N$$

$$\propto \Delta t$$

$$\Rightarrow \underline{\Delta N = \alpha N \Delta t}$$

$$\frac{\Delta N}{N} = \alpha \Delta t$$

$$\frac{\Delta N}{\Delta t} = \alpha N$$

$$\frac{dN}{dt} = \alpha N \Rightarrow N(t) = N_0 e^{\alpha t}$$

$$\alpha > 0 \rightarrow \tau = 1/\alpha$$

$$N(t) = N_0 \cdot e^{t/\tau}$$

$$\alpha < 0 \rightarrow \tau = -1/\alpha$$

$$N(t) = N_0 e^{-t/\tau}$$

$$\frac{dx}{dt} = \frac{1}{\tau}(x_f - x) \Rightarrow -\frac{1}{\tau}(x - x_f)$$

$$\xi = x - x_f$$

$$\frac{d\xi}{dt} = -\frac{1}{\tau}\xi$$

$$d\xi = dx$$

$$\frac{d\xi}{dt} = -\frac{1}{\tau}\xi \qquad \xi = x - x_F$$

$$\Rightarrow \xi(t) = \xi_0 e^{-t/\tau}$$

$$(x - x_F) = (x_0 - x_F) e^{-t/\tau}$$