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1.

$$\frac{x(t)}{V} r$$

$$\frac{dx}{dt} = cr - \frac{x(t)}{V} r$$

$$\frac{dx}{dt} + \frac{r}{V} x(t) = cr$$

2. $\frac{dx}{dt} + 2x(t) = 2c$ , $x(0) = 0$

$$\frac{dx}{dt} = 2(c - x(t))$$

$0 = c - k$

$c = k$

$$\int \frac{1}{c - x(t)} dx = \int 2 \, dt$$

$$-\ln|c - x(t)| = 2t + k_1$$

$$|c - x(t)| = e^{-2t - k_1}$$

$$x(t) = c - ke^{-2t}$$

$$\therefore x(t) = c(1 - e^{-2t})$$

Limiting amount is the concentration $C$, yes.

$$1-e^{-2t} = 0.5$$

$$e^{-2t} = 0.5$$

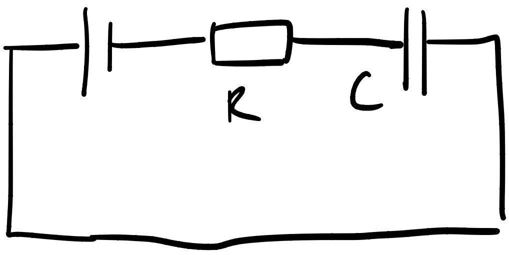
$$-2t = \ln 0.5$$

$$-2t = \ln 1 - \ln 2$$

$$t = \frac{\ln 2}{2}$$

3. $$\frac{dx}{dt} = r x(t)$$

4.




$$R\frac{dI}{dt} + \frac{1}{C}I = \frac{dV}{dt}$$

$$V(t) = V_0$$

$$\Rightarrow \quad R\frac{dI}{dt} + \frac{1}{C}I = 0$$

$$\frac{dI}{dt} = -\frac{1}{RC}I$$

$$\int \frac{1}{I}\, dI = -\int \frac{1}{RC}\, dt$$

$$\ln|I| = -\frac{t}{RC} + k_1$$

$$I = \pm k e^{-\frac{t}{RC}} \qquad \tau = RC$$

$$\therefore I = I(0)e^{-\frac{t}{RC}}$$

$$I(t+\tau) = I(0)e^{-\frac{t+\tau}{\tau}}$$

$$= I(0)e^{-\frac{t}{\tau}} \cdot e^{-1}$$

$$= \frac{I(t)}{e}$$