2.3: Modeling Diff. Eq

famous (Common) Questions :-

- **Newton's law of Cooling :-**

$$\frac{du}{dt} = -K(u-T)$$

$$\frac{du}{u-T} = -dt\,K$$

$$\ln(u-T) = -Kt + C$$

$$u-T = e^{-Kt}C$$

$$\boxed{u = e^{-Kt}C + T}$$

- **falling object or thrown object**

$$ma = mg - \gamma v$$

$$\frac{dv}{dt} = g - \frac{\gamma v}{m}$$

$$\frac{dv}{g - \frac{\gamma v}{m}} = g\,dt$$

$$ma = \gamma v - mg$$

$$\frac{dv}{dt} = \frac{\gamma v}{m} - g$$

The rest is the same

$$-\frac{\gamma}{m}\ln\left(g - \frac{\gamma v}{m}\right) = gt + C$$

$$g - \frac{\gamma v}{m} = \left(e^{\frac{-gtm}{\gamma}}\right) + (C)$$

$$-\frac{\gamma v}{m} = e^{\frac{-gtm}{\gamma}} \pm e^{C} - g$$

Constants

$$v = \left(\frac{m}{\gamma}\right) e^{\frac{-gtm}{\gamma}} C + \frac{g\,m}{\gamma}$$

Concentration

$$\frac{dQ}{dt} = \text{flow in} - \text{flow out}$$

dQ: g (or kg --)

dt: min (or s or h)

$\frac{dQ}{dt}$: should be in Salt (material)/min

flow in: rate of flow in

flow out: usually same rate of flowing in multiplied with Concentration

- Use Units to Specify your Equation