$$\frac{dN}{dt} = -\lambda N$$ integrate for N as function of t and N_0

$$\frac{dN}{N} = -\lambda\, dt \qquad \ln N = -\lambda t + C$$

$t = 0, \; N = N_0$

$\ln N_0 = C$

$$\ln N = -\lambda t + \ln N_0$$

$$\ln N - \ln N_0 = -\lambda t$$

$$\ln \frac{N}{N_0} = -\lambda t$$

$$e^{-\lambda t} = \frac{N}{N_0}$$

$$N_0 e^{-\lambda t} = N \quad \leftarrow \text{decay equation}$$

measurable

But we can not measure N_0

Half-life → when $N = \frac{N_0}{2}$

$$\frac{N_0}{2} = N_0 e^{-\lambda t} \quad \text{solve for } t$$

$$\frac{1}{2} = e^{-\lambda t}$$

$$\ln \frac{1}{2} = -\lambda t$$

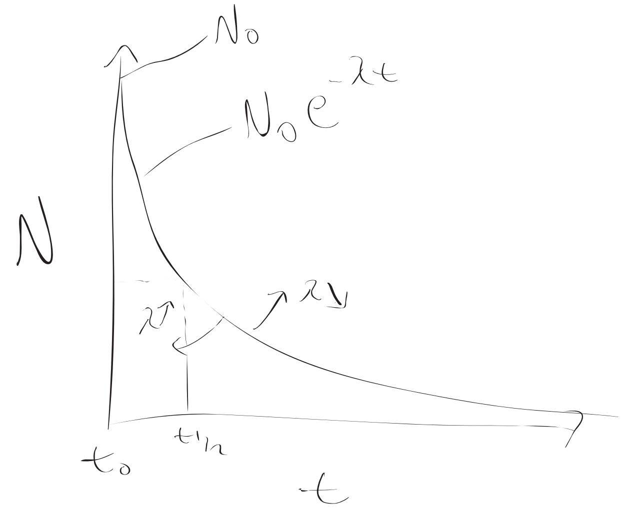
$$-\frac{\ln \frac{1}{2}}{\lambda} = t_{1/2}$$

D^* = daughter isotope to N

$$N_0 e^{-\lambda t} = N$$
$$N e^{\lambda t} = N_0$$
reversable

$$D^* = N_0 - N$$

(assuming no D_0)



$$D^* = N e^{\lambda t} - N$$

$$D^* = N(e^{\lambda t} - 1)$$

samples can start with D_0

$$D = D_0 + D^*$$

$$D = D_0 + N(e^{\lambda t} - 1)$$

measured — 0 or modeled — measured

* absolute values difficult to measure so often ratio with similar non-radiogenic isotope, X

$$\frac{D}{X} = \frac{D_0}{X} + \frac{N}{X}\left(e^{\lambda t} - 1\right)$$