

Initially $\frac{dx}{dt} = -k(x-A)$ is Newton's Law of cooling.

$$t = \frac{1}{k} \bar{t}$$

or $\bar{t} = kt$ gives $\frac{dx}{d\bar{t}} = -(x-A)$

choose $x = \beta \bar{x}$

$[x] = \text{C}$, $[\bar{x}] = 1$, dimensionless. choose β to simplify

$$\beta \frac{d\bar{x}}{d\bar{t}} = -(\beta \bar{x} - A), \quad \frac{d\bar{x}}{d\bar{t}} = -\left(\bar{x} - \frac{A}{\beta}\right) \quad \text{choose } \beta = A.$$

you get

$$\boxed{\frac{d\bar{x}}{d\bar{t}} = -(\bar{x} - 1)}$$

fully scaled ODE has NO parameters.

$\bar{x} = \frac{x}{A}$, $\bar{t} = kt$ are dimensionless temp. and time.