$$\int \frac{1}{y}\,dy = \int k\,dt$$

$$\frac{dy}{dt} = ky$$

$$\ln|y| = kt + C$$

$$y = \pm e^{C} e^{kt}$$

$$y = Ae^{kt}$$

$$e^{kt} = 1 \text{ when } t = 0$$

So $y_0 = A$

NEWTON'S LAW of Cooling

$$\frac{dT}{dt} = -k(T - T_s)$$

Suppose

$$y = (T - T_s)$$

$$\frac{dy}{dT} = 1$$

$$dy = dT$$

$$T - T_s = (T_0 - T_s)e^{-kt}$$

$$T = T_s + (T_0 - T_s)e^{-kt}$$

An egg is removed from boiling water and has a temp of 98°c. 5 minutes later, the temp is 38°c. The room is 18°c.

How many more minutes will it take to reach 20°c?

$$T - T_s = (T_0 - T_s)e^{-kt}$$

$$T = T_s + (T_0 - T_s)e^{-kt}$$

$$T = 18 + 80e^{-kt}$$

$$38 = 18 + 80e^{-5k}$$

$$\frac{1}{4} = e^{-5k}$$

$$\ln\frac{1}{4} = -5k$$

$$k = \frac{-\ln\frac{1}{4}}{5}$$

$$k = \frac{\ln 4}{5}$$

$$T = 18 + 80e^{-kt}$$