Assignment 5

Rate of Change of temp. $= \frac{dT}{dt}$

$\therefore \frac{dT}{dt} = k(T - T_0)$

$\frac{dT}{T - T_0} = k\,dt$

$\int \frac{dT}{T - T_0} = k \int dt$

$\ln(T - T_0) = kt + c$

$T - T_0 = e^{kt} + e^c$ $\quad$ Let $e^c = A$

$T - T_0 = e^{kt} + A$

$T - T_0 = Ae^{kt}$

$T = Ae^{kt} + T_0$

Initially

$10 = Ae^{kt} + 25$

$10 - 25 = Ae^{k(0)}$

$-15 = A$

$\therefore T = -15e^{kt} + 25$ or $T = 25 - 15e^{kt}$

At $T = 20$, $t = 5$

$20 = 25 - 15e^{k(5)}$

$20 - 25 = -15e^{5k}$

$-5 = -15e^{5k}$

$\frac{1}{3} = e^{5k}$

$\ln\left(\frac{1}{3}\right) = 5k$

$-1.099 = 5k$

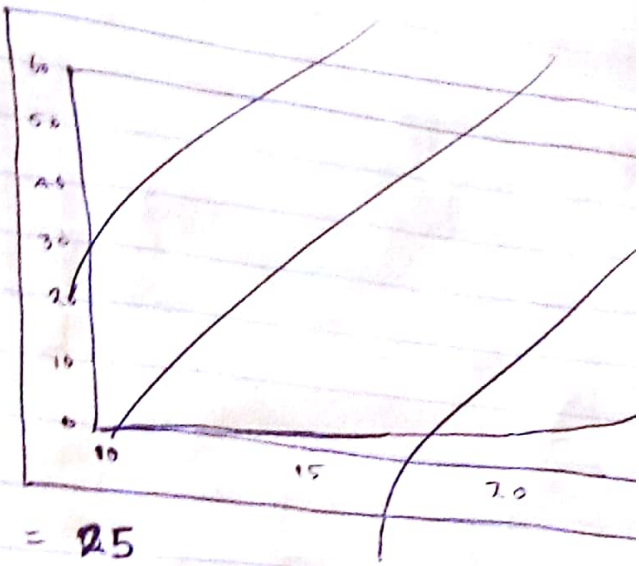
$k = \frac{-1.099}{5} = -0.22$

$\therefore T = 25 - 15e^{(-0.22t)}$

- USING MATLAB

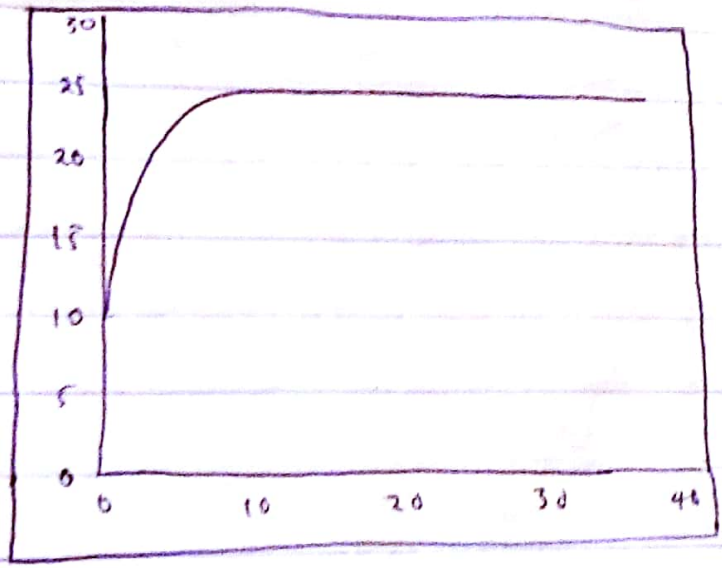
Command Window

```
clear
clc
close all
t = 0:1:60
k = -0.22
T = 25 - 15*exp(k*t)
plot (T, t)
```



∴ The steady state value = 25

- USING EXCEL



- As $t \to \infty$

$$T = 25 - 15e^{(-0.22(\infty))}$$

$$T = 25 - 0$$

$$T = 25$$

Mathematical Modelling is the act or process of using mathematical equations to solve real life problems.

Methods: Theoretical and Experimental (practical)