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1) A model is a mathematical representation of a system in order to study its behaviour

2) Methods of obtaining a model
i) Differential equation
ii) Use of balance law

3) From Newton's law of cooling

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

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

$\ln(T - T_m) = kt + c_1$

$T - T_m = e^{kt + c_1}$

$T - T_m = e^{kt} \times e^{c_1}$

let $e^{c_1} = c$

$T - T_m = ce^{kt}$

$T = ce^{kt} + T_m$

at $t = 0$, $T = 10°C$

$10 = ce^{k0} + 25$

$10 = c + 25$

$c = -15$

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

at $t = 5$, $T = 20°C$

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

$5 = 15e^{5k}$

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

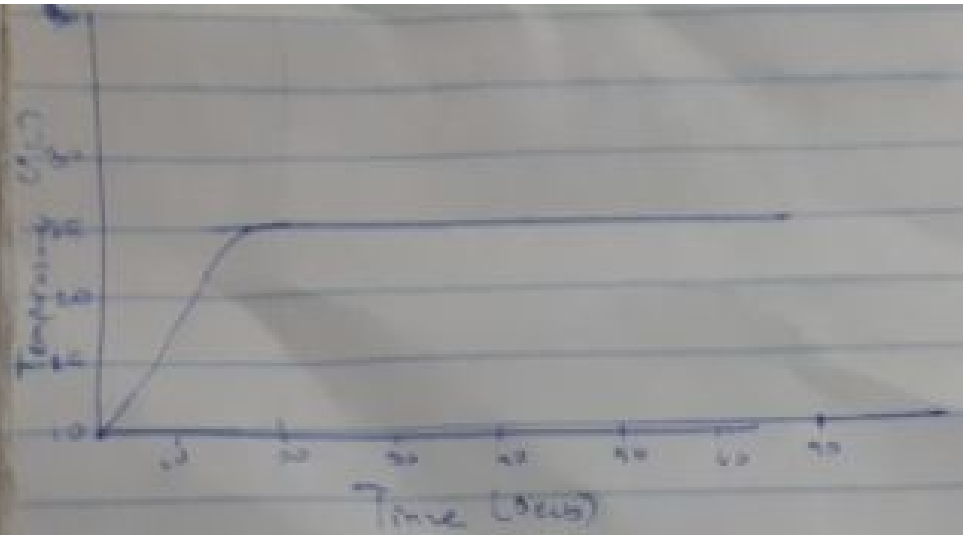
$k = -0.22$

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

2) Using excel.

- Create columns, t and T
- ~~t ... T~~
- In the first row of column t, enter "0", go to home, select [illegible] then select a step then enter
- In the first row of column T, type "= 25 - 15*EXP(-0.2*t)" then enter
- Drag the box at the bottom corner of the row to drag down
- Highlight both columns
- Go to insert, choose graphs, then scatter graphs then smooth

- Using matlab
- command window
- clear
- clc
- close all
- t = [0:1:50]
- T = 25 - 15*exp(-0.22*t)
- Plot(t, T)
- grid on
- axis [illegible]
- xlabel('Time(min)')
- ylabel('Temperature(°C)')



a) Using the dynamic response the steady state temperature is 75°C at 30 minutes

b) Using the equation for the model developed, the temperature at the thermometer at $\hat{I} \rightarrow \infty$ = 25°C