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17/ENG05/004
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1) What is mathematically modelling

Mathematically modelling can be defined as a description of system using mathematically concepts and languages mathematics models are used in the Natural Sciences and engg disciplines as well as two social science

(b) Methods of obtaining a model

(1) Differentiating (2) Using Balance law

(c) Solu

$T_{(as)} = 10°C$, $T_{(2)} = 20°C$

Actual temp. $= 25°C = T_A$

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

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

Integrating both s.de

$\ln(T - T_a) = kt + C$

$T - T_A = e^{kt} + e^C$

$2c + C^c$ Sc A

$T - T_A = e^{kt} A$

$T - T_A = Ae^{kt}$

$T = Ae^{kt} + T_A$

When $T = 10$

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

$10 = A + 25$

$A = 10 - 25$

$A = -15$

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

At $t(5)$ = end $T - 20$

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

At $t(5)$ = end $T = 20$

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

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

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

$15e^{5k} = 5$

$e^{5k} = \frac{5}{15}$

$e^{5k} = 0.33$

$e^{5k} = \ln 0.33$

$5k = -1.0987$

$k = \frac{-1.0987}{5}$

$k = -0.22$

$[T_{(t)} = 25 - 15e^{-0.22t}]$ → model eqn.

Using microsoft excel

→ Picking a cell insert (T)

→ Picking another cell insert (t)

→ Under the already labelled cell (T)

→ Insert a value at in an empty cell

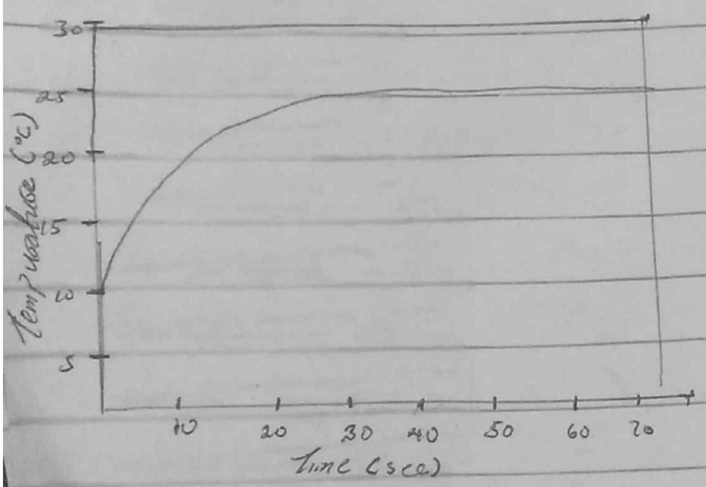
→ Click on scores

→ Insert a step volume of 1

→ Change the scores into columns

→ Insert a step value of 60
→ Under the already labelled (e.g "T")
- Pick a cell
- Insert "=25 (15Exs (-0.22 A2)]
- Auto fill
- Go into insert
- Pick a graph of choice
- label graph

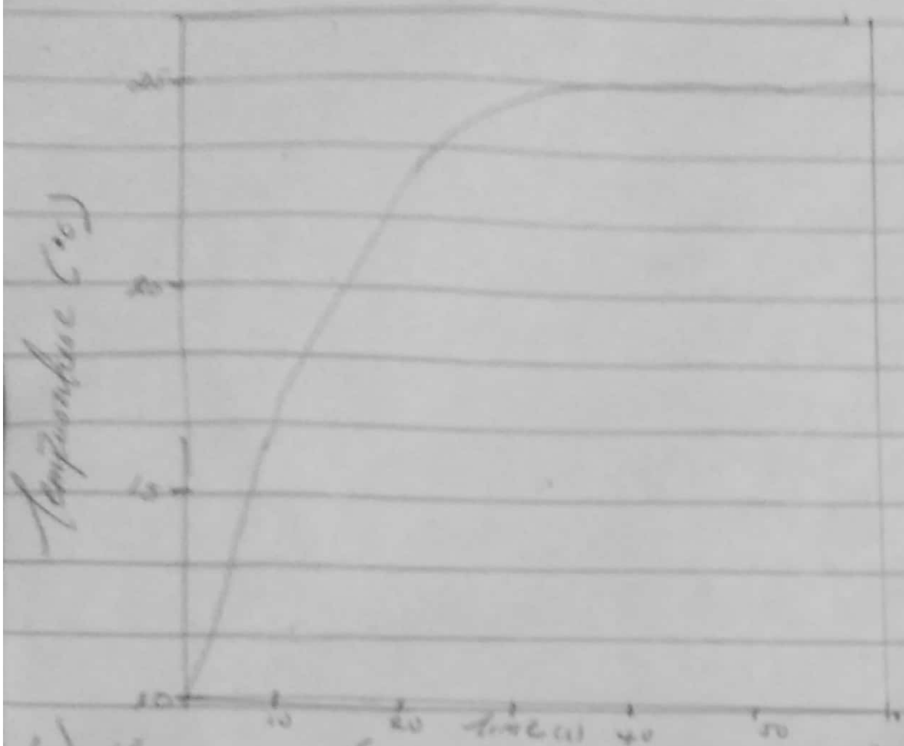
Output



Using matlab
Command Window
Clear
Clc
Close all
t = 0:1:60
T = 25-15 exp (-0.22 t)
Plot (t, T)
Grid on
Grid minor
xlabel (Time(sec))
ylabel ('Temperature')
Grid on

gn2 [illegible]

Output



1a) Using gnL dynamic response the steady state temperature of the system would be 25°C to 20mins

1b) Using developed model equation. The temperature of the thermometre at t = ∝ will be 25°C