a.) Mathematical modelling is a mathematical representation of system and simulation of a system which makes solving the model and obtaining its output variable for different values of input variable for different values of its input variable or as input variable or as input variable is changed from one values to another

b.) methods of obtaining a model

c.) Bernoulli Law - flowing problems

Torricelli's law - leaking problems

c.)

Solution

$\bar{T}(0) = 10°$

$\bar{T}(1) = 20°C$

Actual temperature $= 25°C = \bar{T}_A$

$$\frac{d\bar{T}}{dt} = k(\bar{T} - \bar{T}_0)$$

$$d\bar{T} = k(\bar{T} - \bar{T}_0)dt$$

$$\frac{d\bar{T}}{(\bar{T} - T_A)} = kt + C$$

$$\lim (\bar{T} - \bar{T}_A) = kt + c.$$

$\bar{T} - \bar{T}_A = e^{kt} + e^c$ i.e let $e^c = A$.

$= e^c = A$

$\bar{T} - \bar{T}_A = Ae^{kt}$.

$\bar{T} = \bar{T}_A + Ae^{kt}$.

$\bar{T} = Ae^{kt} + \bar{T}_A$

when

$\bar{T} = 10$

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

$10 = A + 25$

$A = -15$ //

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

at t(5) = 20

$20 = 25 - 15e^{k5}$

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

$15 e^{5k} = 5$

$e^{5k} = 5/15 = 0.3333$

$5k = \ln 0.3333$

$5k = -1.0986$

$k = -1.0986/5$

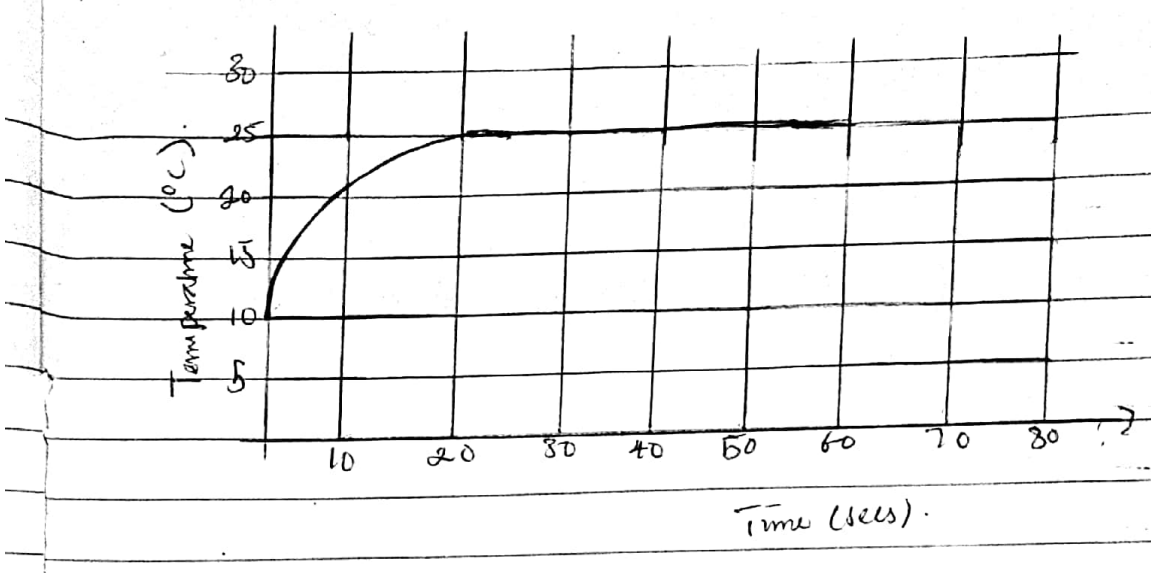
$= 0.22.$

$T(t) = 25 - 15 e^{-0.22k}$ relating the equation

Using microsoft Excel.

- Pick a box and insert 't'
- Pick another box insert 'T'
- Under the already labelled box 't'
- insert a value of 0 in an empty box
- insert a step value of 4
- Change the series in to columns.
- insert a stop value of 80
- Under the already labelled box 2. 't'
- pick a box.
- insert t = 25 - (15 * exp(-0.22 * A2))
- Auto fill
- Go to insert
- pick a graph of choice (x and y scatter preferably)
- Label the graph.

Output.



Using MATLAB.

1 → Command window

2 → clear

3 → clc

4 → close all

5 → t = 0:1:60

6 → T = 25 - 15*exp(-0.05*t)

7) → plot(t,T).

8) → grid on

9) → grid minor

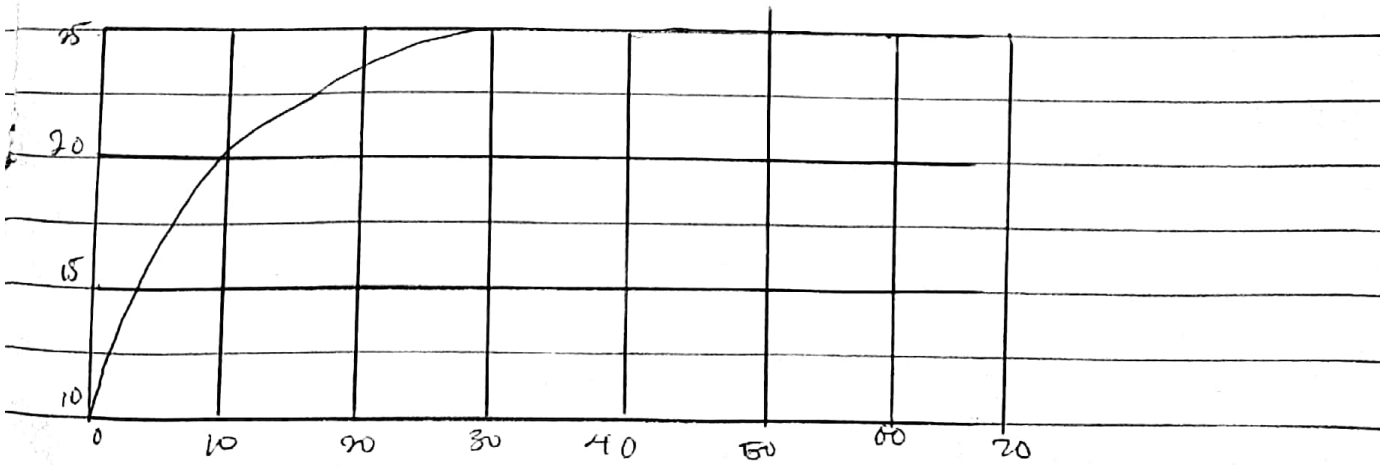
10) → xLabel('Time (secs)')

11) → YLabel('Temperature')

12) → grid on

13) → grid minor

Output.



Using Excel's dynamic response. The steady state temperature of the system would be 25°C at 20 minutes.

vi) Using the developed model equation, the temperature of the thermometer at $t = \infty$ will be 25°C.