

OHWO JAMES OTHOGHENE

17/ENG03/039

CIVIL ENGINEERING

COURSE: ENG 282 ENG MATHS

ASSIGNMENT V

1. Define Mathematical Modelling

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

b. Methods of Obtaining a model

- Differentiating
- Use of Balance law

c. Solution

$$T_0 = 10^\circ\text{C}$$

$$T_\infty = 20^\circ\text{C}$$

$$\text{Actual temp} = 25^\circ\text{C} = T_A$$

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

$$dT = k(T - T_A)dt$$

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

Integrating both sides

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

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

let e^C be A

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

$$T - T_A = Ae^{kt}$$

$$T = Ae^{kt} + T_A$$

When $T = 10$

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

$$10 = A + 25$$

$$A = 10 - 25$$

$$A = -15$$

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

$$At \cdot f(s) = 20$$

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

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

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

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

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

$$5k = \ln 0.3333$$

$$5k = -1.0986$$

$$k = -0.22$$

$$T_{10} = 25 - 15e^{-0.22}$$

Using Microsoft Excel

Pick a box insert 't'

Pick another box insert 't'

Under the already labelled box 't'

Insert a value of 0 in an empty box

Go to fill

Click on Series

Insert a step value of 1

Change the Series into Columns

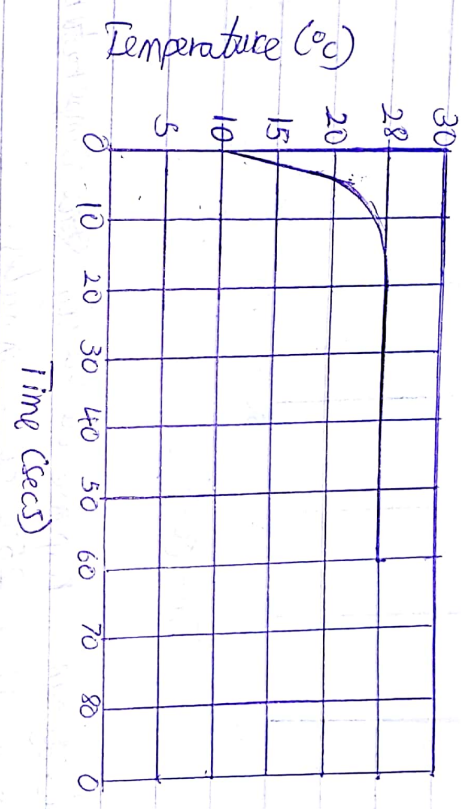
Insert a stop value of 60

Under the already labelled box 2. '1'

Done

• Label the 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

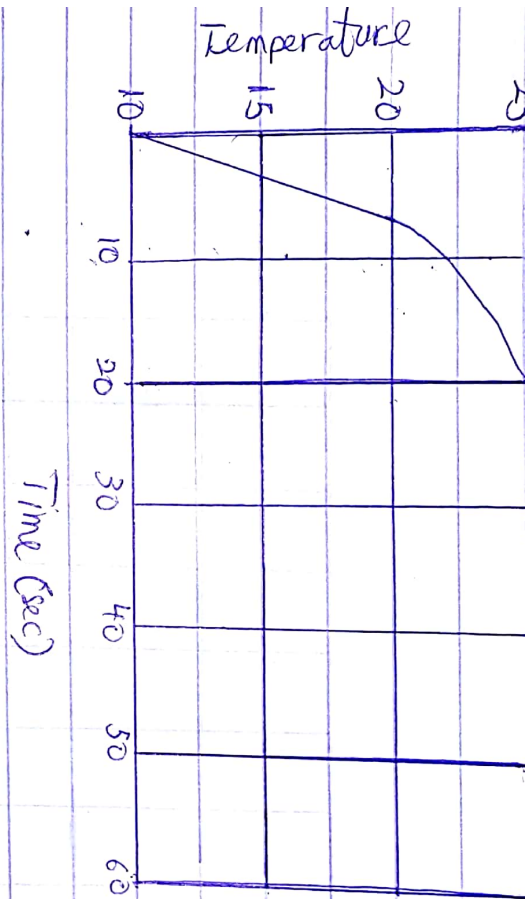
grid minor

X label (Time (Secs))

Y label (Temperature)

grid on

grid minor



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

Using the developed model equation, the temperature of the thermometer at t will be 25°C