

A) Define mathematical modelling

Ans: It is a mathematical representation of a system and system of a system which involves solving the model and obtaining its output variable as input variable is changed from one value to another.

B) Methods of obtaining a model

Ans: (i) Differentiating
(ii) Use of Balance Law

C) Solution

$$T_{(0)} = 10^{\circ}\text{C}$$

$$T_{(9)} = 20^{\circ}\text{C}$$

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

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

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

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

Integrating both sides

$$\ln(T - T_A) = k t + C$$

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

$$\text{Let } e^C \text{ be } A$$

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

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

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

When $T = 10$

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

$$10 = A + 25$$

$$A = 10 - 25$$

$$A = -15$$

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

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

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

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

$$e^{rk} = 0.333$$

$$rk = 100 \cdot 0.3333$$

$$rk = 1.0186$$

$$k = 0.22$$

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

(iv) Using Microsoft excel

pick a box insert 't'

pick another box insert 'T'

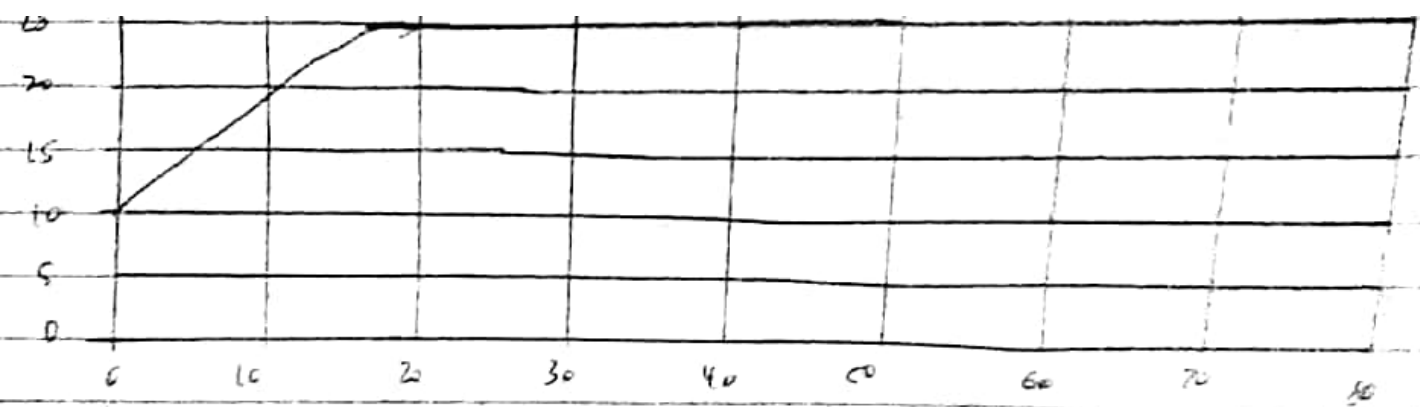
Under the already labelled box 't'

Insert a value or 0 in an empty box

Go to file

Click on series

Insert a new row of 1



Using matlab

Command windows

clear

clc

close all

t = 0 : 1 : 80

$$T = 20 - 10 * \exp(-0.22 * t)$$

Plot (T vs t)

grid on

grid minor

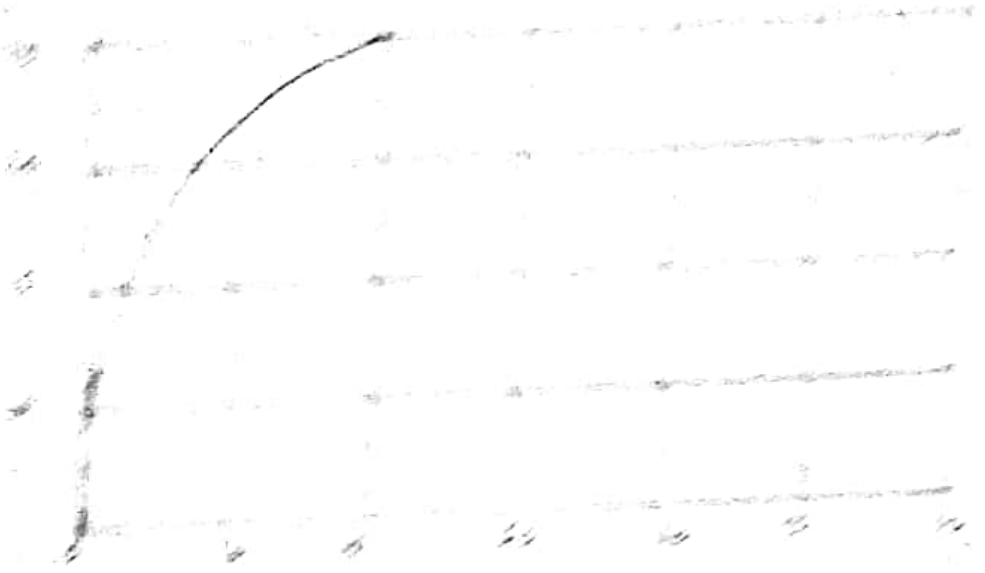
x label ('time (sec)')

y label ('temperature')

grid on

grid minor

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The graph shows the relationship between the number of hours worked and the amount of money earned. The curve starts at the origin (0,0) and rises steeply, indicating that the amount of money earned increases rapidly with the number of hours worked. After about 10 hours, the curve levels off, suggesting that the amount of money earned reaches a maximum and does not increase further with additional hours worked.