1 (a) Mathematical model is a description of a system using mathematical concepts & language. The process of developing a mathematical mathematical model is termed mathematical modelling.

(b) Finite & element analysis

(iv) Use of Newton's laws and other laws of physics.

(c)(i) $\dfrac{dT}{dt} = K(T - T_s)$ where T = initial temperature of the body

T_s = Surrounding temperature.

$$\dfrac{dT}{T - T_s} = Kdt$$

$$\ln T - T_s = Kt + C$$

$$T - T_s = e^{Kt} \cdot e^{C}$$

let $e^C = C$

$\therefore T - T_s = Ce^{Kt}$

$\therefore T = T_s + Ce^{Kt}$

when $t = 0$, $T = 10°C$ & $T_s = 25°C$ is a constant

$\therefore 10 = 25 + Ce^{0}$

$10 = 25 + C$

$C = -15$

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

when $t = 5mins$ $T = 20°C$

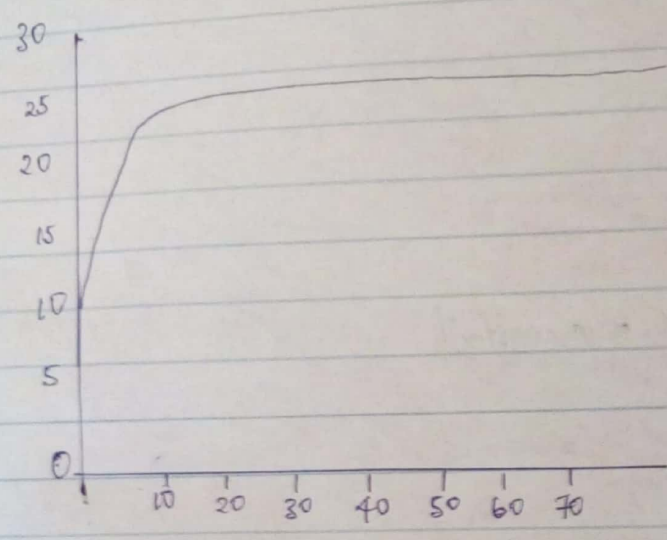$20 = 25 - 15e^{5k}$

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

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

$5K = \ln\left(\dfrac{5}{15}\right)$

$K = \dfrac{\ln\left(\dfrac{5}{15}\right)}{5}$

$K = -0.22$

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

(ii)

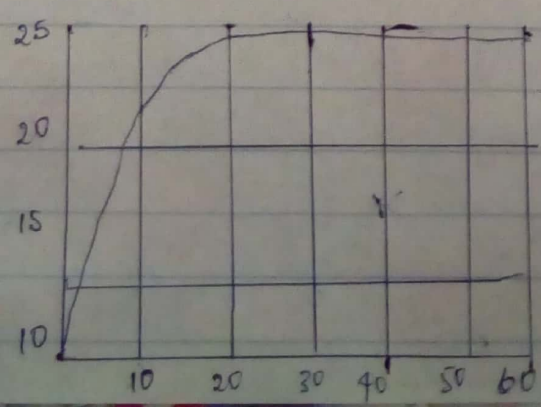|	A	B	
	t	T	
1	t	T	10.00
2	0	= 25 - 15*EXP(-0.22 * A2)	12.96
3	1	= 25 - 15* EXP(-0.22 * A3)	15.34
4	2	= 25 - 15* EXP(-0.22 * A4)	17.25
5	3		18.78
6	4		20.00
7	5		20.99
8	6		

(iii) Command window

```
clear
clc
close all
t = (0:1:60)
T = 25 - 15* log(-0.22 * t)
Plot (t, T)
grid on
grid minor
```

(iv) The steady state temprature which is the temprature at which the system's temprature stopped increasing is 24.9.

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

when $t \to \infty$

then $T \approx 24.9$