AGWANIRU ROSEMARY
17/ENG01/003
CHEMICAL ENGINEERING
ASSIGNMENT V SOLUTION

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

$$\int \frac{1}{T - T_A} dT = \int K dt$$

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

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

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

$$T - T_A = T_0 e^{kt}$$

$$T = T_A + T_0 e^{kt}$$

when $t = 0$

$$10 = 25 + T_0 e^{k(0)}$$

$$10 = 25 + T_0$$

$$T_0 = 10 - 25 = -15$$

$$T_0 = -15$$

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

$$at\ t(5) = 20^{\circ}$$

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

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

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

$$e^{k(5)} = 5/15$$

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

$$5k = \ln 0.33$$

$$5k = -1.0986$$

$$k = -0.2197$$

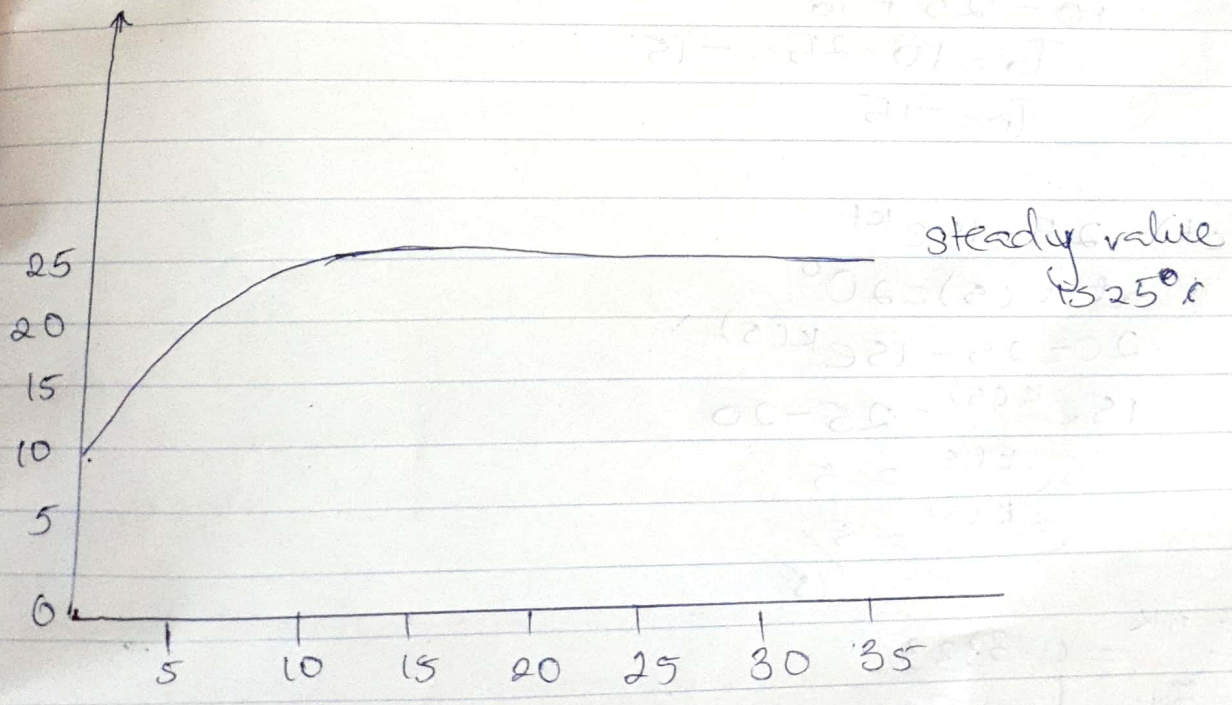
$$T(t) = 25 - 15\exp^{-0.2197t}$$

Microsoft Excel

- 10 = 25 - (15 * Exp(-0.2197 * a2))
- 12.95 = 25 - (15 * Exp(-0.2197 * a3))
- 15.33 = 25 - (15 * Exp(-0.2197 * a4))
- 17.240 = 25 - (15 * Exp(-0.2197 * a5))

iii) Command window

```
clear
clc
close
t=0:1:60
y= 25- 15* Exp(-0.2197* t)
plot(t, y)
grid on
minor grid on
xlabel ('Time (secs)')
ylabel ('Yaxis')
```



Steady temperature of the system is 25°C

at $t \to \infty$

$T = 25 - 15 \times Exp(-0.2197 \times \infty)$

$T = 25°C$ //

(i) Modelling is mathematical representation of a system. It is describing a system using mathematical concepts and language.

ii) Using balance
Differentiation
partial
Using differential equations