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### Assignment 5

\* Rate of change of temp =  $\frac{dT}{dt}$

$$\therefore \frac{dT}{dt} = K(T - T_0)$$

$$\frac{dT}{T - T_0} = K dt$$

$$\int \frac{dT}{T - T_0} = K \int dt$$

$$\ln(T - T_0) = Kt + C$$

$$T - T_0 = e^{Kt} + e^C \quad (\text{let } e^C = A)$$

$$T - T_0 = e^{Kt} + A$$

$$T - T_0 = A e^{Kt}$$

$$T = A e^{Kt} + T_0$$

Initially

$$10 = A e^{Kt} + 25$$

$$10 - 25 = A e^{K(0)}$$

$$-15 = A$$

$$\therefore T = -15 e^{Kt} + 25 \quad \text{or} \quad T = 25 - 15 e^{Kt}$$

At  $T = 20, t = 5$

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

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

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

$$\frac{1}{3} = e^{5K}$$

$$\ln\left(\frac{1}{3}\right) = 5K$$

$$-1.099 = 5K$$

$$K = \frac{-1.099}{5} = -0.22$$

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

### USING MATLAB

- Command window

```
clear
```

```
clc
```

```
close all
```

```
t = 0:1:60
```

```
K = -0.22
```

```
T = 25 - 15 * exp(K * t)
```

```
Plot(t, T)
```

$\therefore$  The steady state value = 25

### USING EXCEL

