ADEPOJU MARY ABIMBOLA
MTE/ENG/21004
CIVIL ENGINEERING
ENG 262

Modelling is a mathematical representation of a system in order to steady its behaviour

Differential Equation
Use of

From Newtons law of cooling

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

$$dT = k(T - T_M)\,dt$$

$$\frac{dT}{T - T_M} = k\,dt$$

Integrating Both Sides

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

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

$$T - T_M = e^{kt} \cdot e^{C}$$

Let $e^{C} = C$

$$T - T_M = e^{kt} \cdot C$$

$$T - T_M = Ce^{kt}$$

$$T = Ce^{kt} + T_M$$

At $t = 0$, $T = 10^{\circ}C$, $T_M = 25^{\circ}C$

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

$$10 = C + 25$$

$$C = 10 - 25$$

$$C = -15$$

$$T = -15e^{kt} + 25$$

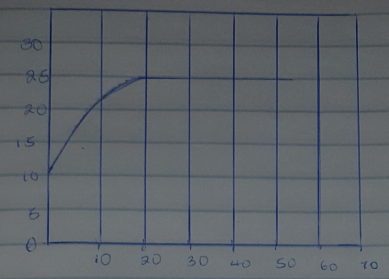
at $t = 5$ and $T = 20^{\circ}C$

$$20 = -15e^{k(5)} + 25$$
$$20 - 25 = -15e^{k(5)}$$
$$-5 = -15e^{k(5)}$$
$$\frac{-5}{-15} = \frac{-15}{-15} e^{k(5)}$$
$$1/3 = e^{5k}$$

$$5k = \ln(1/3)$$
$$k = -0.22$$

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

- Using Microsoft Excel
- Type in 't' for column 1
- " " 'T' " " 2
- For column 1, type '0' under t
- On the home, select fill under editing
- Select Series, Change Columns, insert a Step Value of 1 and a
- Step Value of 60 in enter
- Then in column 2, under t, type = 25 - 15*Exp(-0.22*/2) then enter
- Double click the dot at the bottom right of the cell
- Highlight columns 1 and 2
- Go to insert and click on graph type



Using Matlab
Commandwindow
clear
clc
close all
syms t
t = [0:1:60]
T = 25 - 15 * exp(-0.22 * t)
plot(t, T)
grid on
grid minor
xlabel('Time(sec)')
ylabel('Temperature(°C)')