

### Question 1

$$T_{\text{init}} = 10^\circ\text{C}$$

$$T = 20^\circ\text{C} \quad @ \quad 5 \text{ mins}$$

$$T_{\text{actual}} = 25^\circ\text{C}$$

$$\frac{dT}{dt} \propto (T - T_a)$$

$T_a = \text{Actual temperature}$

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

$$\frac{dT}{dt} = K(T - 25)$$

Collecting like terms

$$\frac{dT}{(T - 25)} = K dt$$

$$(T - 25)$$

Integrating both sides

1/2

$$\ln(T - 25) = tK + C$$

$$\therefore T - 25 = e^{tK + C}$$

where  $e^C = A$

$$T - 25 = e^{tK} \cdot e^C$$

$$T - 25 = A e^{tK}$$

$$T = A e^{tK} - 25$$

at initial conditions  $t = 0$   $T = 10^\circ\text{C}$

$$10 = A e^0 - 25$$

$$A = 35$$

$$\therefore T = 35 e^{tK} - 25$$

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

$$20 = 35 e^{5K} - 25$$

$$45 = 35 e^{5K}$$

$$e^{5K} = 45/35$$

$$5K = \ln(45/35)$$

$$K = \frac{0.251}{5}$$

$$K = 0.05$$

$$T = 35 e^{0.05t} - 25$$

Given

$$T = 24.9 \text{ at } t = ?$$

$$24.9 = 35 e^{0.05t} - 25$$

$$49.9 = 35 e^{0.05t}$$

$$e^{0.05t} = 49.9/35$$

$$e^{0.05t} = \ln(1.426)$$

$$0.05t = 0.355$$

$$t = 7.1 \text{ minutes}$$

```
yimaquiz2.m x +  
- commandwindow  
- clear  
- clc  
- close all  
- format short g  
- mdata=xlsread('onlinequizdata','fluiddata')  
- x=mdata(1:2:250,1)  
- y=mdata(1:2:250,2)  
- plot(x,y)  
- grid on  
- grid minor|
```

I

Command Window

```
86  
88  
90  
92  
94  
96  
98  
100  
fx 102
```

script

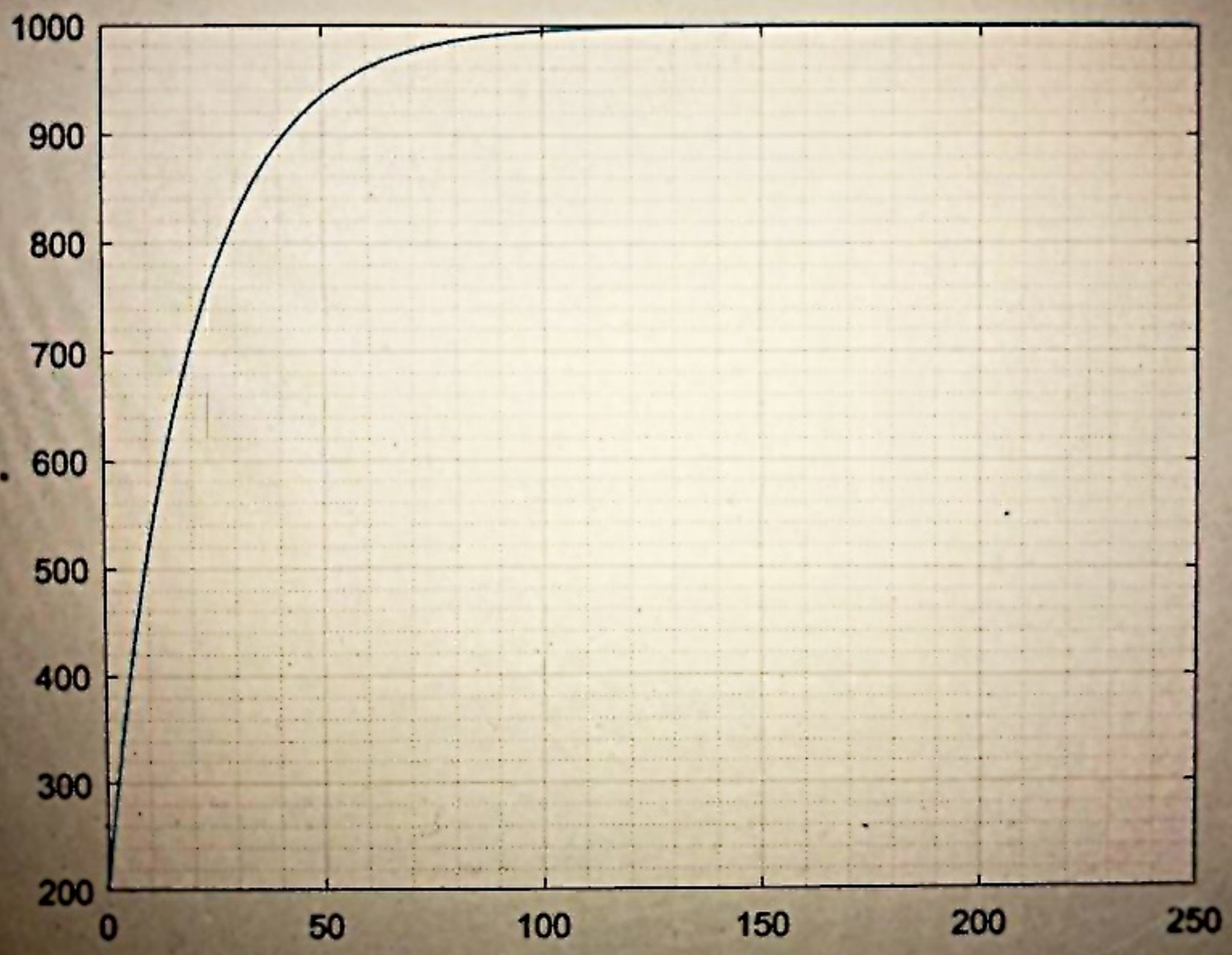
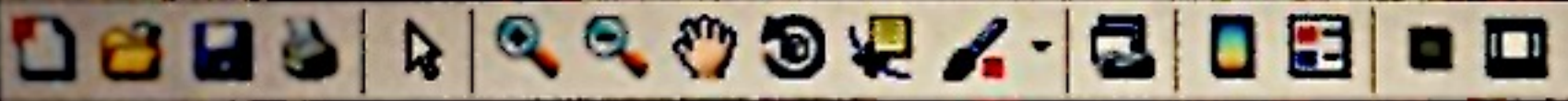
Ln 11 Col 11

EDITOR

Figure 1



File Edit View Insert Tools Desktop Window Help



- ts ▶ MAT
- Ed
- y
- 1 -
- 2 -
- 3 -
- 4 -
- 5 -
- 6 -
- 7 -
- 8 -
- 9 -
- 10 -
- 11 -

**AbubakarAbdullahi**

**18/eng03/001**

**Civil engineering**