

LEGHEMO SOLOMON

18/ENG08/010

BIO MEDICAL ENGINEERING

Question 1

$$T = 10^{\circ}\text{C} \quad T = 20^{\circ}\text{C} \quad @ \quad 5 \text{ mins}$$

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

$$dT/dt \propto (T - T_A)$$

$$dT/dt = k(T - T_A)$$

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

Collecting like terms

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

Integrating both sides

$$\ln(T-25) = t k + C$$

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

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

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

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

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

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

$$A = 35$$

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

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

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

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

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

$$5k = \ln\left(\frac{45}{35}\right)$$

$$k = \frac{0.251}{5} \quad k = 0.05$$

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

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

$$24.9 = 35e^{0.06t} - 25$$

$$49.9 = 35e^{0.06t}$$

$$e^{0.06t} = 49.9/35$$

$$e^{0.06t} = \ln(1.426)$$

$$0.06t = 0.355$$

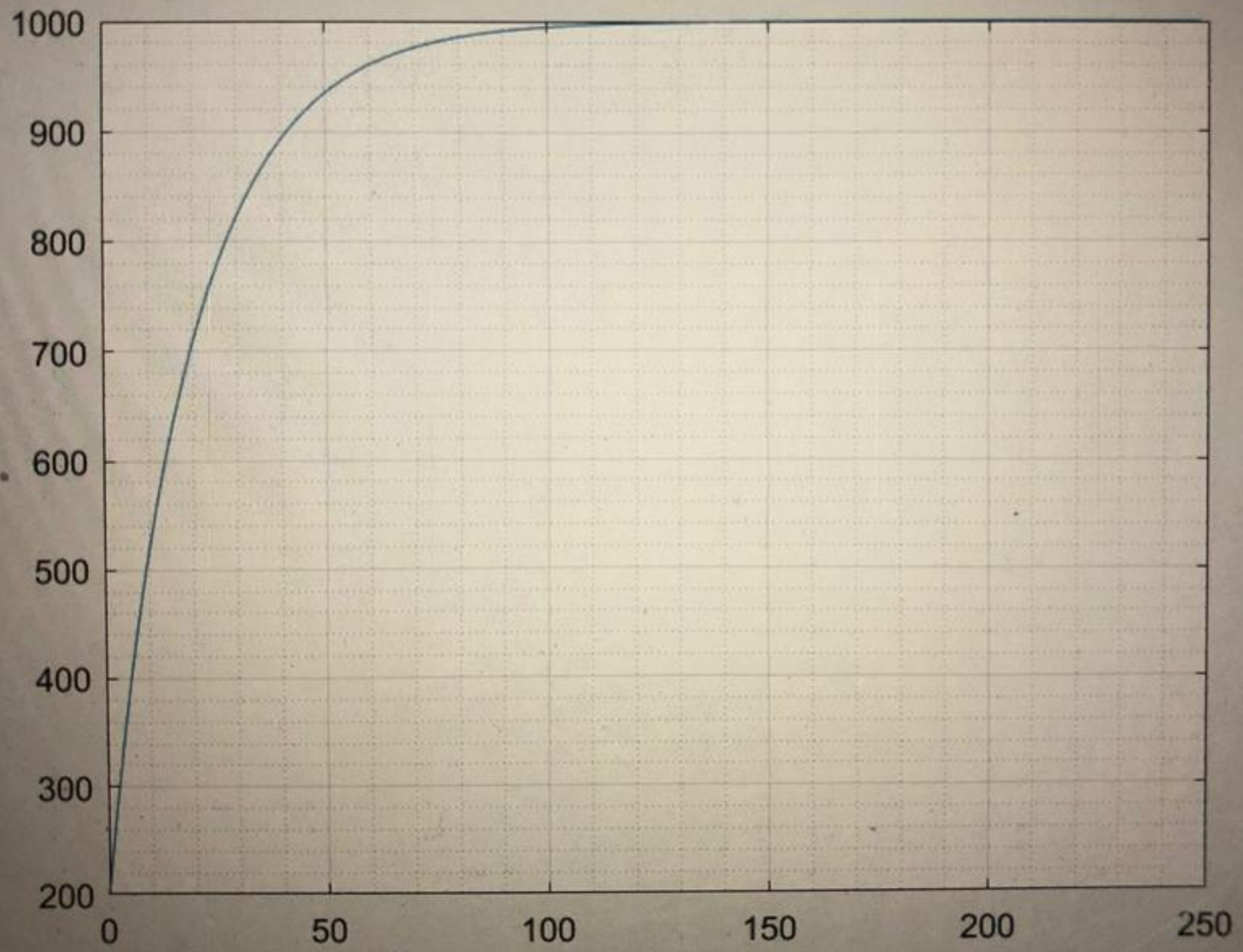
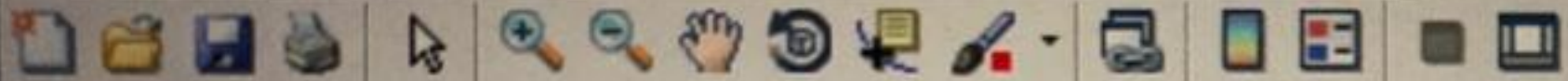
$$t = 7.1 \text{ minutes.}$$

EDITOR

Figure 1



File Edit View Insert Tools Desktop Window Help



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```
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