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18/EN0001013
Biomedical Engineering

Question 1

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

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

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

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

$T_A = \text{Actual temperature}$

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

Collecting like terms

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

Integrating

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

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

$$T - 25 = e^{tk} \cdot e^C \quad \text{where } e^C = A$$

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

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

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

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

$$A = 35$$

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

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

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

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

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

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

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

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

$$T = 2W.9 \text{ at } t = ?$$

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

$$W.9 = 35 e^{0.05t}$$

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

$$0.05t = 0.355$$

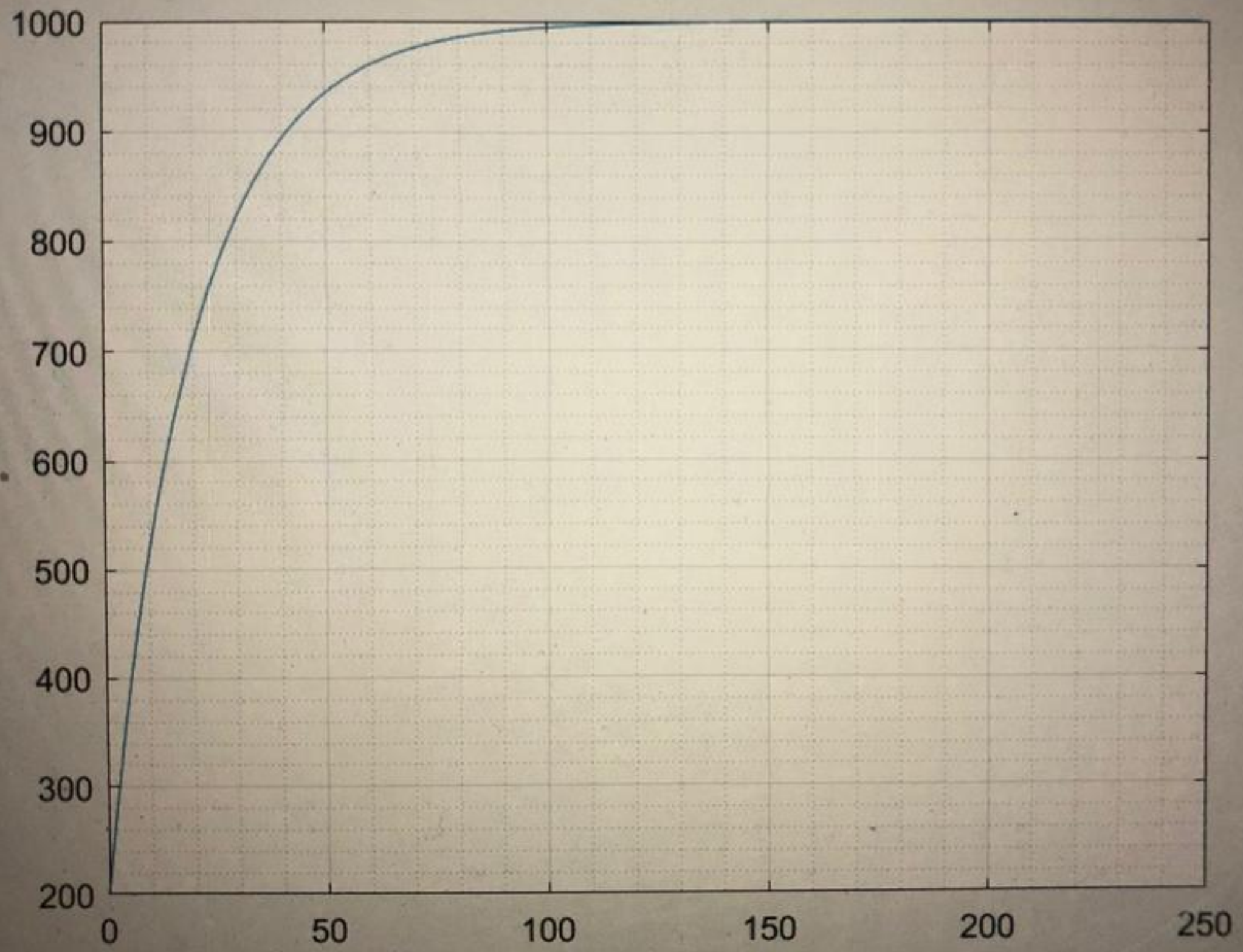
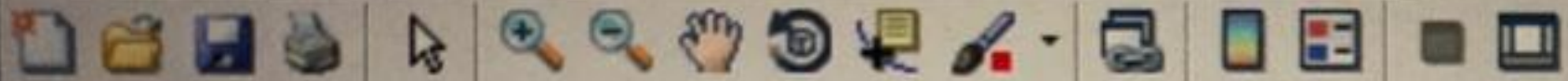
$$t = 7.1 \text{ mins}$$

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Figure 1



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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
```

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Command Window

86
88
90
92
94
96
98
100
102