

18/ENGG07/007

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$$T_{\text{initial}} = 10^{\circ}\text{C} \quad T = 20^{\circ}\text{C} \quad \text{at } 5 \text{ mins}$$
$$T_{\text{actual}} = 25^{\circ}\text{C}$$

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

$T_a = \text{Actual Temperature}$

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

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

Collect like terms

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

Integrating both sides

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

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

where $e^C = A$

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

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

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

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

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

$$A = 35$$

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

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

$$20^{\circ}\text{C} = 35 e^{5k} - 25$$

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

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

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

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

$$k = 0.05$$

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

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

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

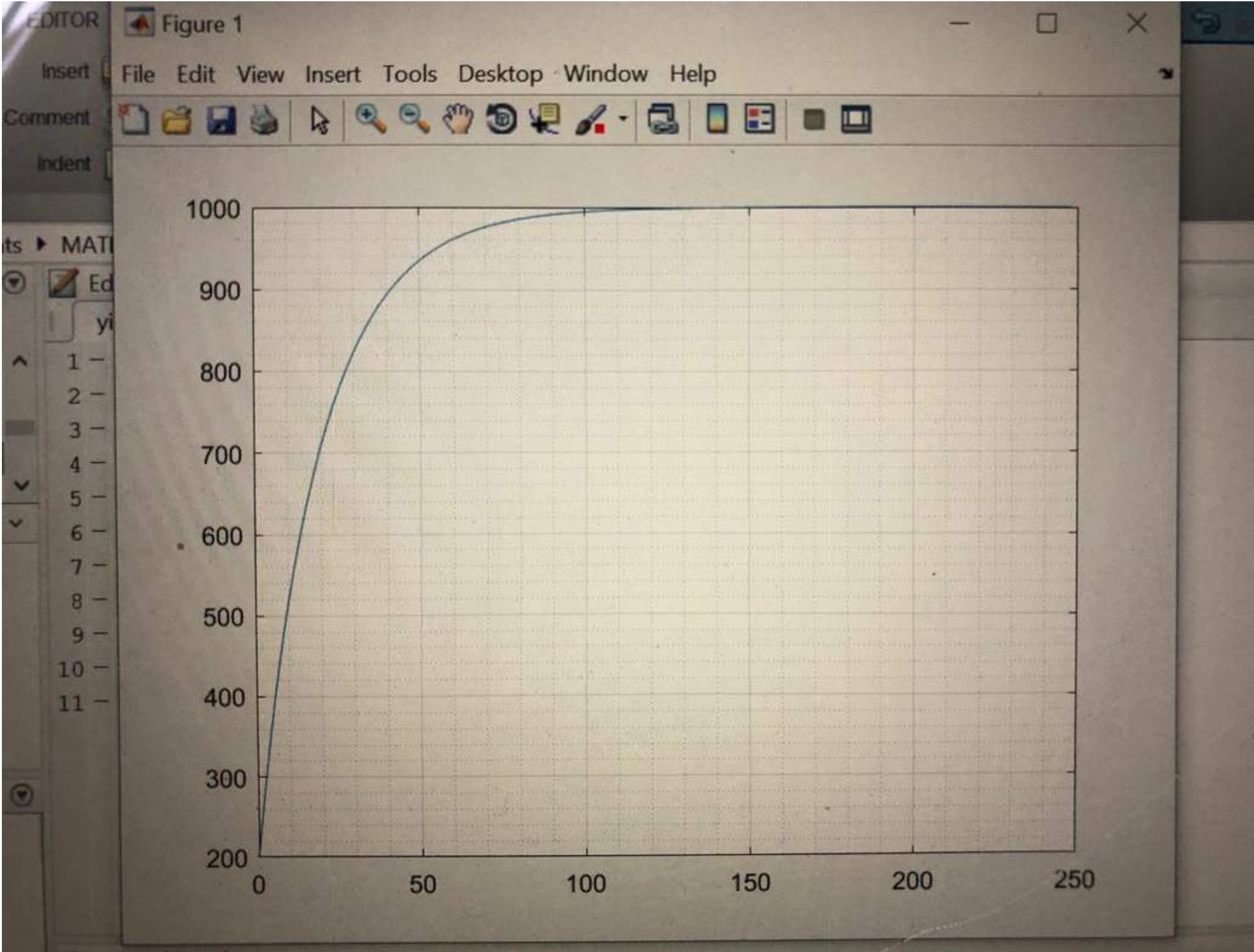
$$49.9 = 35 e^{0.05t}$$

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

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

$$0.05t = 0.355$$

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



```
- 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