Question 1

$T_{initial}$ = 10°c T = 20°c @ 5mins

T_{actual} = 25°c

$dT/dt \propto (T - T_A)$ T_A = Actual temperature

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

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

Collecting like terms

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

Integrating both Sides

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

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

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

$T - 25 = Ae^{tK}$

$T = Ae^{tK} - 25$

at Initial conditions $t = 0$ $T = 10°c$

$10 = Ae^0 - 25$

$A = 35$

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

at $T = 20°c$ $t = 5$ mins

$20° = 35e^{5K} - 25$

$45 = 35e^{5K}$

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

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

$K = \frac{0.251}{5}$ $K = 0.05$

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

T. 24.9 at t = ?

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

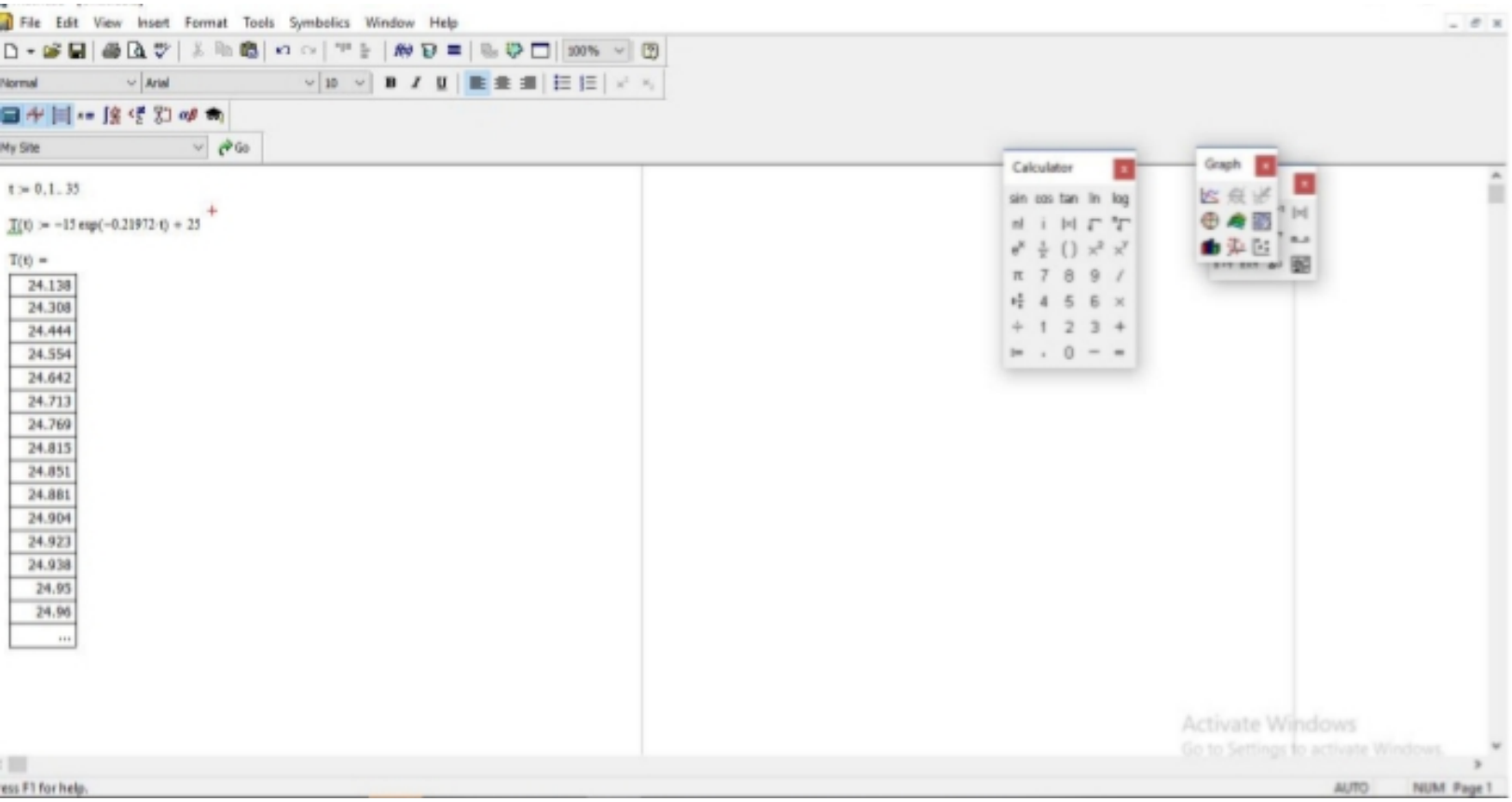
$49.9 = 35e^{0.05t}$

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

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

$0.05t = 0.355$

$t = 7.1$ minutes //


File Edit View Insert Format Tools Symbolics Window Help
Normal
Arial
My Site
Go
t := 0,1.. 35
T(t) := -15 exp(-0.21972·t) + 25
T(t) =
24.138
24.308
24.444
24.554
24.642
24.713
24.769
24.815
24.851
24.881
24.904
24.923
24.938
24.95
24.96
...
Calculator
Graph
Activate Windows
Go to Settings to activate Windows.
ess F1 for help.
AUTO
NUM Page 1

Initial temp (IT) = 10°C

Second temp (ST) = 20°C

Actual Temp (AT) = 25°C

Sayi' Temp (CT) = 24.9°C

Time from IT to ST = 5 mins = 300 secs

2 Time (2T) = ??

if from IT to ST = 20°C − 10°C = 10°C

and it take 5mins to cover 10°C ∴

5°C = ½ of 5mins

= 5°C = 2.5mins (to move from 20°C to 25°C)

25°C = 2.5m

∴ 24.9°C = ?

$$= \frac{2.5 \times 24.9}{25}$$ {2.5 mins = 150 secs)

$$= \frac{\overset{1}{\cancel{150}} \times 24.9}{\cancel{25}} = 6 \times 24.9 = 149.4$$

∴ 149.4 ÷ 60

= 2.49 = 2 mins 49 secs