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18/ENG05/011 Mechatronics. Eng

$$\frac{dT}{dt} = k(T - T_0)$$

$$\int \frac{dT}{T - T_0} = \int k dt$$

$$\ln(T - T_0) = kt + c$$

$$T - T_0 = e^{kt+c}$$

$$T - T_0 = e^{kt} \cdot e^c$$

$$T = T_0 e^{kt} - \text{--- (1)}$$

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

Substituting into (1)

$$10 = T_0 e^{k(0)}$$

$$T_0 = 10^\circ\text{C}$$

$$T = 10 \times e^{kt}$$

At $t = 5$ mins

$$T = 20^\circ$$

$$20 = 10 \times e^{k(5)}$$

$$20 = 10 \times e^{5k}$$

$$\ln 2 = e^{5k}$$

$$0.6931 = 5k$$

$$k = \frac{0.6931}{5} = 0.139$$

$$T = 10 \times e^{0.139t} - \text{--- (2)}$$

Time at $T = 24.9^\circ\text{C}$

Substitute into (2)

$$24.9 = 10 \times e^{0.139t}$$

$$2.49 = e^{0.139t}$$

$$\ln 2.49 = 0.139t$$

$$0.9123 = 0.139t$$

$$t = \frac{0.9123}{0.139}$$

$$t = 6.56 \text{ minutes}$$

Normal | Rad | 10 | [Icons]

$t = 0..20$

$T(t) = 10 e^{0.119t}$

T(t) =	t =
10	0
11.491	1
13.205	2
15.174	3
17.437	4
20.037	5
23.025	6
26.459	7
30.404	8
34.938	9
40.149	10
46.130	11
53.016	12
60.921	13
70.006	14
80.446	15

Graph

Temperature in degree Celsius

Time in minutes

at

24.9
19.03
14.97
10

0 2.19 4.37 6.36

Activate Windows
Go to Settings to activate Windows

Press F1 for help. AUTO

11:17 am
2/26/2020

QUESTION 2

