

Mathcad - [Untitled2]

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My Site

$t := 0, 1..35$

$T(t) := -15 \exp(-0.21972 \cdot t) + 25$

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

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10°C

5 mins \rightarrow 20°C

(actual) 5 mins \rightarrow 25°C

$f = 24.9^\circ\text{C}$

$$\frac{dT}{dt} = kT$$

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

$$T = T_0 e^{kt}$$

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

$T =$ (temperature read by thermometer)

$$10 = T_0 \times e^{k \cdot 0}$$

$$\cancel{10 = T_0}$$

$$10 = T_0$$

$$T = 10 \times e^{kt} \quad \text{--- (1)} \Rightarrow T = 10 \times e^{0.139t} \quad \text{--- (2)}$$

$f = 5$ mins

$T = 20^\circ$

$$20 = T_0 \times e^{k \cdot 5}$$

$$\cancel{20 = T_0}$$

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

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

$$\ln 2 = 5k$$

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

time for thermometer to read 24.9°C

substitute into (2)

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

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

$$\ln 2.49 = 0.139t$$

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

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