

Aron Singh

Project 1: Section 4.2

Question 3: At 12:00 PM a thermometer reading 10°F is placed in a room where the temperature is 70°F . It reads 56° when placed outside, where the temperature is 5°F at 12:03. What does it read at 12:05 PM?

$$T_0 = 70^\circ\text{F}$$

$$T = 10^\circ\text{F}, \text{ when } t=0 \text{ (12 PM)}$$

* Newton's Law of Cooling: $T = T_m + (T_0 - T_m)e^{-kt}$

$$C = (T_0 - T_m)$$

$$T = T_m + Ce^{-kt}$$

$$10^\circ\text{F} = 70 + Ce^{kt}$$

$$10 = 70 + Ce^{k(0)} \Rightarrow 10 = 70 + C \Rightarrow C = -60$$

$$T_0 = 70^\circ\text{F}$$

$$C = -60$$

$$T(t) = 70 - 60e^{kt}$$

$$t = 3 \text{ min}$$

$$T_4 = 56^\circ\text{F}$$

$$56^\circ\text{F} = 70 - 60e^{k(3)}$$

$$56 - 70 = -60e^{-k(3)}$$

$$\frac{14}{60} = e^{k(3)} \Rightarrow 3k = \ln\left(\frac{14}{60}\right)$$

$$k = -0.485$$

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$$C = 56 - 5 = 51$$

$$t = 12:05 - 12:03 = 2 \text{ minutes}$$

$$T = 5 + 51e^{-0.485(2)}$$

$$\underline{T = 24.3^\circ\text{F}}$$