

Problem #1. A thermometer is taken from a room where the temperature is 22°C to the outdoors, where the temperature is -6°C . After 1 minute the thermometer reads 10°C .

$$T(\text{time}) = T_s + (T_0 - T_s)e^{-Kt}$$

T = Temperature

t = Time

T_s = Surrounding Temperature

T_0 = Initial Temperature

K = Ratio

$$T_0 = 22^\circ\text{C}; T_s = -6^\circ\text{C}; T(1) = 10^\circ\text{C}$$

① Finding K .

$$T(1) = -6^\circ\text{C} + (22^\circ\text{C} - (-6^\circ\text{C}))e^{-K \cdot 1}$$

$$10^\circ\text{C} + 6^\circ\text{C} = \frac{28^\circ\text{C}}{28^\circ\text{C}} e^{-K}$$

Natural Log

$$\ln\left|\frac{16^\circ\text{C}}{28^\circ\text{C}}\right| = \ln|e|^{-K}$$

$$-\ln\left|\frac{16^\circ\text{C}}{28^\circ\text{C}}\right| = K$$

$$K = 0.559615$$

a) What will the thermometer be after 4 more minutes?

$$T_0 = 10^\circ\text{C}; T_s = -6^\circ\text{C}; K = 0.559615; t = 4.$$

$$T(4) = -6^\circ\text{C} + (10^\circ\text{C} - (-6^\circ\text{C}))e^{-0.559615(4)}$$

$$T(4) = -6^\circ\text{C} + (16^\circ\text{C})e^{-0.559615(4)}$$

$$T(4) = \underline{-4.294^\circ\text{C}}$$

Plug & Solve

b) When will the thermometer read -5°C ?

$$-5^\circ\text{C} = -6^\circ\text{C} + (22^\circ\text{C} - (-6^\circ\text{C}))e^{-0.559615t}$$

$$1^\circ\text{C} = (28^\circ\text{C})e^{-0.559615t}$$

Natural Log

$$\ln\left(\frac{1}{28}\right) = \ln(e^{-0.559615t})$$

$$\frac{\ln\left(\frac{1}{28}\right)}{-0.559615} = \frac{-0.559615t}{-0.559615}$$

$$\frac{\ln\left(\frac{1}{28}\right)}{-0.559615} = t = \underline{5.95 \text{ minutes}}$$

* Solve for t .