Name: _____Solution_____ Section # _____ Serial # ____

A Chicken has been in a refrigerator for several days and has a uniform temperature of $40°$ F. An oven is preheated to $352°$ F. The chicken is placed in the oven for 20 minutes and then taken out and its temperature is found to be $60°$ F. What will be the temperature of the chicken after 3 hours?

Recall Newton's law of Cooling:

$$\frac{dT}{dt} = K(T - T_m), \quad \text{where} \quad \begin{cases} T_m = 325 \\ T(0) = 40 \\ T(20) = 60 \\ T(180) = ? \end{cases}$$

Solving this DE, we get

$$T(t) = T_m + c e^{kt}$$

$$T(t) = 325 + c e^{kt} \quad ---- (1)$$

$$T(0) = 325 + C = 40 \quad \Rightarrow \quad \boxed{C = -285}$$

∴ (1) becomes

$$T(t) = 325 - 285 e^{kt} \quad ---(2)$$

$$T(20) = 325 - 285 e^{20k} = 60$$

$$\Rightarrow \quad 285 e^{20k} = 265 \quad \Rightarrow \quad e^{20k} = \frac{265}{285} = \frac{53}{57}$$

$$\Rightarrow 20k = \ln\left(\frac{53}{57}\right)$$

$$\Rightarrow K = \frac{1}{20} \ln \frac{53}{57} \simeq -.00364$$

∴ (2) becomes

$$T(t) = 325 - 285 e^{-.00364 t}$$

$$T(180) = 325 - 285 e^{-.00364 (180)}$$

$$\approx 177$$

∴ The temperature of the chicken after 3 hours will be $177°$F.