A3) By Newton's law of cooling:

$$\frac{dT}{dt} = -K(T - T_a)$$

where, T = temperature of body (°C)
t = ~~room~~ time (min)
K = proportionality constant (per minute)
T_a = ambient temperature (°C)

Given: $T_a = 21°C$
initial temperature $(T_i) = 68°C$
$K = 0.017/min$
step size $(\Delta t = t_{i+1} - t_i) = 1 min$
start time = 0 min
end time = 10 min
total time = 10 min

To Find:- Need to compute temperature using Euler's method.

Given that, $\frac{dT}{dt} = -K(T - T_a)$

Apply Euler's method;

$$\frac{dT}{dt} = \frac{T(t_{i+1}) - T(t_i)}{t_{i+1} - t_i} = -K(T_i - T_a)$$

$$\Rightarrow T(t_{i+1}) - T(t_i) = -K(T_i - T_a)(t_{i+1} - t_i)$$

$$\Rightarrow T(t_{i+1}) = T(t_i) - K(T_i - T_a) \times (\text{step size})$$

$$\Rightarrow T(t_{j+1}) = T(t_j) - K(T(t_i) - T_a) \times (\text{step size})$$

$$\Rightarrow T_{j+1} = T_j - (0.017)(T_j - 21)(1)$$

$$\Rightarrow \boxed{T_{j+1} = T_j - (0.017)(T_j - 21)}$$

T_{j+1} = New Temperature

T_i = Previous Temperature

From matlab code, we get the final temperature of coffee as 60.594 °C.

Time_min	Temperature_celcius	dT_dt_value
0	68	-0.799
1	67.201	-0.78542
2	66.416	-0.77206
3	65.644	-0.75894
4	64.885	-0.74604
5	64.139	-0.73336
6	63.405	-0.72089
7	62.684	-0.70863
8	61.976	-0.69659
9	61.279	-0.68474
10	60.594	-0.6731