

(A3) Problem Statement :

Using Euler's method, compute temperature of cup of coffee within time interval 0 to 10 minutes with the help of following parameters.

- (i) initial temperature of coffee cup of coffee (T) = 68°C
- (ii) ambient temperature (T_a) = 21°C and
- (iii) proportionality constant (k) = $0.017/\text{minute}$

knowns,

$$T = 68^\circ\text{C} \quad (\text{initial temperature})$$

$$T_a = 21^\circ\text{C} \quad (\text{ambient temperature})$$

$$k = 0.017/\text{min} \quad (\text{proportionality constant})$$

$$t \in [0, 10] \text{ min} \quad (\text{time interval})$$

$$h = \Delta t = 1 \text{ min} \quad (\text{Step size})$$

unknowns,

$$T(t) = ? \quad \text{where } t \in [0, 10]$$

(temperature of coffee at points within t with stepsize 1min)

Solⁿ:

$$\frac{dT}{dt} = -k(T - T_a) \quad \text{--- given}$$

$$(T_a)' = -0.017(68 - 21)$$

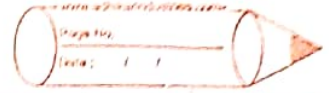
$$V_{i+1} = V_i + h f(V_i)$$

--- from Euler's method

$$\text{ie, } T_1 = T_0 + h(T_0)'$$

$$T_1 = 68 + 1 \times (-0.017(47))$$

$$T_1 = 67.201^\circ\text{C}$$



Table, and Plot,

Time (From 0 to .)	Temperature
0	68.000
1	67.201
2	66.416
3	65.644
4	64.885
5	64.139
6	63.405
7	62.684
8	61.976
9	61.279
10	60.594

assumptions;

- ① surrounding temperature doesn't affect the temperature of coffee cup.
- ② rate of cooling is totally depending only on difference between the coffee temperature and ambient temperature
- ③ System (coffee, surrounding, etc) to be ideal.

Temperature of Coffee Over Time

