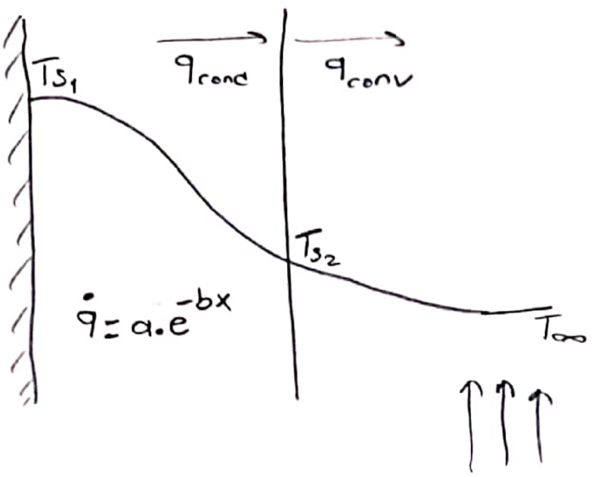
Quiz-2

Mohksah KOCA.



General Heat Eqn.

$$\frac{d}{dx}\left(k\frac{dT}{dx}\right) + \dot{q} = 0$$

- k constant
- $\dot{q} = a.e^{-bx}$

$\Downarrow$

$$k.\frac{d^2T}{dx^2} = -a\,e^{-bx}$$

integrate

$$\frac{dT}{dx} = \frac{1}{k}\cdot\frac{a}{b}e^{-bx} + C_1 \quad \xRightarrow{\text{integrate}} \quad \boxed{T(x) = \frac{1}{k}\cdot -\frac{a}{b^2}e^{-bx} + C_1 x + C_2}$$

$$q_{cond} = q_{conv} \Rightarrow -k.\cancel{A}\left.\frac{dT}{dx}\right|_{x=L} = h.\cancel{A}.(T_\infty - T_{s_2})$$

$$-k\left(\frac{1}{k}\cdot\frac{a}{b}e^{-bx} + c_1\right) = h.(T_\infty - T_{s_2}) \quad (*)$$

c_1: ?

T_{s_2}: $T(\underbrace{a.b}_{L})$

$$q''_x = -k.\frac{dT}{dx}$$

$$\boxed{q''_x = -k\left(\frac{1}{k}\cdot\frac{a}{b}e^{-bx} + \left(-\frac{a}{kb}\right)\right)}$$

(b.) ✓

Insulated boundary condition:

at $x=0$ $\quad \left.\frac{dT}{dx}\right|_{x=0} = 0 \Rightarrow \frac{1}{k}\cdot\frac{a}{b}e^{-bx \nearrow 0} + c_1 = 0 \Rightarrow c_1 = -\frac{1}{k}\cdot\frac{a}{b}e^{\cancel{0}\nearrow 1}$

$$c_1 = -\frac{a}{kb}$$

put this into $(*)$

$$\boxed{-\frac{k}{h}\left(\frac{1}{k}\cdot\frac{a}{b}e^{-b.(a.b)} + \left(-\frac{a}{kb}\right)\right) = T_\infty - \left(\frac{1}{k}\cdot\frac{-a}{b^2}e^{-b.(a,b)} + \left(-\frac{a}{kb}\right)(a.b) + C_2\right)}$$

put the numbers and solve for C_2

we have found C_1 and C_2,
Thus we can rewrite $T(x)$ by putting C_1 and C_2 into $T(x)$

(a.) ✓