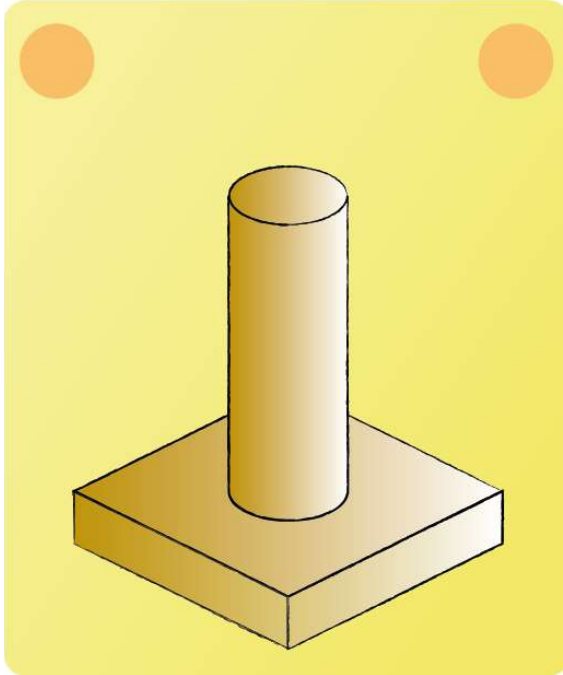# Lecture 11 - Question 2

Remember the inhomogeneous differential equation for fins:

$$-\lambda \cdot A_c \cdot \frac{\partial^2 T}{\partial x^2} = \alpha \cdot U \left(T\left(x\right) - T_A \right)$$

Which of the following terms can be used to simplify it to a 2nd order homogeneous differential equation?

$$\theta\left(x\right) \; = \; T\left(x\right) - T_A$$

Substitution of: $\theta\left(x\right) \; = \; T\left(x\right) - T_A$ and thus $\frac{\partial^2 \theta}{\partial x^2} \; = \; \frac{\partial^2 T}{\partial x^2}$ into $-\lambda \cdot A_c \cdot \frac{\partial^2 T}{\partial x^2} = \alpha \cdot U \left(T\left(x\right) - T_A \right)$ leads to:

$$-\lambda \cdot A_c \cdot \frac{\partial^2 \theta}{\partial x^2} = \alpha \cdot U \cdot \theta\left(x\right)$$

Rearranging results in the 2nd order homogeneous differential equation:

$$\frac{\partial^2 \theta}{\partial x^2} + \frac{\alpha \cdot U}{\lambda \cdot A_c} \cdot \theta\left(x\right) \; = \; 0$$