a) Derive a mathematical model that describes the solid unsteady temperature distribution, T(r, t)

b) Solve the model and compare your result with the following equation and find the parameters of *A*, *B*, C_n , β and γ .

$$T(r,t) := A + \frac{B}{r} + \sum_{n=1}^{\infty} \frac{C_n}{r} \sin[\beta(r-r_i)] e^{\gamma t}$$

2. A cylindrical block of radius *R*, thermal diffusivity of α and at uniform temperature of T_0 is isolated from its circular surface. The temperature of the curved surface is increased suddenly to T_1 .

a) Derive a mathematical model that describes the transient response of the cylinder temperature, T(r, t)

b) Solve the formulation and compare your result with the following equation and find the parameters of A, β_n , Z, v and γ .

$$\frac{T_1 - T(r, t)}{T_1 - T_0} \coloneqq A \sum_{n=1}^{\infty} \frac{Z_{\nu}(\beta_n r)}{\beta_n Z_{\nu+1}(\beta_n R)} e^{\gamma r}$$

3. Consider a semi-infite body at initial temperature of T_0 between y = 0 and $y = \infty$. Suddenly the body s surface at y = 0 is exposed to a constant flux of q_0 .

(a) Derive unsteady state model of the system describing its thermal flux distribution. q(y, t). compare the model with the following formula and find the parameter of α .

$$\alpha \frac{\partial^2 q}{\partial y^2} \coloneqq \frac{\partial q}{\partial t}$$

(b) Solve the model and find the thermal flux distribution.