Transient one-dimensional heat conduction

	Exact temperature distribution	Coefficient	Eigenvalues	Approximate energy transfer[a]
Finite slab	$\theta^* = \sum_{n=1}^{\infty} C_n \cos(\lambda_n x^*) e^{-\lambda_n^2 .Fo}$	$C_n = \frac{4 \sin \lambda_n}{2\lambda_n + \sin 2\lambda_n}$	$\lambda_n \tan \lambda_n = Bi$	$\frac{Q}{Q_0} = 1 - \frac{\sin \lambda_1}{\lambda_1} \theta_0^*$
Infinite cylinder (L/r_o > 10)	$\theta^* = \sum_{n=1}^{\infty} C_n J_0 \cos(\lambda_n r^*) e^{-\lambda_n^2 .Fo}$	$C_n = \frac{2}{\lambda_n} \cdot \frac{J_1(\lambda_n)}{J_0^2(\lambda_n) + J_1^2(\lambda_n)}$	$\lambda_n \frac{J_1(\lambda_n)}{J_0(\lambda_n)} = Bi$	$\frac{Q}{Q_0} = 1 - \frac{2\theta_0^*}{\lambda_1} J_1(\lambda_1)$
Sphere	$\theta^* = \sum_{n=1}^{\infty} C_n \frac{1}{\lambda_n r^*} \sin(\lambda_n r^*) e^{-\lambda_n^2 .Fo}$	$C_n = \frac{4(\sin \lambda_n - \lambda_n \cos \lambda_n)}{2\lambda_n - \sin 2\lambda_n}$	$1 - \lambda_n \cot \lambda_n = Bi$	$\frac{Q}{Q_0} = 1 - \frac{3\theta_0^*}{\lambda_1^3} (\sin \lambda_1 - \lambda_1 \cos \lambda_1)$

[a]In all cases: $\theta_0^* = C_1 e^{-\lambda_1^2 Fo}$

Systematic approach:

1. Check to see if Fo ≥ 0.2. If this is the case, use only the first term in the development of θ^* (C_1 and λ_1 [aka ζ_1] can be obtained from Table 5.1 p 274)
2. If Fo < 0.2, obtain the first four eigenvalues from the eigenvalue equation or Appendix B.3. Determine J_0 and J_1 from Appendix B.4
3. Obtain the first four values for C_n (this is typically sufficient) and solve for θ^*