$$\frac{d^2x}{dt^2} = -\frac{C}{x^2}$$

$$\frac{dv}{dt} = -\frac{K}{x^2}$$

$$\frac{dx}{dt} = v$$

$$\text{flow in from left} = f(x_i)\ dy\ dz$$

$$\text{flow out to right} = f(x_{i+1})\ dy\ dz$$

$$f(x_{i+1})\ dy\ dz = f(x_i)\ dy\ dz$$

$$\Delta x \equiv x_{i+1} - x_i$$

$$f(x + \Delta x) = f(x)$$

$$\frac{df}{dx} = 0$$

$$f(x) = C \qquad \text{(some constant value)}$$

$$\frac{\partial q}{\partial x} = 0$$

$$q = -K\frac{\partial T}{\partial x}$$

$$\frac{\partial^2 T}{\partial x^2} = 0$$

$$\frac{\partial^2 T}{\partial x^2} = S(x)$$

$$\text{forward difference } D_i^+ \quad = \quad \frac{T_{i+1} - T_i}{x_{i+1} - x_i}$$

$$\text{backward difference } D_i^- \quad = \quad \frac{T_i - T_{i-1}}{x_i - x_{i-1}}$$

$$\text{centered second difference } D_i^2 \quad = \quad \frac{D_i^+ - D_i^-}{\frac{1}{2}(x_{i+1} - x_{i-1})}$$

$$q \quad = \quad -k\rho C \, \frac{\partial T}{\partial x}$$

$$-\frac{\partial q}{\partial x} \, \Delta t \quad = \quad \rho C \, \Delta T$$

$$k \, \frac{\partial^2 T}{\partial x^2} \quad = \quad \frac{\partial T}{\partial t}$$

$$T_i^{\text{new}} \quad = \quad T_i^{\text{old}} \; + \; k \left(\frac{\partial^2 T}{\partial x^2} \right)_i dt$$

$$\Delta T \quad = \quad \frac{\text{Heat added to segment}}{(\text{heat capacity}) * (\text{mass})}$$

$$= \quad \frac{-K \frac{\partial T}{\partial x} \, A \, \Delta t}{C \, (\rho \, dx \, A)}$$

$$\Delta T \quad = \quad \frac{-K \; (T_i - T_{i-1}) \, \Delta t}{C \, \rho \, dx^2}$$