

# ME 303 Advanced Engineering Mathematics

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## Ordinary Differential Equations in Spherical Coordinates

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When certain partial differential equations formulated in spherical coordinates are separated by the separation of variables method, or the Laplace transform method, one of the following second-order differential equations may appear.

As a review of some second-order ordinary differential equations, obtain the solutions of the following *ODES* using any **CAS** such as: *Mathematica*, *Maple*, *Matlab*, *MathCAD*, etc.

$$\frac{d^2 y}{dr^2} + \frac{2}{r} \frac{dy}{dr} = 0 \quad (1)$$

$$\frac{d^2 y}{dr^2} + \frac{2}{r} \frac{dy}{dr} = \frac{S}{k} \quad (2)$$

$$\frac{d^2 y}{dr^2} + \frac{2}{r} \frac{dy}{dr} = -\frac{S}{k} \quad (3)$$

$$\frac{d^2 y}{dr^2} + \frac{2}{r} \frac{dy}{dr} + \lambda^2 y = 0 \quad (4)$$

$$\frac{d^2 y}{dr^2} + \frac{2}{r} \frac{dy}{dr} - \lambda^2 y = 0 \quad (5)$$