ME 303 Advanced Engineering Mathematics

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Ordinary Differential Equations in Spherical Coordinates

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.

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

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

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

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

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