

General solution for equation in $\mathbb{R}$

$$R(r) = Ar^l + \frac{B}{r^{l+1}}$$

Exercise: verify that this expression is a solution to the equation in $\mathbb{R}$.

General solution for equation in $\mathbb{H}$

$$\mathbb{H}(\theta) = P_l(\cos\theta)$$

Exercise: verify that $P_0, P_1, P_2, \dots$ are solutions to the equation in $\mathbb{H}$.

where $P_l(\cos\theta)$ are the Legendre Polynomials given by:

$$P_0(\cos\theta) = 1$$

$$P_1(\cos\theta) = \cos\theta$$

$$P_2(\cos\theta) = (3\cos^2\theta - 1)/2$$

$$P_l(\cos\theta) = \frac{1}{2^l l!} \left(\frac{d}{d(\cos\theta)} \right)^l (\cos^2\theta - 1)^l$$