Legendre Polynomials

LegendreP[n,x] gives the Legendre polynomial $P_n(x)$.
LegendreP[n, m, x] gives the associated Legendre polynomial $P_n^m(x)$.

BesselY[n, z] gives the Bessel function of the second kind $Y_n(z)$ ... The Neumann function

It satisfy the differential equation
$(1-x^2)\,(d^2y/dx^2) - 2\,x\,(dy/dx) + n\,(n+1)\,y = 0$ that we obtained for example in the solution of the Laplace equation in spherical coordenates.

Remenber that :

n = l is a number
y = y (x) = P (x) where x is the independent variable

Traditional form

In[3]:=
```
LegendreP[n, x] // TraditionalForm
LegendreP[n, m, x] // TraditionalForm
```

Out[3]//TraditionalForm=
$P_n(x)$

Out[4]//TraditionalForm=
$P_n^m(x)$

Solve Equation

Solving the Legendre equation

In[29]:=
```
DSolve[Sin[θ] D[Sin[θ] f'[θ], θ] - m^2 f[θ] == -λ (λ + 1) Sin[θ]^2 f[θ], f[θ], θ]
```

Out[29]= {{f[θ] → C[1] LegendreP[λ, m, Cos[θ]] + C[2] LegendreQ[λ, m, Cos[θ]]}}

Examples

In[30]:=
```
LegendreP[0, x]
LegendreP[1, x]
LegendreP[2, x]
LegendreP[3, x]
LegendreP[10, x]

LegendreP[3, 2, x]
```

Out[30]= 1

Out[31]= x

Out[32]= $\frac{1}{2}\left(-1+3x^2\right)$

Out[33]= $\frac{1}{2}\left(-3x+5x^3\right)$

Out[34]= $\frac{1}{256}\left(-63+3465x^2-30\,030x^4+90\,090x^6-109\,395x^8+46\,189x^{10}\right)$

Out[35]= $-15x\left(-1+x^2\right)$

In[36]:=
```
Plot[{LegendreP[0, x], LegendreP[1, x], LegendreP[2, x], LegendreP[3, x],
  LegendreP[4, x]}, {x, -1.5, 1.5}, PlotLegends → "Expressions"]
```

Out[36]=