```
(*We define the generating function for the Legendre polynomials as in Eq.12.5.1:*)

phi[x_, h_] := 1 / Sqrt[1 - 2 * x * h + h^2]

(*We can expand this in a power series in h about h=0, treating x as a constant:*)

Simplify[Series[phi[x, h], {h, 0, 3}]]
```

$$1 + x\,h + \frac{1}{2}\left(-1 + 3\,x^2\right)h^2 + \frac{1}{2}x\left(-3 + 5\,x^2\right)h^3 + O[h]^4$$

```
 (*We now prove Eq.12.5.5:*)

FullSimplify[(1 - x^2) * D[D[phi[x, h], x], x] - 2 * x * D[phi[x, h], x] + h * D[D[h * phi[x, h], h], h]]
```

```
0
```