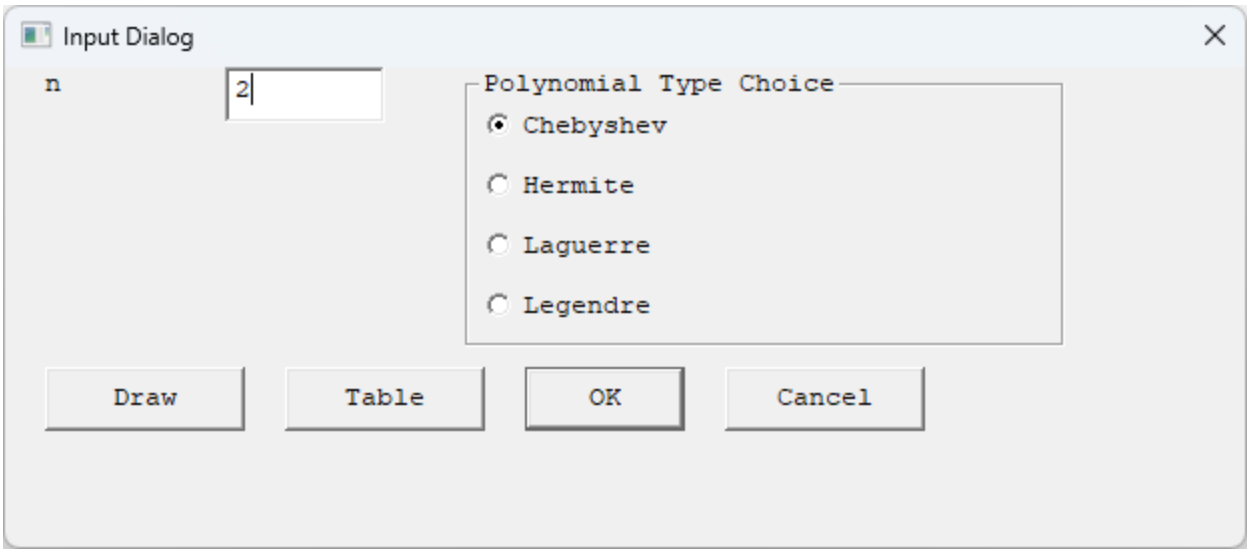
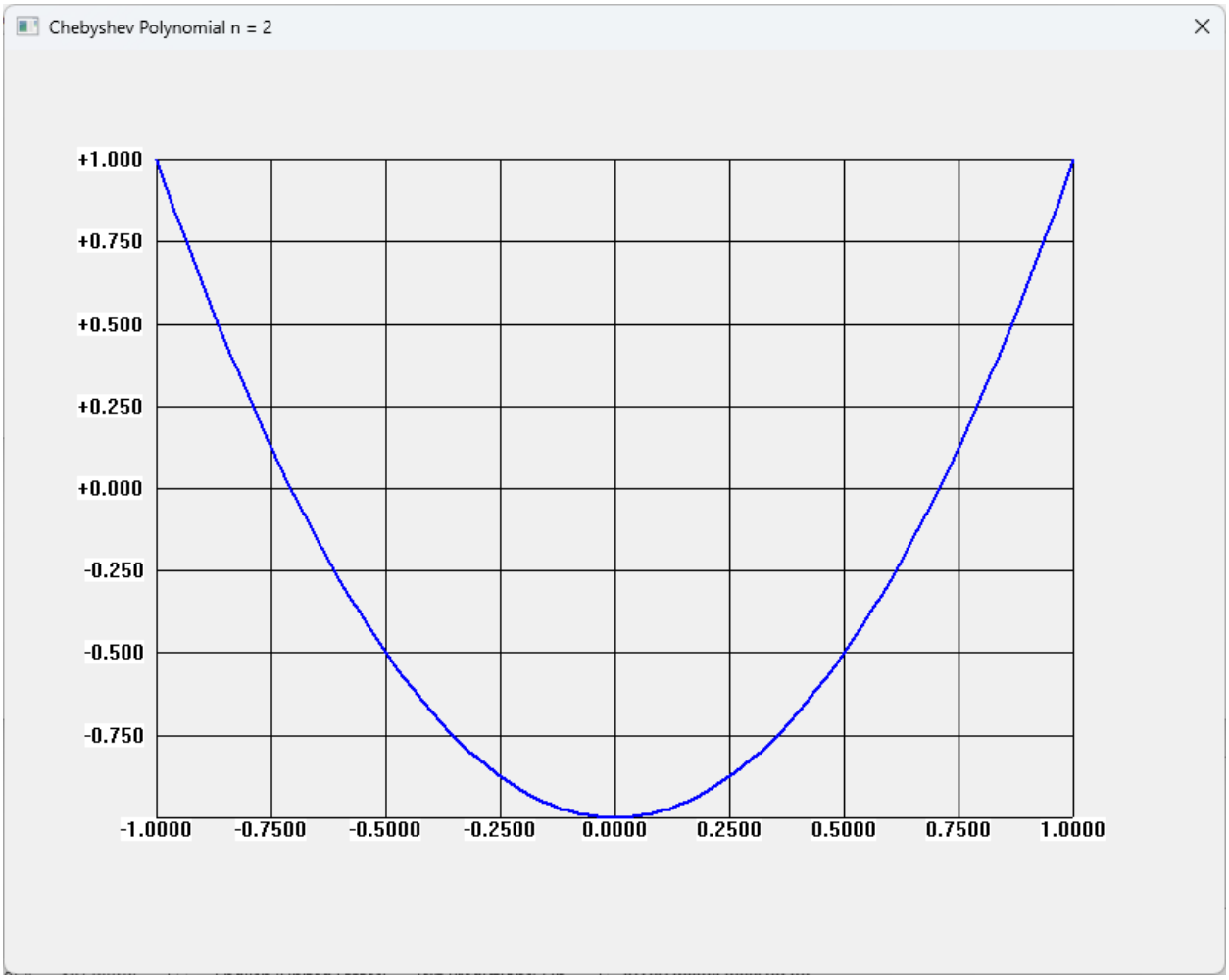
Blog Entry © Wednesday, August 27, 2025, by James Pate Williams, Jr. and the CACM ALGOL60 Algorithms for Calculating the Chebyshev, Hermite, Laguerre, and Legendre Orthogonal Polynomials

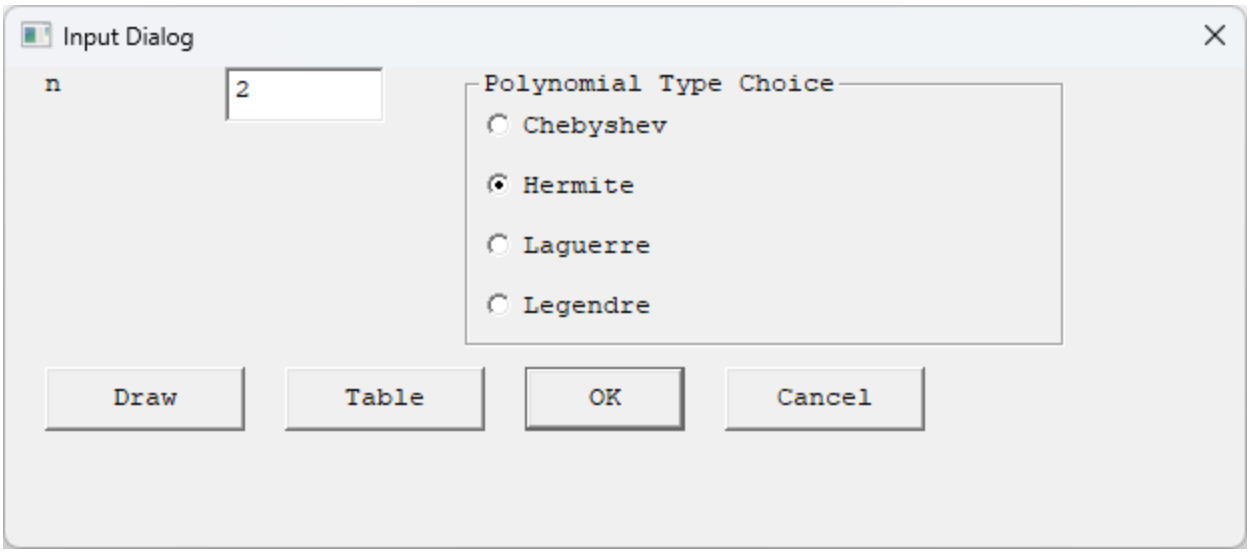
```
#pragma once
class OrthoPolys
{
public:
     //https://algol60.org/acm/010.pdf
     static double Chebyshev(double x, int n);
     // https://algol60.org/acm/011.pdf
     static double Hermite(double x, int n);
     // https://algol60.org/acm/012.pdf
     static double Laguerre(double x, int n);
     // https://algol60.org/acm/013.pdf
     static double Legendre(double x, int n);
};

#include "pch.h"
#include "OrthoPolys.h"

double OrthoPolys::Chebyshev(double x, int n)
{
    double a = 0.0, b = 0.0, c = 0.0;

    a = 1.0;
    b = x;

    if (n == 0)
    {
        c = a;
    }

    else if (n == 1)
    {
        c = b;
    }

    else
    {
        for (int i = 2; i <= n; i++)
        {
            c = 2.0 * x * b - a;
            a = b;
            b = c;
        }
    }
```

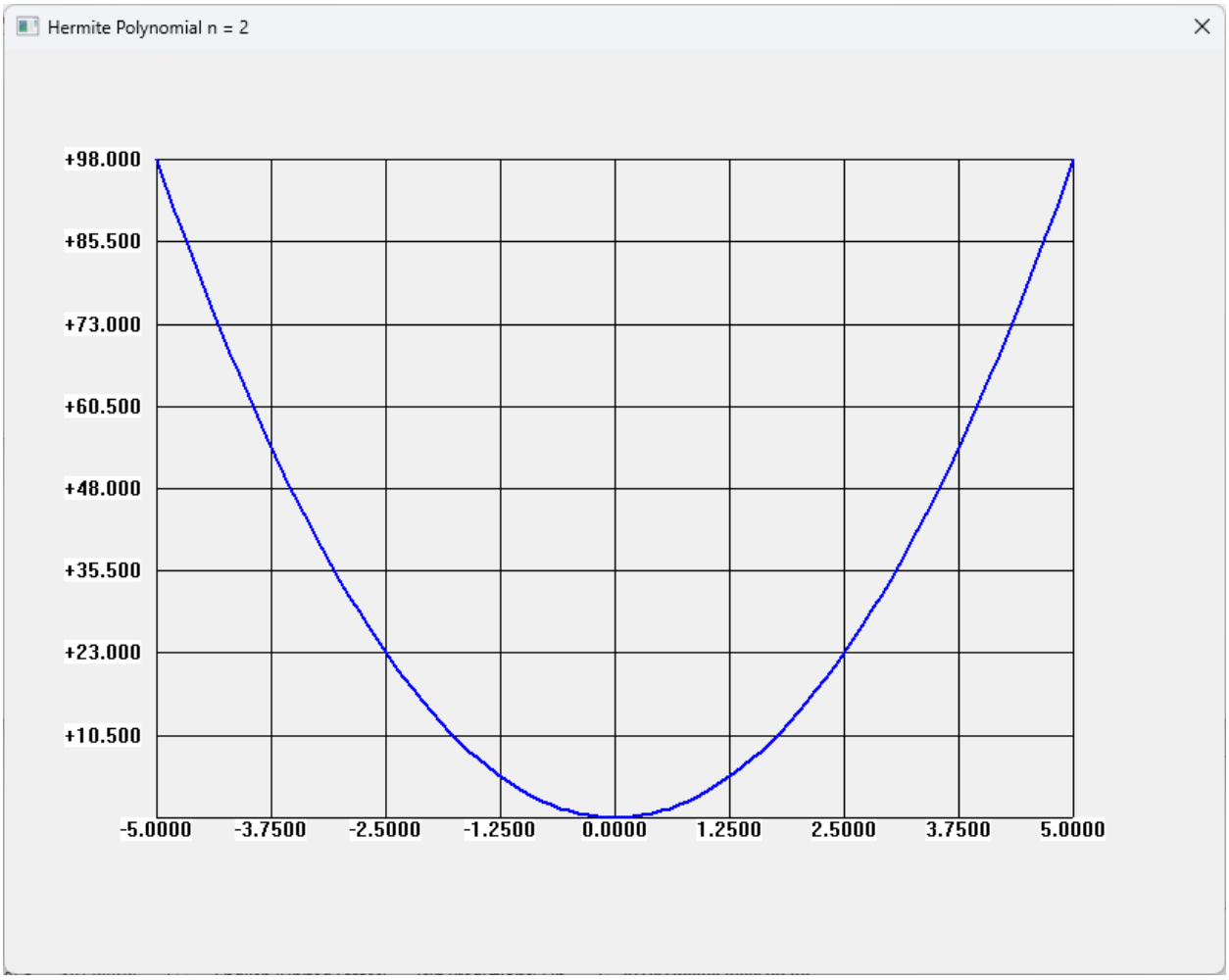
```
    return c;
}

double OrthoPolys::Hermite(double x, int n)
{
    double a = 0.0, b = 0.0, c = 0.0;

    a = 1;
    b = 2.0 * x;

    if (n == 0)
    {
        c = a;
    }

    else if (n == 1)
    {
        c = b;
    }

    else
    {
        for (int i = 1; i <= n - 1; i++)
        {
            c = 2.0 * x * b - 2.0 * i * a;
            a = b;
            b = c;
        }
    }

    return c;
}

double OrthoPolys::Laguerre(double x, int n)
{
    double a = 0.0, b = 0.0, c = 0;

    a = 1.0;
    b = 1.0 - x;

    if (n == 0)
    {
        c = a;
    }

    else if (n == 1)
```

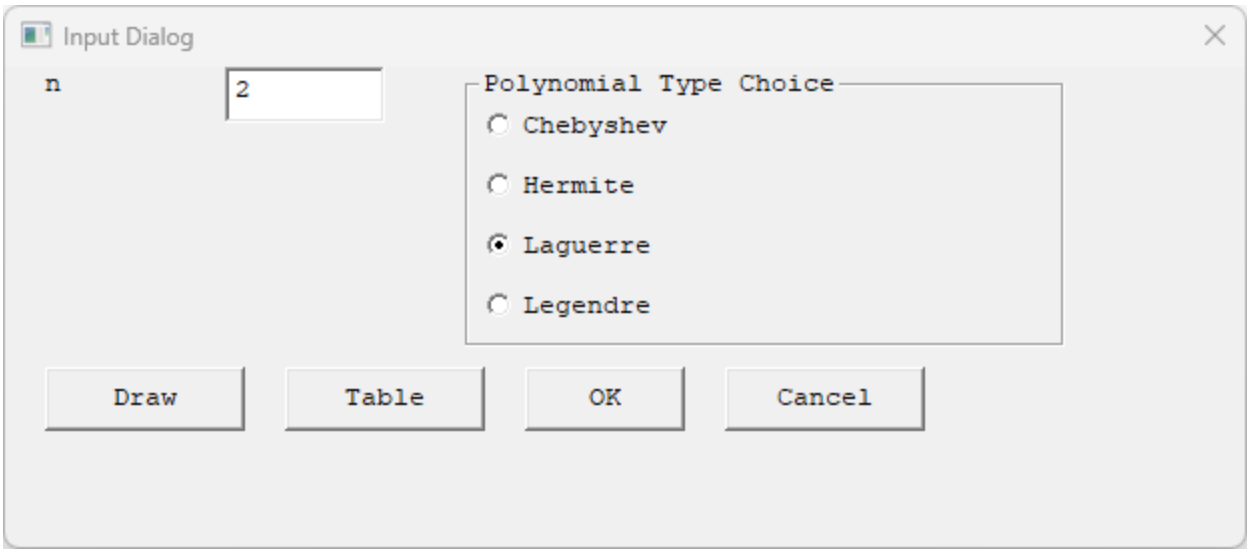
```
    {
        c = b;
    }

    else
    {
        for (int i = 1; i <= n - 1; i++)
        {
            c = (1.0 + 2.0 * i - x) * b - i * i * a;
            a = b;
            b = c;
        }
    }

    return c;
}

double OrthoPolys::Legendre(double x, int n)
{
    double a = 0.0, b = 0.0, c = 0.0;

    a = 1.0;
    b = x;

    if (n == 0)
    {
        c = a;
    }

    else if (n == 1)
    {
        c = b;
    }

    else
    {
        for (int i = 1; i <= n - 1; i++)
        {
            c = b * x + i * (x * b - a) / (i + 1);
            a = b;
            b = c;
        }
    }

    return c;
}
```

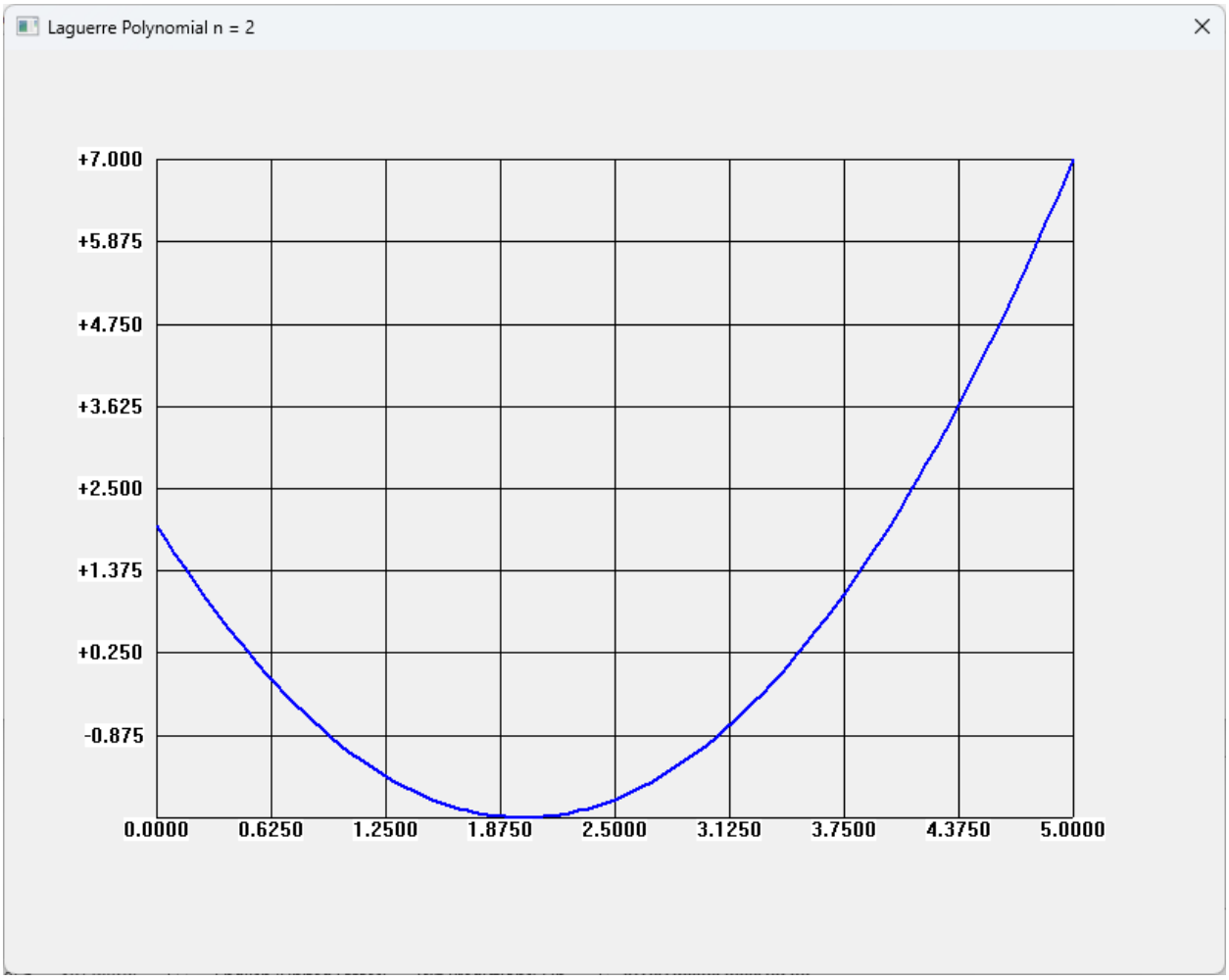

Input Dialog
n
2
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel

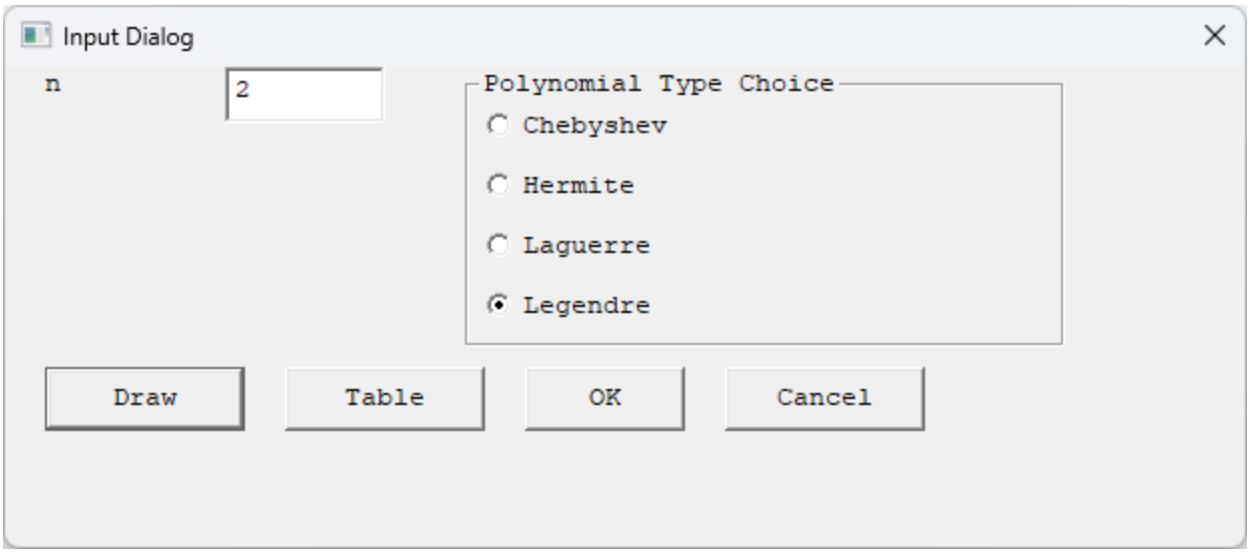

Chebyshev Polynomial n = 2
+1.000
+0.750
+0.500
+0.250
+0.000
-0.250
-0.500
-0.750
-1.0000
-0.7500
-0.5000
-0.2500
0.0000
0.2500
0.5000
0.7500
1.0000

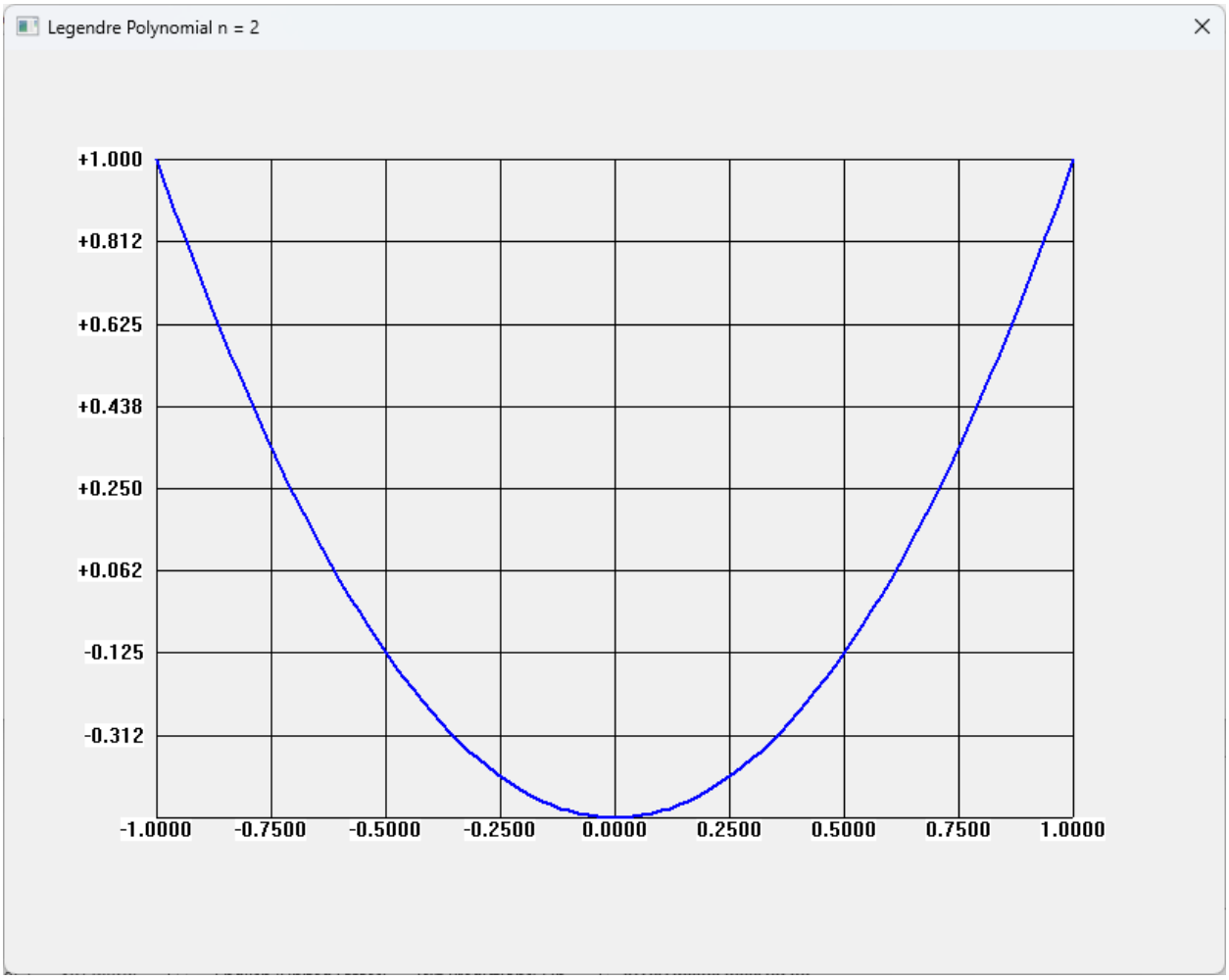

Input Dialog
n
2
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel

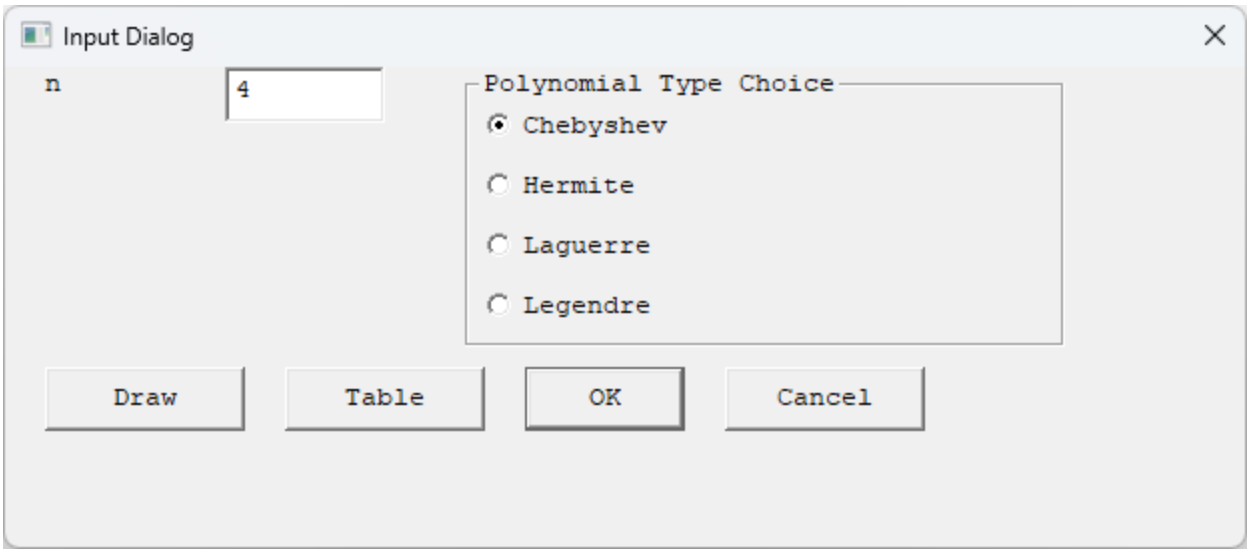

Hermite Polynomial n = 2
+98.000
+85.500
+73.000
+60.500
+48.000
+35.500
+23.000
+10.500
-5.0000
-3.7500
-2.5000
-1.2500
0.0000
1.2500
2.5000
3.7500
5.0000

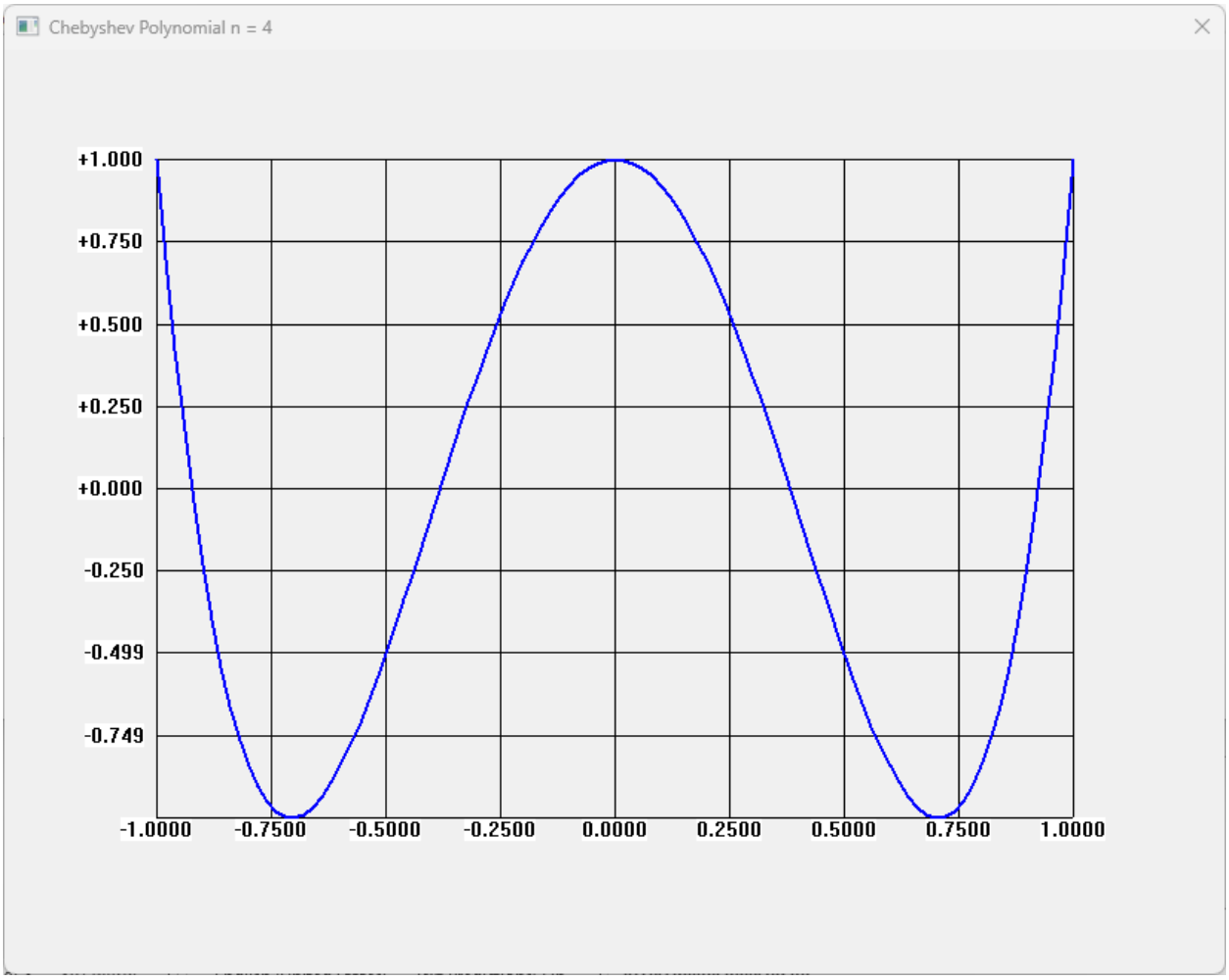

Input Dialog
n
2
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel

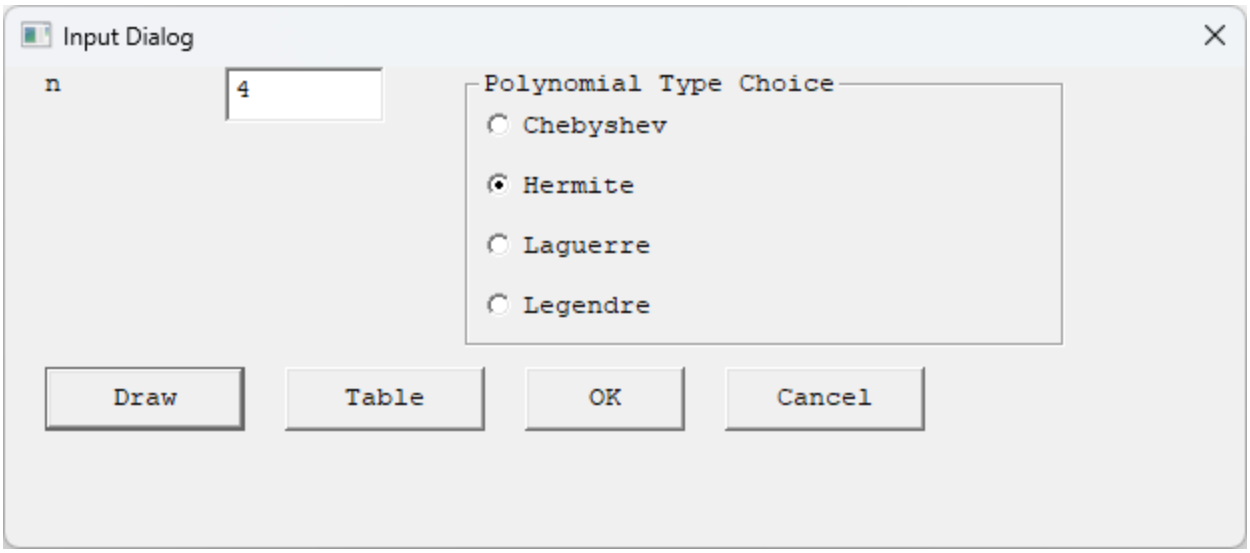

Laguerre Polynomial n = 2
+7.000
+5.875
+4.750
+3.625
+2.500
+1.375
+0.250
-0.875
0.0000
0.6250
1.2500
1.8750
2.5000
3.1250
3.7500
4.3750
5.0000

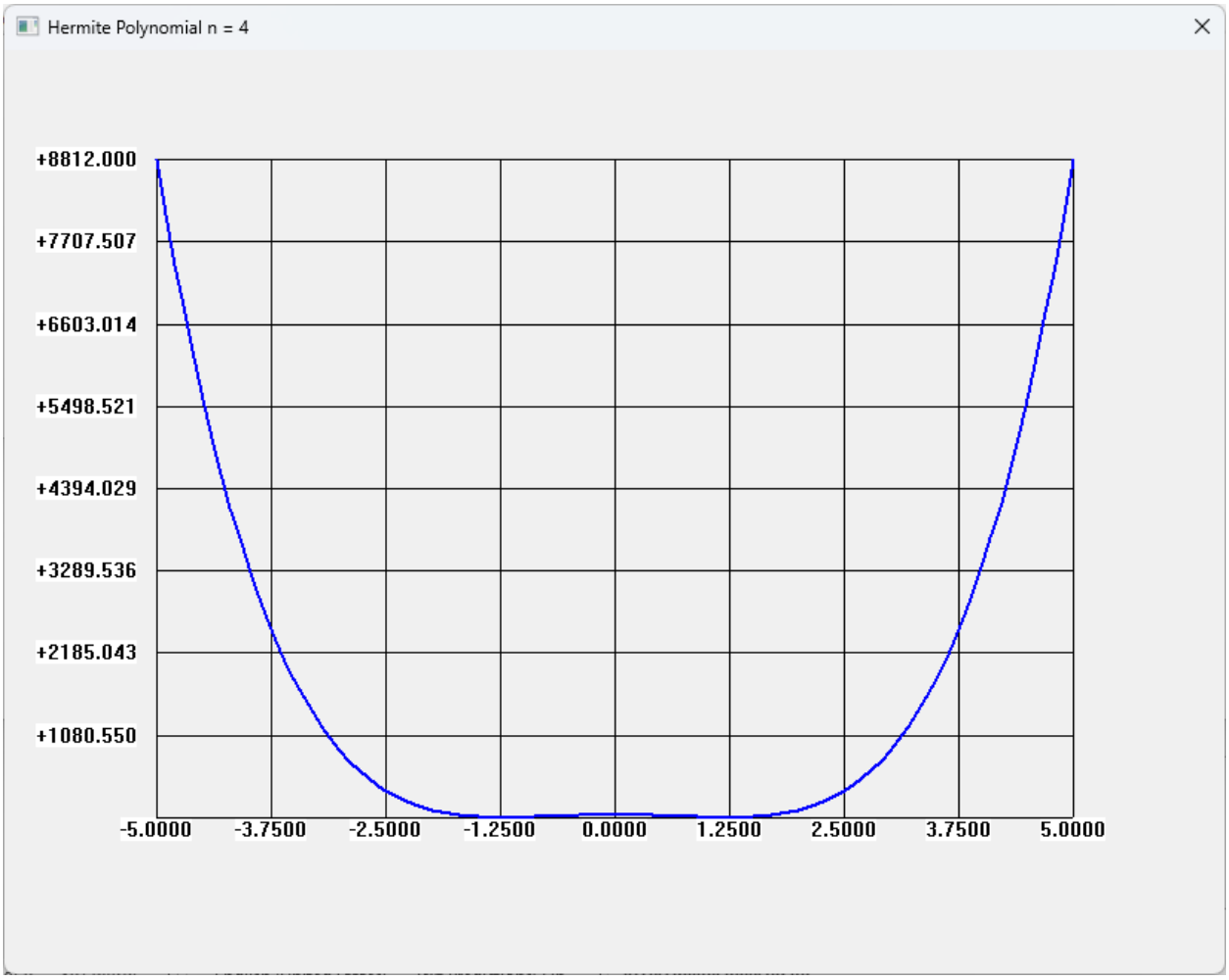

Input Dialog
n
2
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel

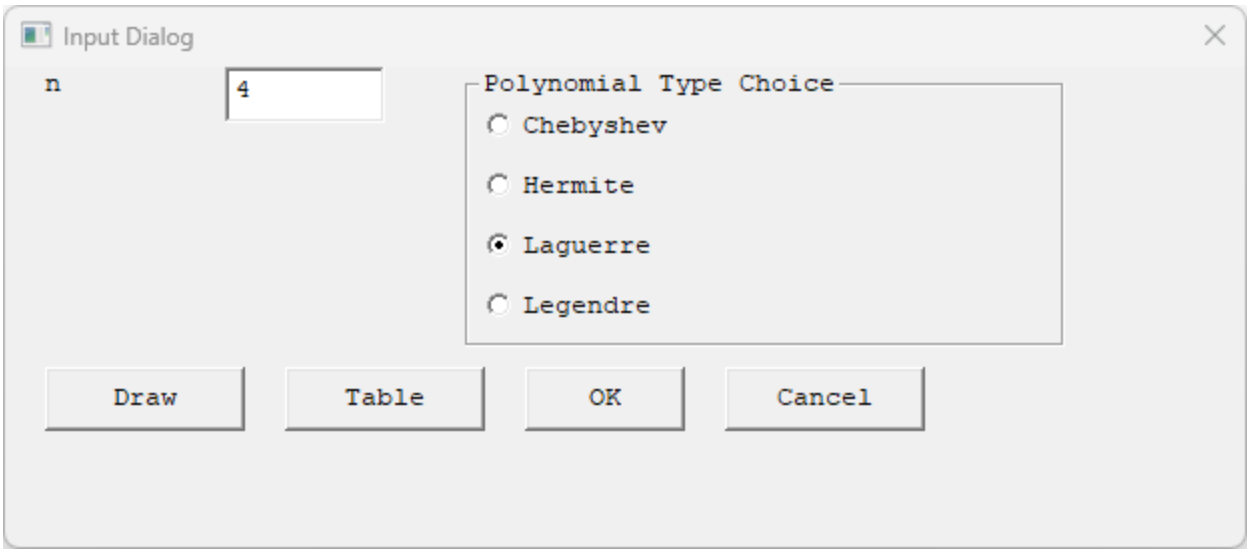

Legendre Polynomial n = 2
+1.000
+0.812
+0.625
+0.438
+0.250
+0.062
-0.125
-0.312
-1.0000
-0.7500
-0.5000
-0.2500
0.0000
0.2500
0.5000
0.7500
1.0000


Input Dialog
n
4
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel


Chebyshev Polynomial n = 4
+1.000
+0.750
+0.500
+0.250
+0.000
-0.250
-0.499
-0.749
-1.0000
-0.7500
-0.5000
-0.2500
0.0000
0.2500
0.5000
0.7500
1.0000


Input Dialog
n
4
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel


Hermite Polynomial n = 4
+8812.000
+7707.507
+6603.014
+5498.521
+4394.029
+3289.536
+2185.043
+1080.550
-5.0000
-3.7500
-2.5000
-1.2500
0.0000
1.2500
2.5000
3.7500
5.0000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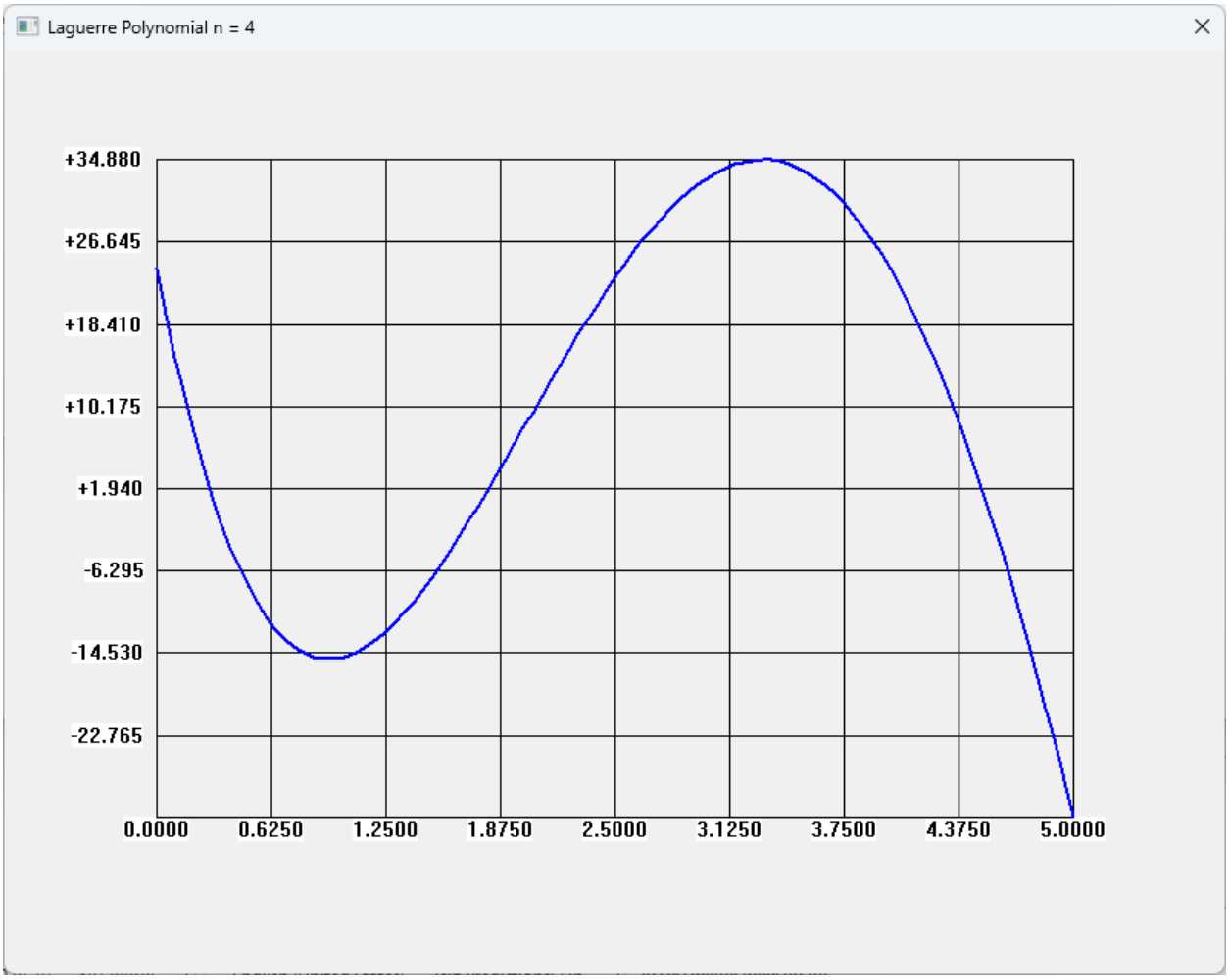
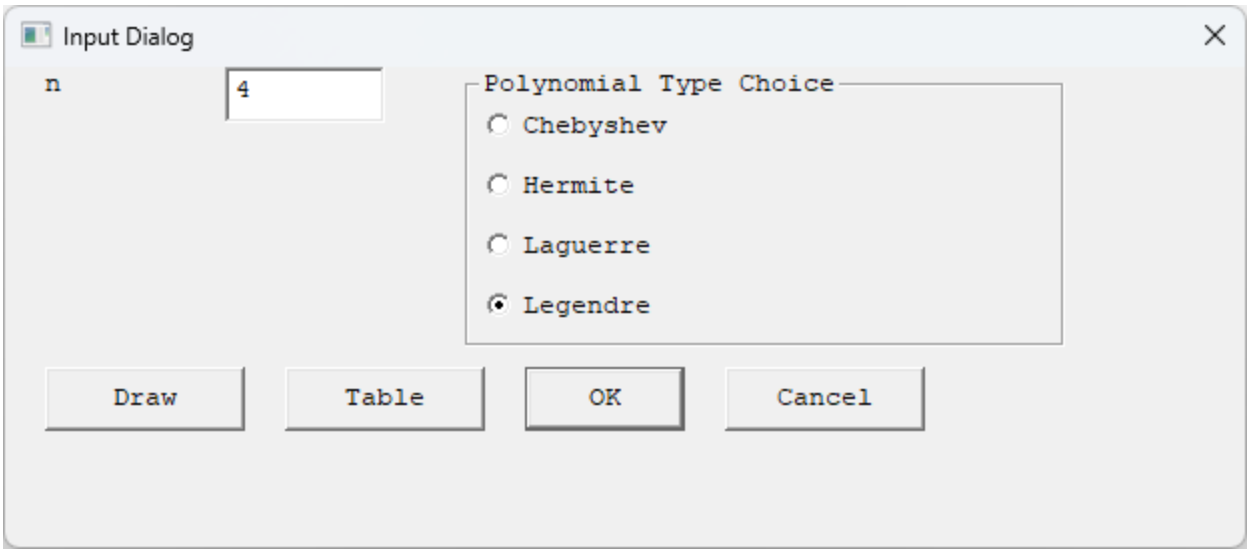
n
4
Polynomial Type Choice
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel


Laguerre Polynomial n = 4
+34.880
+26.645
+18.410
+10.175
+1.940
-6.295
-14.530
-22.765
0.0000
0.6250
1.2500
1.8750
2.5000
3.1250
3.7500
4.3750
5.0000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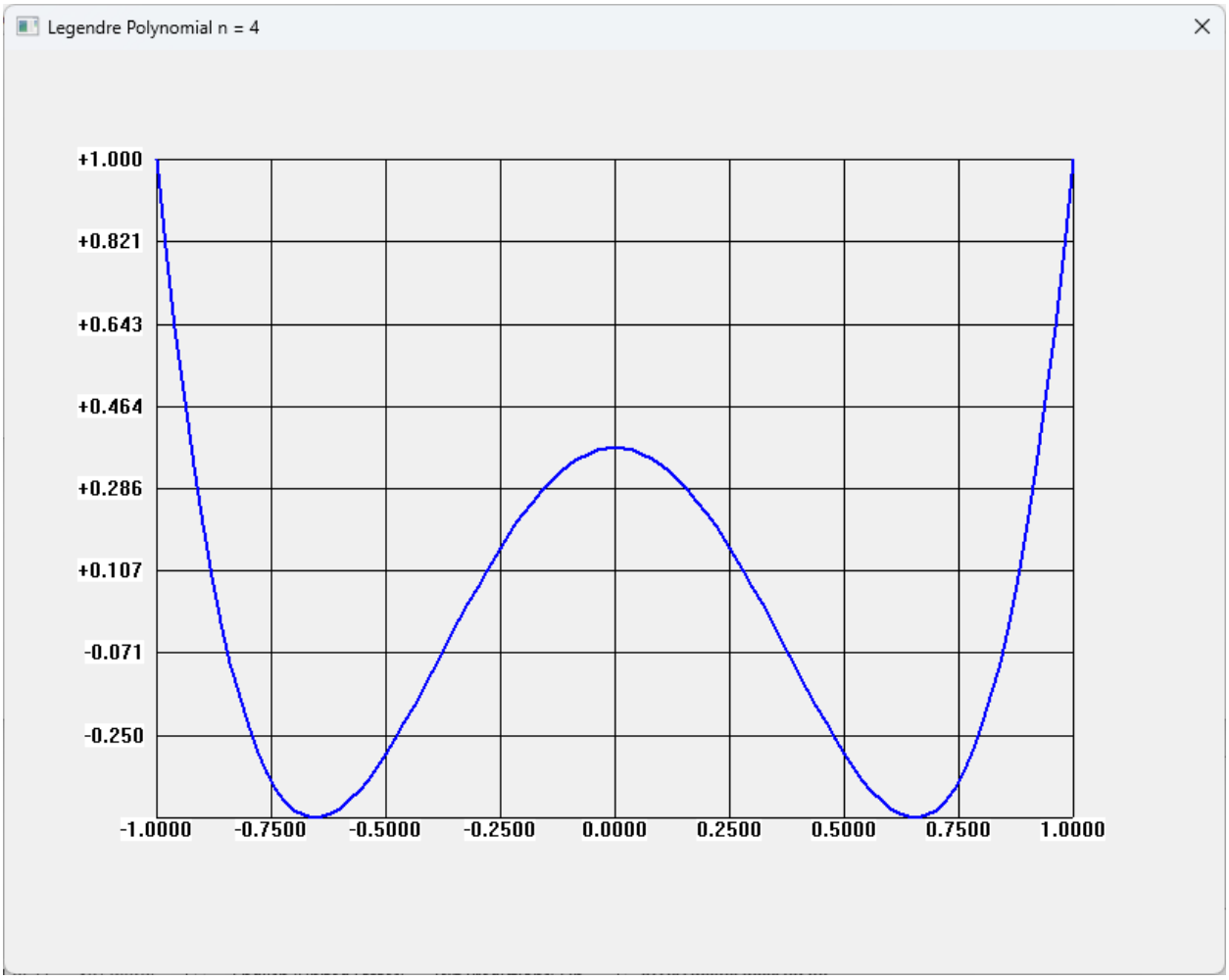
Chebyshev
Hermite
Laguerre
Legendre
Draw
Table
OK
Cancel


Legendre Polynomial n = 4
+1.000
+0.821
+0.643
+0.464
+0.286
+0.107
-0.071
-0.250
-1.0000
-0.7500
-0.5000
-0.2500
0.0000
0.2500
0.5000
0.7500
1.0000