Вариант 4, Крюк В.В.

Задание 1

In[1]:=
$$f[x\_] = \frac{4x^2 - 5x + 1}{\sqrt{2 + x^2 + \sqrt{(2 + x^2)^5}}};$$

n=6

In[•]:=
```
a = 0;
b = 6;
n = 6;
```
$$h = \frac{b - a}{n};$$
```
data = N[Table[{a + i h, f[a + i h]}, {i, 0, n}]]
```

Out[•]=

```
{{0., 0.361389}, {1., 0.}, {2., 0.721298},
 {3., 1.08345}, {4., 1.20586}, {5., 1.23046}, {6., 1.21631}}
```

In[•]:=
```
TableForm[data]
```

Out[•]//TableForm=

0.	0.361389
1.	0.
2.	0.721298
3.	1.08345
4.	1.20586
5.	1.23046
6.	1.21631

In[•]:=
```
dataX = Table[data[[i, 1]], {i, n + 1}];
dataY = Table[data[[i, 2]], {i, n + 1}];
```

a)

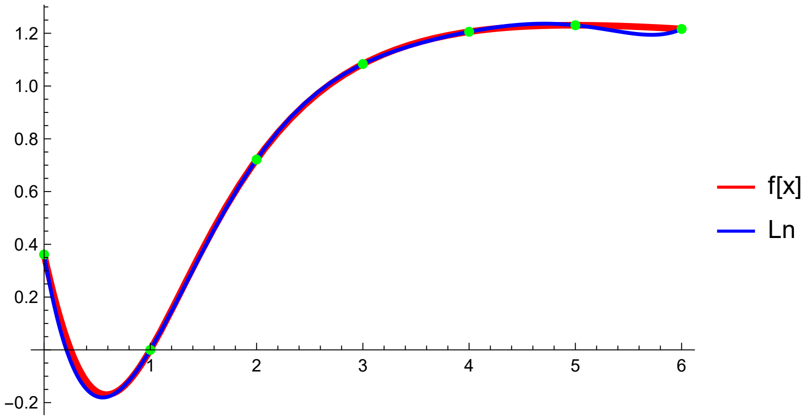
In[•]:=
$$\text{LagrangeInterpolation[dataX\_, dataY\_, n\_]} := \sum_{i=1}^{n} \text{dataY[[i]]} *$$
```
    Product[If[i ≠ j, (x - dataX[[j]]) / (dataX[[i]] - dataX[[j]]), 1], {j, 1, Length[dataX]}];
Ln = LagrangeInterpolation[data[[All, 1]], data[[All, 2]], n + 1] // Simplify
```

Out[•]=

$$0.361389 - 2.32027\,x + 3.16438\,x^2 - 1.5273\,x^3 + 0.362481\,x^4 - 0.0426823\,x^5 + 0.00199066\,x^6$$

In[∘]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Ln, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Ln"}]]
```

Out[∘]=



б)

In[∘]:=
```
Array[diff, {n + 1, n + 1}, {0, 0}];
For[k = 1, k ≤ n, k++,
      For[i = n, i ≥ n - k, i--, diff[i, k] = ""]];
For[i = 0, i ≤ n, i++, diff[i, 0] = data[[i + 1, 2]]];
For[k = 1, k ≤ n, k++,
   For[i = 0, i ≤ n - k, i++,
    diff[i, k] = diff[i + 1, k - 1] - diff[i, k - 1]]];
tab = Array[diff, {n + 1, n + 1}, {0, 0}];
TableForm[tab]
```

Out[∘]//TableForm=

0.361389	−0.361389	1.08269	−1.44183	1.56123	−1.53869	1.43328
0.	0.721298	−0.359144	0.119397	0.0225395	−0.105414	
0.721298	0.362154	−0.239747	0.141937	−0.0828744		
1.08345	0.122407	−0.09781	0.0590624			
1.20586	0.0245974	−0.0387476				
1.23046	−0.0141501					
1.21631						

в)

In[∘]:=

findNewtonInter[dataX_, dataY_, deltaTab_, h_, n_] :=

$$\text{dataY}[[n]] + \sum_{i=1}^{n-1}\left(\frac{\prod_{k=1}^{i}\left(\frac{x-\text{dataX}[[n]]}{h} + k - 1\right)}{\text{Factorial}[i]} * \text{deltaTab}[[n - i, i + 1]]\right);$$

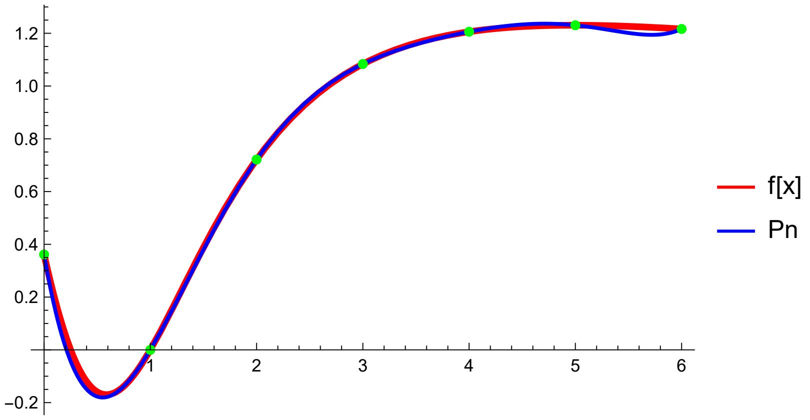
```
Pn = findNewtonInter[dataX, dataY, tab, h, n + 1] // Simplify
```

Out[∘]=

$$0.361389 - 2.32027\,x + 3.16438\,x^2 - 1.5273\,x^3 + 0.362481\,x^4 - 0.0426823\,x^5 + 0.00199066\,x^6$$

In[∘]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Pn, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Pn"}]]
```

Out[∘]=



г)

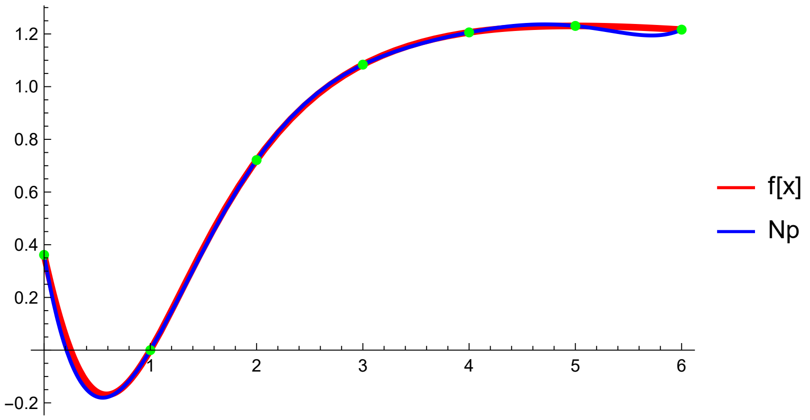
In[∘]:=
```
Np = InterpolatingPolynomial[data, x];
Np = Simplify[Np]
```

Out[∘]=

$$0.361389 - 2.32027\,x + 3.16438\,x^2 - 1.5273\,x^3 + 0.362481\,x^4 - 0.0426823\,x^5 + 0.00199066\,x^6$$

In[∘]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Np, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Np"}]]
```

Out[∘]=



д)

In[•]:=
```
f[2.4316]
Ln /. x → 2.4316
Pn /. x → 2.4316
Np /. x → 2.4316
```

Out[•]=
```
0.920893
```

Out[•]=
```
0.926478
```

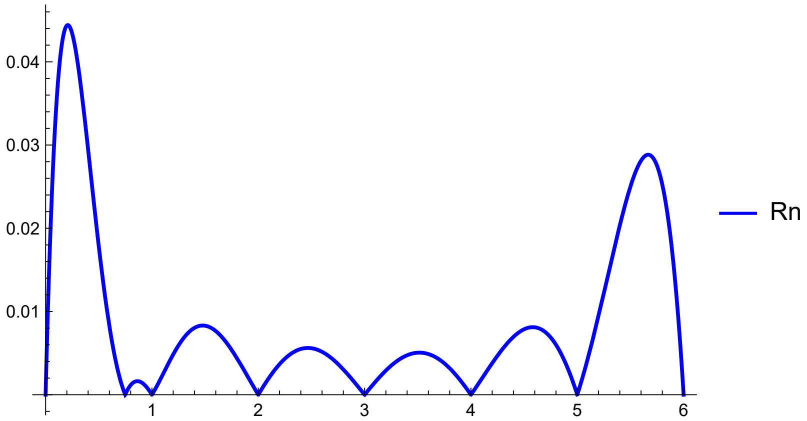
Out[•]=
```
0.926478
```

Out[•]=
```
0.926478
```

е)

In[•]:=
```
Rn = Abs[f[x] - Np];
graph1 = Plot[Rn, {x, 0, 6}, PlotStyle → Blue];
Legended[Show[graph1], LineLegend[{Blue}, {"Rn"}]]
```

Out[•]=



In[•]:=
```
Maximize[{Rn, a ≤ x ≤ b}, x]
```

Out[•]=
```
{0.044415, {x → 0.208523}}
```

In[•]:=
```
ClearAll
```

Out[•]=
```
ClearAll
```

n=10

In[2]:=
```
a = 0;
b = 6;
n = 10;
h = (b - a)/n;
data = N[Table[{a + i h, f[a + i h]}, {i, 0, n}]]
```

Out[6]=
```
{{0., 0.361389}, {0.6, -0.169493}, {1.2, 0.150834},
 {1.8, 0.601076}, {2.4, 0.908823}, {3., 1.08345}, {3.6, 1.17407},
 {4.2, 1.2159}, {4.8, 1.2298}, {5.4, 1.22766}, {6., 1.21631}}
```

In[7]:=
```
TableForm[data]
```

Out[7]//TableForm=

0.	0.361389
0.6	-0.169493
1.2	0.150834
1.8	0.601076
2.4	0.908823
3.	1.08345
3.6	1.17407
4.2	1.2159
4.8	1.2298
5.4	1.22766
6.	1.21631

In[8]:=
```
dataX = Table[data[[i, 1]], {i, n + 1}];
dataY = Table[data[[i, 2]], {i, n + 1}];
```

a)

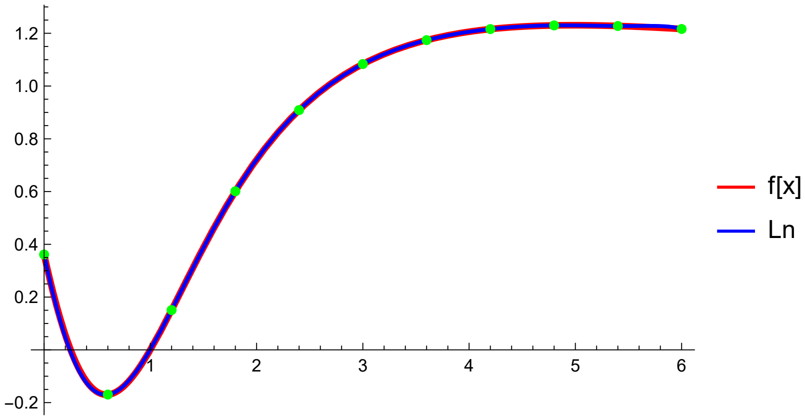
In[10]:=
```
LagrangeInterpolation[dataX_, dataY_, n_] := Sum[dataY[[i]] *
    Product[If[i ≠ j, (x - dataX[[j]]) / (dataX[[i]] - dataX[[j]]), 1], {j, 1, Length[dataX]}], {i, 1, n}];
Ln = LagrangeInterpolation[data[[All, 1]], data[[All, 2]], n + 1] // Simplify
```

Out[11]=

$$0.361389 - 1.8914\,x + 1.4246\,x^2 + 1.33727\,x^3 - 2.15145\,x^4 + 1.26835\,x^5 - 0.424881\,x^6 + 0.0878129\,x^7 - 0.0111179\,x^8 + 0.000792822\,x^9 - 0.0000244297\,x^{10}$$

In[12]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Ln, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Ln"}]]
```

Out[15]=



б)

In[16]:=
```
Array[diff, {n + 1, n + 1}, {0, 0}];
For[k = 1, k ≤ n, k++,
      For[i = n, i ≥ n - k, i--, diff[i, k] = ""]];
For[i = 0, i ≤ n, i++, diff[i, 0] = data[[i + 1, 2]]];
For[k = 1, k ≤ n, k++,
   For[i = 0, i ≤ n - k, i++,
    diff[i, k] = diff[i + 1, k - 1] - diff[i, k - 1]]];
tab = Array[diff, {n + 1, n + 1}, {0, 0}];
TableForm[tab]
```

Out[21]//TableForm=

0.361389	-0.530882	0.851209	-0.721294	0.448885	-0.167098
-0.169493	0.320327	0.129915	-0.27241	0.281787	-0.24206
0.150834	0.450242	-0.142495	0.00937676	0.0397266	-0.053592
0.601076	0.307747	-0.133118	0.0491034	-0.0138653	-0.000534612
0.908823	0.174629	-0.0840147	0.0352381	-0.0144	0.00545747
1.08345	0.0906145	-0.0487767	0.0208381	-0.00894248	0.00388044
1.17407	0.0418378	-0.0279386	0.0118956	-0.00506204	
1.2159	0.0138992	-0.016043	0.00683358		
1.2298	-0.00214371	-0.00920938			
1.22766	-0.0113531				
1.21631					

в)

In[22]:=
```
findNewtonInter[dataX_, dataY_, deltaTab_, h_, n_] :=
  dataY⟦n⟧ + Sum[(Product[((x - dataX⟦n⟧)/h + k - 1), {k, 1, i}]/Factorial[i]) * deltaTab⟦n - i, i + 1⟧, {i, 1, n - 1}];
Pn = findNewtonInter[dataX, dataY, tab, h, n + 1] // Simplify
```

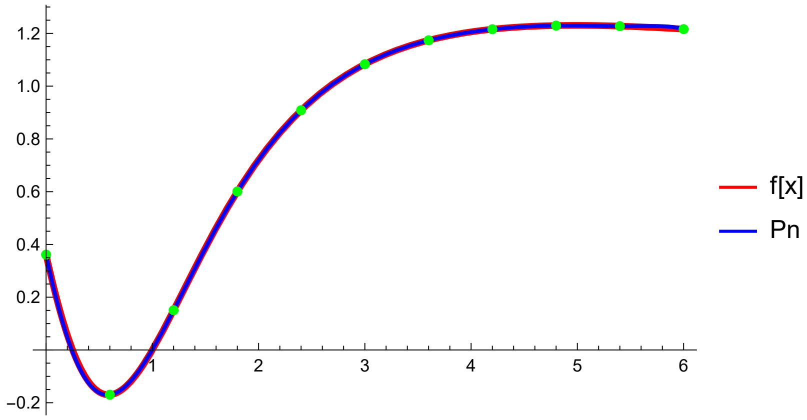
$$\mathrm{dataY}[\![n]\!] + \sum_{i=1}^{n-1}\left(\frac{\prod_{k=1}^{i}\left(\frac{x-\mathrm{dataX}[\![n]\!]}{h}+k-1\right)}{\mathrm{Factorial}[i]} * \mathrm{deltaTab}[\![n-i,\ i+1]\!]\right);$$

Out[23]=

$$0.361389 - 1.8914\,x + 1.4246\,x^2 + 1.33727\,x^3 - 2.15145\,x^4 + 1.26835\,x^5 - 0.424881\,x^6 + 0.0878129\,x^7 - 0.0111179\,x^8 + 0.000792822\,x^9 - 0.0000244297\,x^{10}$$

In[24]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Pn, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Pn"}]]
```

Out[27]=



г)

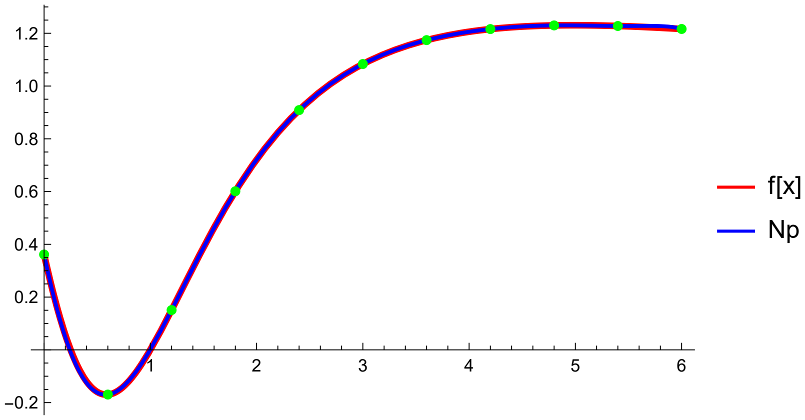
In[28]:=
```
Np = InterpolatingPolynomial[data, x];
Np = Simplify[Np]
```

Out[29]=

$$0.361389 - 1.8914\,x + 1.4246\,x^2 + 1.33727\,x^3 - 2.15145\,x^4 + 1.26835\,x^5 - 0.424881\,x^6 + 0.0878129\,x^7 - 0.0111179\,x^8 + 0.000792822\,x^9 - 0.0000244297\,x^{10}$$

In[30]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Np, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Np"}]]
```

Out[33]=



д)

In[34]:=
```
f[2.4316]
Ln /. x → 2.4316
Pn /. x → 2.4316
Np /. x → 2.4316
```

Out[34]=

0.920893

Out[35]=

0.920865

Out[36]=

0.920865

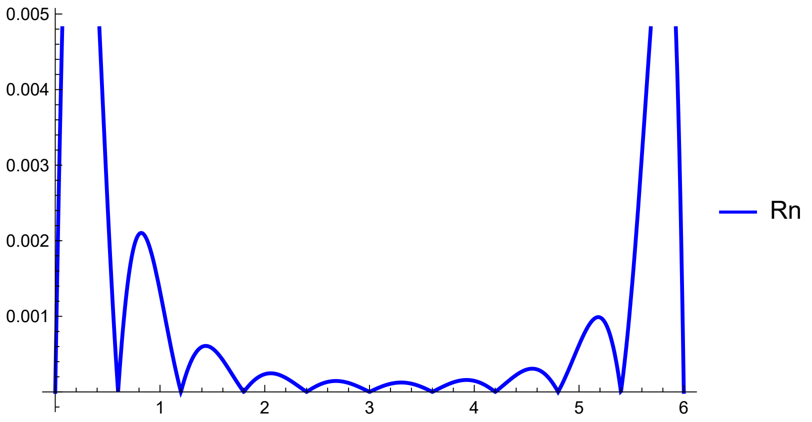
Out[37]=

0.920865

е)

In[38]:=
```
Rn = Abs[f[x] - Np];
graph1 = Plot[Rn, {x, 0, 6}, PlotStyle → Blue];
Legended[Show[graph1], LineLegend[{Blue}, {"Rn"}]]
```

Out[40]=



In[41]:=
```
Maximize[{Rn, a ≤ x ≤ b}, x]
```

Out[41]=
```
{0.00894544, {x → 0.217494}}
```

ж) Увеличение количества узлов интерполяции привело к снижению погрешности интерполяции, что демонстрирует влияние числа узлов на точность интерполирования

Задание 2

n = 6

In[42]:=
```
n = 6;
For[i = 0, i ≤ n, i++, t_i = Cos[(Pi * (2 * i + 1)) / (2 * n + 2)];
  x_i = (a + b)/2 + (b - a)/2 * t_i;]
data = N[Table[{x_i, f[x_i]}, {i, 0, n}]];
dataX = Table[data[[i, 1]], {i, n + 1}];
dataY = Table[data[[i, 2]], {i, n + 1}];
TableForm[data]
```

Out[47]//TableForm=

5.92478	1.21808
5.34549	1.22831
4.30165	1.21981
3.	1.08345
1.69835	0.533034
0.654506	-0.164007
0.0752163	0.232961

а)

In[48]:=
```
findDividedDiff[dataX_, dataY_, first_, last_] := If[first + 1 == last,
  (dataY[[last]] - dataY[[first]]) / (dataX[[last]] - dataX[[first]]), (findDividedDiff[dataX, dataY, first + 1, last] -
    findDividedDiff[dataX, dataY, first, last - 1]) / (dataX[[last]] - dataX[[first]])]
Array[diff, {n + 1, n + 1}, {0, 0}];
For[k = 1, k ≤ n, k++,
    For[i = n, i ≥ n - k, i--, diff[i, k] = ""]];
For[i = 0, i ≤ n, i++, diff[i, 0] = data[[i + 1, 2]]];
For[k = 1, k ≤ n, k++,
  For[i = 0, i ≤ n - k, i++,
   diff[i, k] = findDividedDiff[dataX, dataY, i + 1, k + i + 1]]];
tab = Array[diff, {n + 1, n + 1}, {0, 0}];
TableForm[tab]
```

Out[54]//TableForm=

1.21808	-0.0176657	-0.0159003	0.00864759	-0.00320869	-0.00170431	0
1.22831	0.00814265	-0.0411926	0.0222089	0.00577349	-0.0130838	
1.21981	0.10476	-0.122192	-0.00487447	0.0747285		
1.08345	0.422862	-0.104414	-0.32071			
0.533034	0.667764	0.833592				
-0.164007	-0.685267					
0.232961						

In[55]:=
```
diffRes = Table[diff[i, k], {i, 0, n}, {k, 1, n}];
```

б)

In[56]:=
```
findNewtonDividedDiff[dataX_, dataY_, n_, diff_] :=
```

$$\text{dataY}[[1]] + \sum_{i=1}^{n} \text{diff}[[1, i]] * \prod_{k=1}^{i} (x - \text{dataX}[[k]])$$

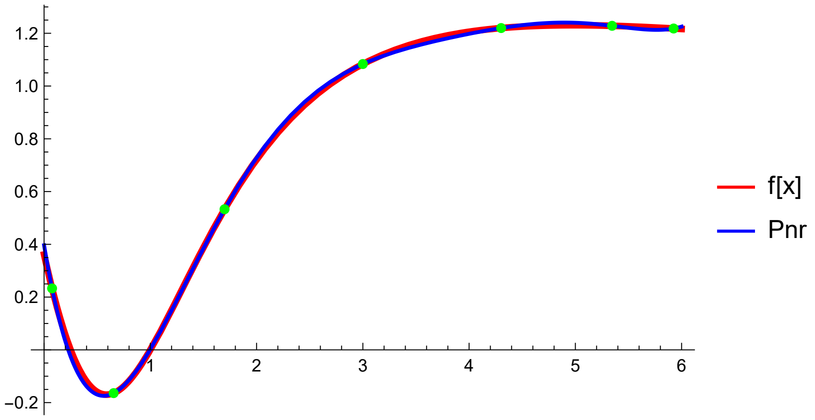
In[57]:=
```
Pnr = findNewtonDividedDiff[dataX, dataY, n, diffRes] // Simplify
```

Out[57]=

$$0.396436 - 2.40885\,x + 3.24517\,x^2 - 1.55538\,x^3 + 0.365308\,x^4 - 0.0424103\,x^5 + 0.00194535\,x^6$$

In[58]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Pnr, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Pnr"}]]
```

Out[61]=

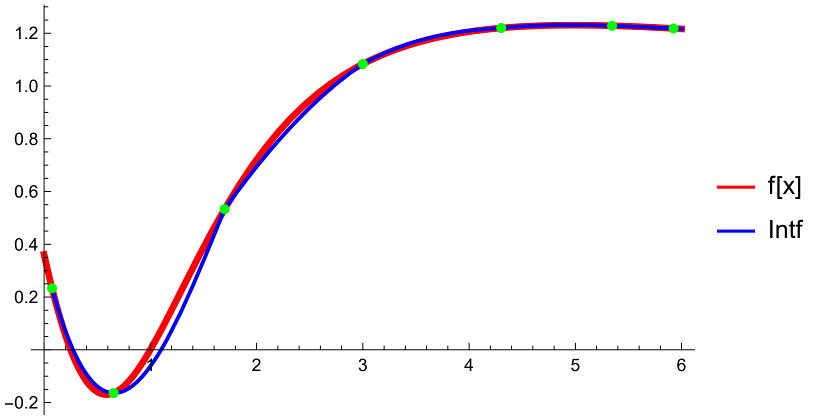


в)

In[62]:=
```
Intf = Interpolation[data];
```

In[63]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Intf[x], {x, dataX⟦n + 1⟧, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Intf"}]]
```

Out[66]=



г)

In[67]:=
```
f[2.4316]
Pnr /. x → 2.4316
Intf[2.4316]
```

Out[67]=

0.920893

Out[68]=

0.932527

Out[69]=

0.890226

д)

In[70]:=
```
AbsPnr[x_] := Abs[f[x] - Pnr];
Maximize[{AbsPnr[x], a ≤ x ≤ b}, x]
```

Out[71]=
```
{0.0350472, {x → 0.}}
```

In[72]:=
```
AbsIntf[x_] := Abs[f[x] - Intf[x]];
Maximize[{AbsIntf[x], dataX[[n + 1]] ≤ x ≤ dataX[[1]]}, x]
```

Out[73]=
```
{0.0792782, {x → 1.22049}}
```

n = 10

In[74]:=
```
n = 10;
For[i = 0, i ≤ n, i++, t_i = Cos[(Pi * (2 * i + 1))/(2 * n + 2)];
 x_i = (a + b)/2 + (b - a)/2 * t_i;]
data = N[Table[{x_i, f[x_i]}, {i, 0, n}]];
dataX = Table[data[[i, 1]], {i, n + 1}];
dataY = Table[data[[i, 2]], {i, n + 1}];
TableForm[data]
```

Out[79]//TableForm=

5.96946	1.21704
5.7289	1.22227
5.26725	1.22911
4.62192	1.22777
3.8452	1.19561
3.	1.08345
2.1548	0.801904
1.37808	0.292926
0.732751	-0.144311
0.271104	-0.0214034
0.0305357	0.307409

а)

In[80]:=
```
findDividedDiff[dataX_, dataY_, first_, last_] := If[first + 1 == last,
  (dataY[[last]] - dataY[[first]]) / (dataX[[last]] - dataX[[first]]), (findDividedDiff[dataX, dataY, first + 1, last] -
     findDividedDiff[dataX, dataY, first, last - 1]) / (dataX[[last]] - dataX[[first]])]
Array[diff, {n + 1, n + 1}, {0, 0}];
For[k = 1, k ≤ n, k++,
      For[i = n, i ≥ n - k, i--, diff[i, k] = ""]];
For[i = 0, i ≤ n, i++, diff[i, 0] = data[[i + 1, 2]]];
For[k = 1, k ≤ n, k++,
  For[i = 0, i ≤ n - k, i++,
   diff[i, k] = findDividedDiff[dataX, dataY, i + 1, k + i + 1]]];
tab = Array[diff, {n + 1, n + 1}, {0, 0}];
TableForm[tab]
```

Out[86]//TableForm=

1.21704	-0.021772	-0.00991183	0.00397236	-0.00122315	0.000336964
1.22227	-0.0148118	-0.0152648	0.00657066	-0.00222375	0.000510227
1.22911	0.00208592	-0.0276419	0.012639	-0.00404735	-0.000468235
1.22777	0.0413941	-0.0562977	0.0252362	-0.0022263	-0.00992129
1.19561	0.132705	-0.118558	0.032458	0.0363593	-0.0288093
1.08345	0.333115	-0.198636	-0.0807084	0.139326	0.0359061
0.801904	0.655288	-0.0156502	-0.460916	0.0327046	
0.292926	0.677543	0.852576	-0.530389		
-0.144311	-0.266236	1.5673			
-0.0214034	-1.36682				
0.307409					

In[87]:=
```
diffRes = Table[diff[i, k], {i, 0, n}, {k, 1, n}];
```

б)

In[88]:=
```
findNewtonDividedDiff[dataX_, dataY_, n_, diff_] :=
```

$$\text{dataY[[1]]} + \sum_{i=1}^{n} \text{diff[[1, i]]} * \prod_{k=1}^{i} (x - \text{dataX[[k]]})$$

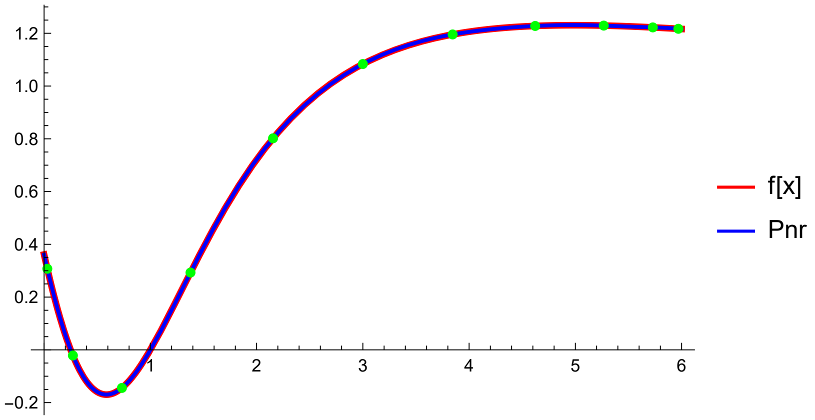
In[89]:=
```
Pnr = findNewtonDividedDiff[dataX, dataY, n, diffRes] // Simplify
```

Out[89]=

$$0.360467 - 1.7677\, x + 0.923946\, x^2 + 2.13483\, x^3 - 2.81903\, x^4 + 1.59703\, x^5 - 0.524709\, x^6 + 0.106654\, x^7 - 0.0132566\, x^8 + 0.000925314\, x^9 - 0.0000278247\, x^{10}$$

In[90]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Pnr, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Pnr"}]]
```

Out[93]=

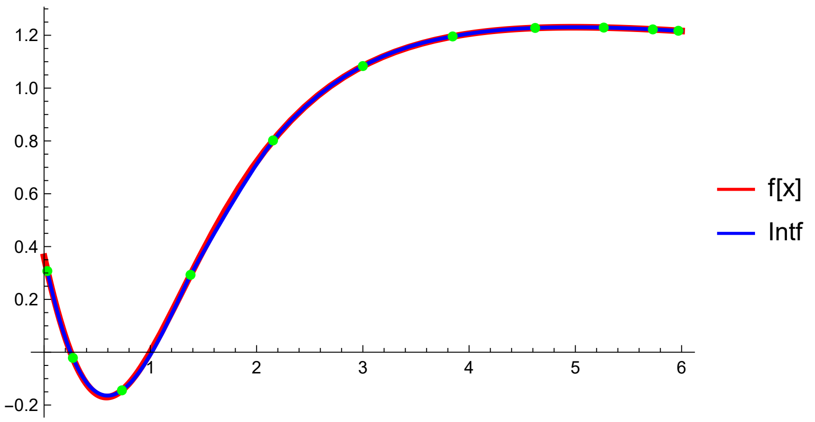


в)

In[94]:=
```
Intf = Interpolation[data];
```

In[95]:=
```
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Intf[x], {x, dataX[[n + 1]], b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Intf"}]]
```

Out[98]=



г)

In[99]:=
```
f[2.4316]
Pnr /. x → 2.4316
Intf[2.4316]
```

Out[99]=

0.920893

Out[100]=

0.919821

Out[101]=

0.919982

д)

In[102]:=

```
AbsPnr[x_] := Abs[f[x] - Pnr];
Maximize[{AbsPnr[x], a ≤ x ≤ b}, x]
```

Out[103]=

```
{0.00122078, {x → 2.56448}}
```

In[104]:=

```
AbsIntf[x_] := Abs[f[x] - Intf[x]];
Maximize[{AbsIntf[x], dataX[[n + 1]] ≤ x ≤ dataX[[1]]}, x]
```

Out[105]=

```
{0.0168223, {x → 1.74388}}
```

Задание 3

По результатам 1 и 2 задания видно, что погрешность интерполирования зависит от числа узлов/степени многочлена (чем выше количество узлов, тем выше точность) и от расположения на отрезке (погрешность интерполирования многочленом степени n будет минимальной при использовании чебышевских узлов интерполяции по сравнению с равноотстоящими).

Задание 4

In[106]:=

```
n = 10;
h = b/n;
data = N[Table[{i h, f[i h]}, {i, 0, n}]];
TableForm[data]
```

Out[109]//TableForm=

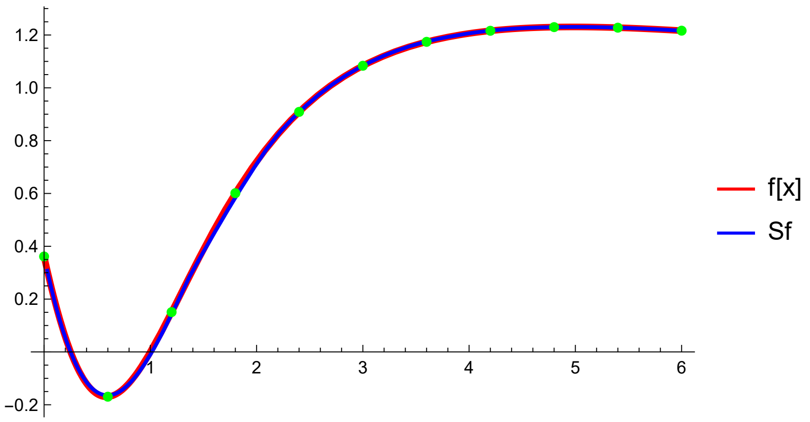
0.	0.361389
0.6	-0.169493
1.2	0.150834
1.8	0.601076
2.4	0.908823
3.	1.08345
3.6	1.17407
4.2	1.2159
4.8	1.2298
5.4	1.22766
6.	1.21631

б)

In[110]:=

```
Sf = Interpolation[data, Method → "Spline"];
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Intf[x], {x, dataX[[n + 1]], b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Sf"}]]
```

Out[114]=



г)

In[115]:=

```
f[2.4316]
Sf[2.4316]
```

Out[115]=

```
0.920893
```

Out[116]=

```
0.920876
```

Задание 5

In[117]:=

```
n = 10;
b = 6;
h = b/n;
data = N[Table[{i h, f[i h]}, {i, 0, n}]];
dataX = Table[data[[i, 1]], {i, n + 1}];
dataY = Table[data[[i, 2]], {i, n + 1}];
TableForm[data]
```

Out[123]//TableForm=

0.	0.361389
0.6	-0.169493
1.2	0.150834
1.8	0.601076
2.4	0.908823
3.	1.08345
3.6	1.17407
4.2	1.2159
4.8	1.2298
5.4	1.22766
6.	1.21631

a)

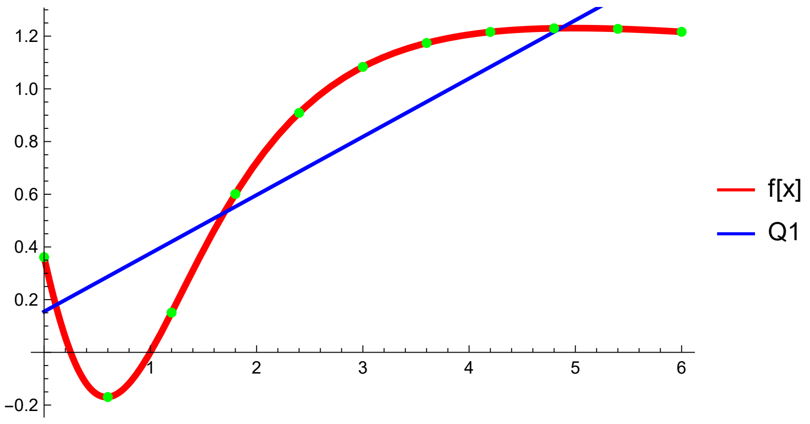
In[124]:=

```
res = LinearSolve[Table[Table[If[i + k == 0, Sum[1, {j, 1, n+1}], Sum[dataX[[j]]^(i+k), {j, 1, n+1}]], {i, 0, 1}], {k, 0, 1}],
   Table[If[i == 0, Sum[dataY[[j]], {j, 1, n+1}], Sum[(dataY[[j]] * dataX[[j]]^i), {j, 1, n+1}]], {i, 0, 1}]];
polRes = 0;
For[i = 0, i ≤ 1, i++, polRes = polRes + res[[i + 1]] * x^i];
Q1 = polRes
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Q1, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Q1"}]]
```

Out[127]=

$0.154756 + 0.221137\, x$

Out[131]=



б)

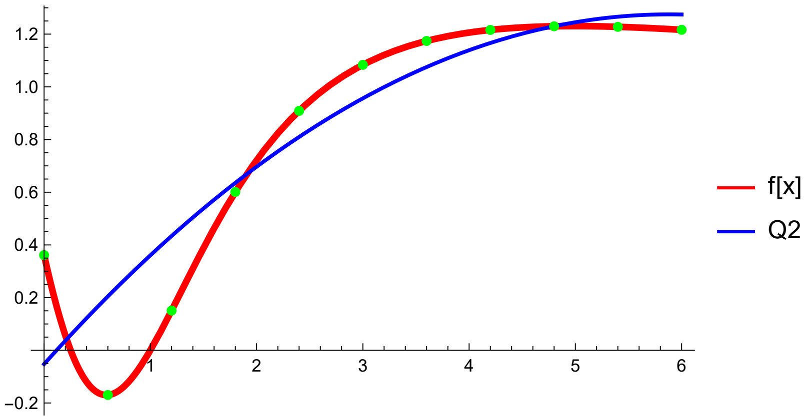
In[132]:=

```
res = LinearSolve[Table[Table[If[i + k == 0, Sum[1, {j, 1, n+1}], Sum[dataX[[j]]^(i+k), {j, 1, n+1}]], {i, 0, 2}], {k, 0, 2}],
    Table[If[i == 0, Sum[dataY[[j]], {j, 1, n+1}], Sum[(dataY[[j]] * dataX[[j]]^i), {j, 1, n+1}]], {i, 0, 2}]];
polRes = 0;
For[i = 0, i ≤ 2, i++, polRes = polRes + res[[i + 1]] * x^i];
Q2 = polRes
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Q2, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Q2"}]]
```

Out[135]=

$-0.0523877 + 0.451296\, x - 0.0383599\, x^2$

Out[139]=



в)

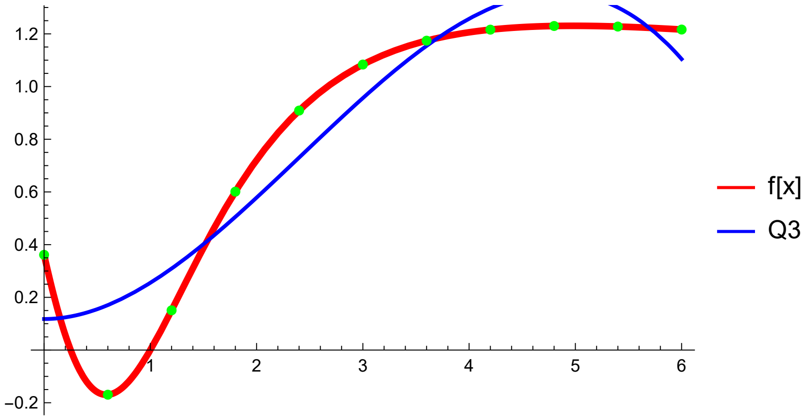
In[140]:=

```
Q3 = Fit[data, {1, x, x^2, x^3}, x]
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Q3, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Q3"}]]
```

Out[140]=

$0.117733 + 0.000792759\,x + 0.158538\,x^2 - 0.0218776\,x^3$

Out[144]=



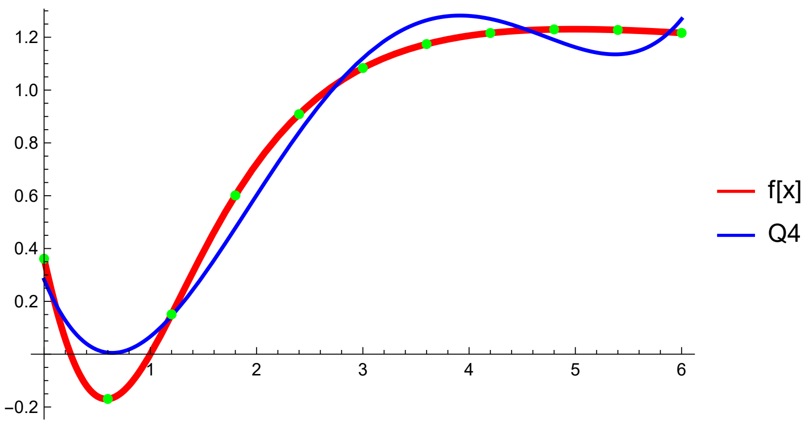
In[145]:=

```
Q4 = Fit[data, {1, x, x^2, x^3, x^4}, x]
graph1 = Plot[f[x], {x, a, b}, PlotStyle → {Red, Thickness[0.01]}];
graph2 = Plot[Q4, {x, a, b}, PlotStyle → Blue];
graph3 = ListPlot[data, PlotStyle → {PointSize[0.015], Green}];
Legended[Show[graph1, graph2, graph3], LineLegend[{Red, Blue}, {"f[x]", "Q4"}]]
```

Out[145]=

$0.282389 - 0.952083\,x + 0.952601\,x^2 - 0.233628\,x^3 + 0.0176458\,x^4$

Out[149]=



д)

In[150]:=

```
graph1 = Plot[Q1, {x, a, b}, PlotStyle → Orange];
graph2 = Plot[Q2, {x, a, b}, PlotStyle → Red];
graph3 = Plot[Q3, {x, a, b}, PlotStyle → {Blue, Thickness[0.01]}];
graph4 = Plot[Q4, {x, a, b}, PlotStyle → Green];
graph5 = ListPlot[data, PlotStyle → {PointSize[0.02], Black}];
Legended[Show[graph1, graph2, graph3, graph4, graph5],
 LineLegend[{Orange, Red, Blue, Green}, {"Q1", "Q2", "Q3", "Q4"}]]
```

Out[155]=