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Лабораторная работа № 3
Интерполяция и среднеквадратичное приближение
Вариант 1

Задание 1

Создать таблицу значений функции
f(x), разбив отрезок [0, 6] на n равных частей точками x_i(i=0,n)
Для полученной таблично заданной в
равноотстоящих узлах функции f(x), выполнить следующие действия при n=6 и n=10.

In[8]:=
```
f[x_] := 5 * Exp[-1/18 * x^2 + 1/3 * x - 1/2] - 2 * Sin[√x]
a = 0(*начало отрезка*)
b = 6(*конец отрезка*)
n = 6(*количество разбиений*)
data = N[Table[{x, f[x]}, {x, a, b, (b - a) / n}]]
 (*таблица значений функции f(x), на отрезке[0,6] разбитом на n частей*)
```

Out[9]= 0

Out[10]= 6

Out[11]= 6

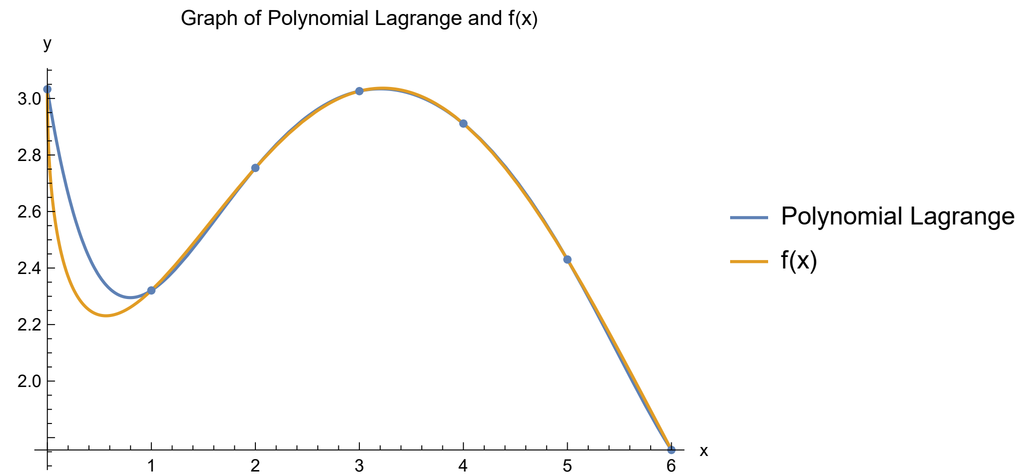
Out[12]=
```
{{0., 3.03265}, {1., 2.32075}, {2., 2.75427},
 {3., 3.02595}, {4., 2.9112}, {5., 2.43019}, {6., 1.75634}}
```

а) Построить интерполяционный многочлен Лагранжа

In[7]:=
```
lagrangeInterpolation[data_, x_] :=
 Module[{n = Length[data], polynomials = {}}, Do[Module[{polynomial = 1},
    Do[If[i ≠ j, polynomial *= (x - data[[j, 1]]) / (data[[i, 1]] - data[[j, 1]])], {j, 1, n}];
    AppendTo[polynomials, polynomial]], {i, 1, n}];
  Total[polynomials * data[[All, 2]]]]
```

In[13]:=
```
Show[Plot[{lagrangeInterpolation[data, x], f[x]}, {x, 0, n},
  PlotLegends → {"Polynomial Lagrange", "f(x)"}, AxesLabel → {"x", "y"},
  PlotLabel → "Graph of Polynomial Lagrange and f(x)"], ListPlot[data]]
```

Out[13]=



б) Создать таблицу разделенных разностей функции f (x) по точкам

In[14]:=
```
dividedDifferences[f_, data_List] := Module[{n, dividedDiffs}, n = Length[data];
  dividedDiffs = ConstantArray[0, {n, n}];
  dividedDiffs[[All, 1]] = f /@ data[[All, 1]];
  Do[dividedDiffs[[i, j]] = (dividedDiffs[[i, j - 1]] - dividedDiffs[[i - 1, j - 1]]) /
     (data[[i, 1]] - data[[i - j + 1, 1]]), {j, 2, n}, {i, j, n}];
  dividedDiffs]
```

In[ ]:=
```
TableForm[dividedDifferences[f, data]]
```

Out[ ]//TableForm=

3.03265	0	0	0	0	0	0
2.32075	-0.711908	0	0	0	0	0
2.75427	0.43352	0.572714	0	0	0	0
3.02595	0.271681	-0.0809196	-0.217878	0	0	0
2.9112	-0.114744	-0.193213	-0.0374311	0.0451117	0	0
2.43019	-0.481014	-0.183135	0.00335933	0.0101976	-0.00698283	0
1.75634	-0.673851	-0.0964185	0.0289054	0.00638652	-0.000762214	0.0010367

в) построить первый или второй интерполяционный многочлен
Ньютона

In[15]:=
```
newtonPolynomial[f_, data_List] :=
 Module[{dividedDiffs, polynomial}, dividedDiffs = dividedDifferences[f, data];
  polynomial = dividedDiffs⟦1, 1⟧;
  Do[polynomial += dividedDiffs⟦i, i⟧ * Product[(x - data⟦j, 1⟧), {j, 1, i - 1}],
   {i, 2, Length[data]}];
  polynomial]
Table[newtonPolynomial[f, data], {x, 0, n}]
```

Out[16]=
```
{3.03265, 2.32075, 2.75427, 3.02595, 2.9112, 2.43019, 1.75634}
```

г) построить интерполяционный многочлен Ньютона с помощью функции InterpolatingPolynomial

In[ ]:=
```
Table[InterpolatingPolynomial[data, x], {x, 0, n}]
```

Out[ ]=
```
{3.03265, 2.32075, 2.75427, 3.02595, 2.9112, 2.43019, 1.75634}
```

д) вычислить значения функции f (x) и всех построенных интерполяционных многочленов в точке x = 2, 4316

In[21]:=
```
xPoint = 2.4316
```

Out[21]=
```
2.4316
```

In[22]:=
```
f[xPoint]
newtonPolynomial[f, data] /. x → xPoint
lagrangeInterpolation[data, xPoint]
InterpolatingPolynomial[data, xPoint]
```

Out[22]=
```
2.91119
```

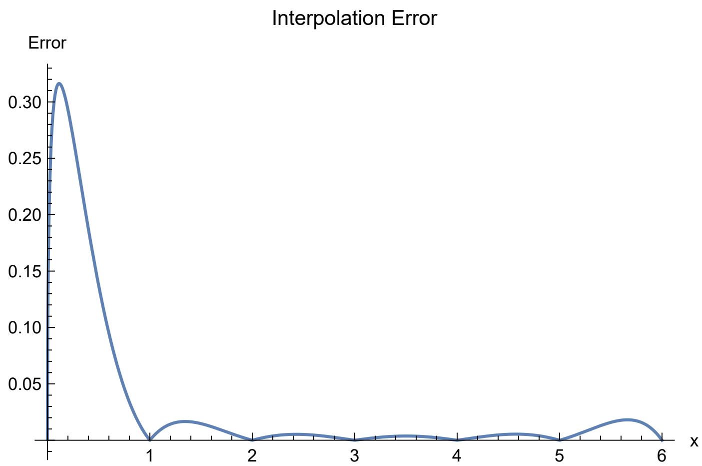
Out[23]=
```
2.91645
```

Out[24]=
```
2.91645
```

Out[25]=
```
2.91645
```

е) построить график погрешности интерполирования многочленом Ньютона на отрезке[0, 6]

In[26]:=
```
Np = InterpolatingPolynomial[data, x];
Rn[x_] := Abs[f[x] - Np]
Plot[Rn[x], {x, 0, 6}, PlotRange → All,
 AxesLabel → {"x", "Error"}, PlotLabel → "Interpolation Error"]
```
Out[28]=



In[∘]:=
```
FindMaximum[Rn[x], {x, 0, 6}]
```
Out[∘]=
```
{0.316287, {x → 0.114284}}
```

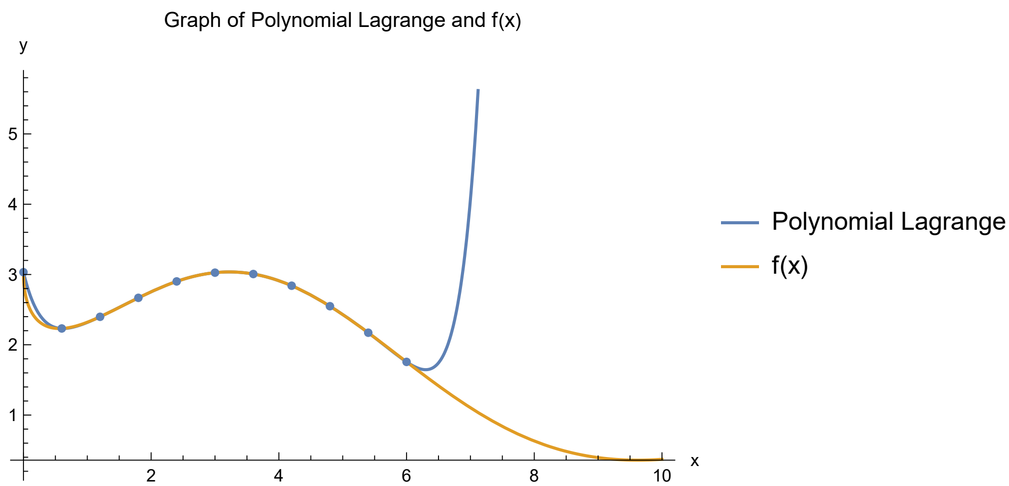
Задание 1, n=10

а)

In[∘]:=
```
n = 10(*количество разбиений*)
data = N[Table[{x, f[x]}, {x, a, b, (b - a) / n}]]
 (*таблица значений функции f(x), на отрезке[0,6] разбитом на n частей*)
```
Out[∘]=
```
10
```
Out[∘]=
```
{{0., 3.03265}, {0.6, 2.23189}, {1.2, 2.39809}, {1.8, 2.66786}, {2.4, 2.90146},
 {3., 3.02595}, {3.6, 3.0067}, {4.2, 2.84029}, {4.8, 2.5487}, {5.4, 2.17146}, {6., 1.75634}}
```

In[ ]:=
```
Show[Plot[{lagrangeInterpolation[data, x], f[x]}, {x, 0, n},
  PlotLegends → {"Polynomial Lagrange", "f(x)"}, AxesLabel → {"x", "y"},
  PlotLabel → "Graph of Polynomial Lagrange and f(x)"], ListPlot[data]]
```

Out[ ]=



In[ ]:= б)

In[ ]:=
```
TableForm[dividedDifferences[f, data]]
```

Out[ ]//TableForm=

3.03265	0	0	0	0	0	0
2.23189	-1.33461	0	0	0	0	0
2.39809	0.276996	1.343	0	0	0	0
2.66786	0.449629	0.143861	-0.666189	0	0	0
2.90146	0.389326	-0.050253	-0.107841	0.232645	0	0
3.02595	0.207478	-0.15154	-0.0562705	0.0214878	-0.0703857	0
3.0067	-0.0320828	-0.199634	-0.0267188	0.0123132	-0.00305821	0.018702
2.84029	-0.277337	-0.204378	-0.00263588	0.0100345	-0.000759553	0.000638
2.5487	-0.485986	-0.173874	0.0169466	0.00815938	-0.000625055	0.000037
2.17146	-0.628747	-0.118967	0.030504	0.00564891	-0.000836825	-0.00005
1.75634	-0.691862	-0.052596	0.0368729	0.00265368	-0.000998409	-0.00004

в)

In[ ]:=
```
Table[newtonPolynomial[f, data], {x, 0, n}]
```

Out[ ]=

{3.03265, 2.3179, 2.75398, 3.02595, 2.91135,
 2.43081, 1.75634, 4.06679, 61.266, 549.308, 3207.81}

г)

In[ ]:=
```
Table[InterpolatingPolynomial[data, x], {x, 0, n}]
```

Out[ ]=

{3.03265, 2.3179, 2.75398, 3.02595, 2.91135,
 2.43081, 1.75634, 4.06679, 61.266, 549.308, 3207.81}

д)

In[ ]:=
```
f[xPoint]
newtonPolynomial[f, data] /. x → xPoint
lagrangeInterpolation[data, xPoint]
InterpolatingPolynomial[data, xPoint]
```

Out[ ]=
```
2.91119
```

Out[ ]=
```
2.91122
```

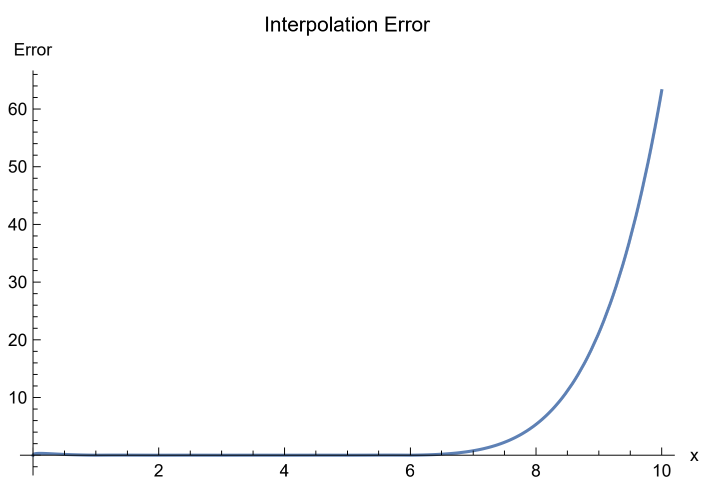
Out[ ]=
```
2.91122
```

Out[ ]=
```
2.91122
```

е)

In[ ]:=
```
Plot[Rn[x], {x, 0, n}, PlotRange → All,
 AxesLabel → {"x", "Error"}, PlotLabel → "Interpolation Error"]
```

Out[ ]=



In[ ]:=
```
FindMaximum[Rn[x], {x, 0, n}]
```

Out[ ]=
```
{0.316287, {x → 0.114282}}
```

ж) исследовать зависимость погрешности интерполирования от количества узлов интерполирования

In[29]:=
```
table1 = Table[{x, Rn[x]}, {x, 0, 10}] (*10 узлов*)
```

Out[29]=

$\{\{0, 0.\}, \{1, 0.\}, \{2, 2.22045\times10^{-16}\}, \{3, 0.\}, \{4, 4.44089\times10^{-16}\}, \{5, 6.66134\times10^{-16}\}, \{6, 0.\}, \{7, 0.767349\}, \{8, 5.33614\}, \{9, 21.1973\}, \{10, 63.1776\}\}$

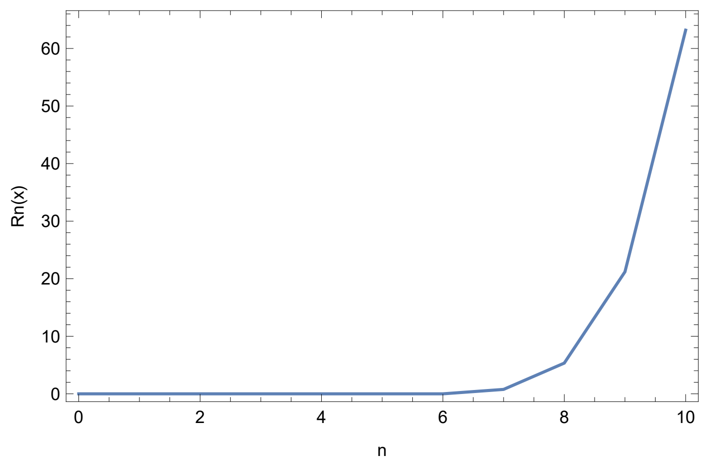
In[31]:=
```
data2 = N[Table[{x, f[x]}, {x, a, b, (b - a) / 6}]] (*6 узлов*)
```
Out[31]=
```
{{0., 3.03265}, {1., 2.32075}, {2., 2.75427},
 {3., 3.02595}, {4., 2.9112}, {5., 2.43019}, {6., 1.75634}}
```

In[32]:=
```
Rn2[x_] := Abs[f[x] - InterpolatingPolynomial[data2, x]]
```

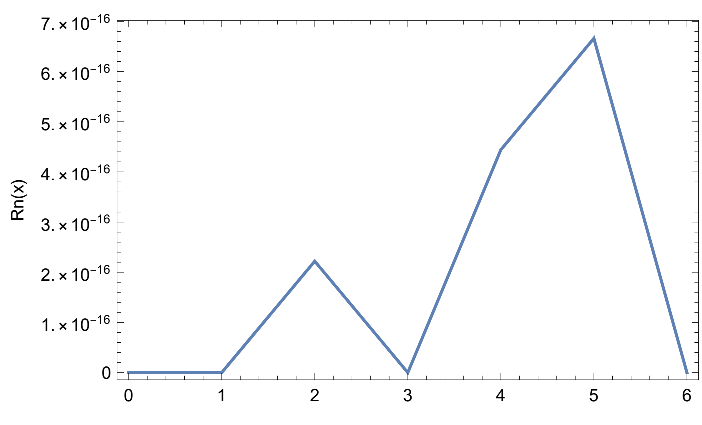
In[33]:=
```
table2 = Table[{x, Rn2[x]}, {x, 0, 6}]
```
Out[33]=

$\{\{0, 0.\}, \{1, 0.\}, \{2, 2.22045\times10^{-16}\}, \{3, 0.\}, \{4, 4.44089\times10^{-16}\}, \{5, 6.66134\times10^{-16}\}, \{6, 0.\}\}$

In[34]:=
```
ListPlot[table1, Joined → True, Frame → True, FrameLabel → {"n", "Rn(x)"}]
(*график зависимости значений погрешности от количества узлов(10)*)
```
Out[34]=




```
ListPlot[table2, Joined → True, Frame → True, FrameLabel → {"n", "Rn(x)"}]
(*график зависимости значений погрешности от количества узлов(6)*)
```
Out[ ]=



Задание 2

In[ ]:=
```
n = 6
```

In[35]:=
```
6
dataXi = List[]
```
Out[35]=
```
6
```
Out[36]=
```
{}
```
In[37]:=
```
For[i = 0, i ≤ n, i++,
 Ti = Cos[(Pi * (2 * i + 1))/(2 * n + 2)];
 Xi = (a + b)/2 + (b - a)/2 * Ti;
 AppendTo[dataXi, Xi];
]
```
In[ ]:=
```
dataXi = N[dataXi]
```
Out[ ]=
```
{5.92478, 5.34549, 4.30165, 3., 1.69835, 0.654506, 0.0752163}
```
In[ ]:=
```
data = N[ Table[ {dataXi⟦i⟧, f[dataXi⟦i⟧]} , {i, 1, n} ] ]
```
Out[ ]=
```
{{5.92478, 1.80879}, {5.34549, 2.20803}, {4.30165, 2.79879},
 {3., 3.02595}, {1.69835, 2.62201}, {0.654506, 2.23608}}
```
а) Создать таблицу разделенных разностей функции f (x) по точкам

In[ ]:=
```
TableForm[dividedDifferences[f, data]]
```
Out[ ]//TableForm=

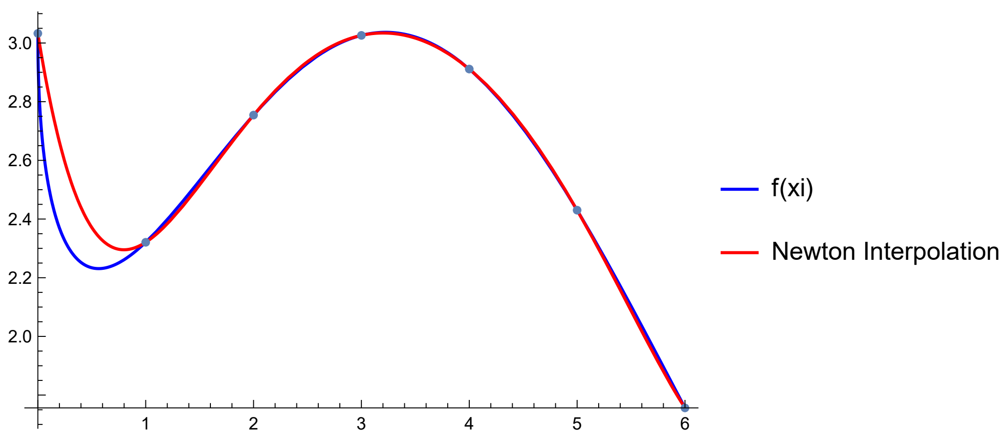
1.80879	0	0	0	0	0
2.20803	-0.689177	0	0	0	0
2.79879	-0.565951	-0.0759186	0	0	0
3.02595	-0.174514	-0.166889	0.0311032	0	0
2.62201	0.310326	-0.18624	0.005306	0.00610376	0
2.23608	0.369722	-0.0253236	-0.0441213	0.0105366	-0.000841109

б) Построить интерполяционный монгочлен Ньютона

In[38]:=

```
xi = data[[All, 1]];
yi = data[[All, 2]];

gr1 = Plot[f[x], {x, 0, n}, PlotStyle → Blue, PlotLegends → {"f(xi)"}]
gr2 = Plot[newtonPolynomial[f, data], {x, 0, n},
  PlotStyle → Red, PlotLegends → {"Newton Interpolation"}]
gr3 = ListPlot[data]
Show[gr1, gr2, gr3]
```

Out[43]=



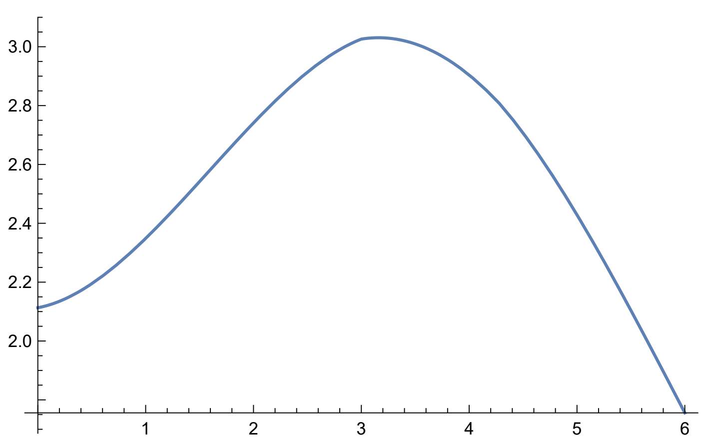
в) построить интерполирующую функцию с помощью Interpolation

In[∘]:=

```
Plot[Interpolation[data, x], {x, 0, n}]
```

InterpolatingFunction: Input value {0.000122571} lies outside the range of data in the interpolating function. Extrapolation will be used.

Out[∘]=



г) вычислить значение x = 2.4316 в функциях

In[ ]:=
```
f[xPoint]
newtonPolynomial[f, data] /. x → xPoint
Interpolation[data, xPoint]
```

Out[ ]=
```
0.894988
```

Out[ ]=
```
0.89191
```

Out[ ]=
```
2.89279
```

In[ ]:=
```
FindMaximum[newtonPolynomial[f, data], {x, 0, n}]
FindMaximum[Interpolation[data, x], {x, 0, n}]
```

Out[ ]=
```
{1.16224, {x → 1.66607}}
```

Out[ ]=
```
{3.03063, {x → 3.15926}}
```

In[ ]:=
```
n = 10
```

Out[ ]=
```
10
```

a)

In[ ]:=
```
dataXi = List[]
For[i = 0, i ≤ n, i++,
 Ti = Cos[Pi * (2 * i + 1) / (2 * n + 2)];
 Xi = (a + b)/2 + (b - a)/2 * Ti;
 AppendTo[dataXi, Xi];
]
dataXi = N[dataXi]
```

Out[ ]=
```
{}
```

Out[ ]=
```
{5.96946, 5.7289, 5.26725, 4.62192, 3.8452,
 3., 2.1548, 1.37808, 0.732751, 0.271104, 0.0305357}
```

In[ ]:=
```
data = N[ Table[ {dataXi⟦i⟧, f[dataXi⟦i⟧]} , {i, 1, n} ] ]
```

Out[ ]=
```
{{5.96946, 0.288346}, {5.7289, 0.0465504}, {5.26725, -0.323249},
 {4.62192, -0.533718}, {3.8452, -0.262451}, {3., 0.44112}, {2.1548, 1.04974},
 {1.37808, 1.11929}, {0.732751, 0.742192}, {0.271104, 0.294906}}
```

In[ ]:=
```
TableForm[dividedDifferences[f, data]]
```

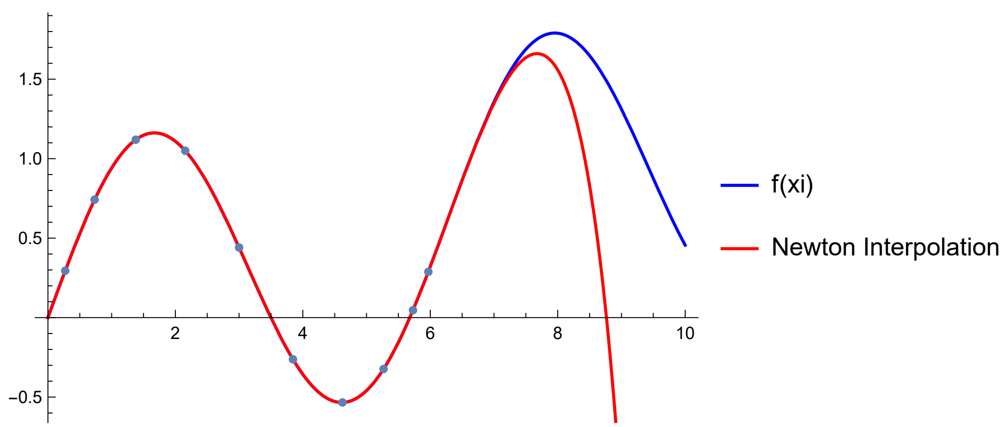
Out[ ]//TableForm=

0.288346	0	0	0	0	0	0
0.0465504	1.0051	0	0	0	0	0
-0.323249	0.801044	0.290592	0	0	0	0
-0.533718	0.326144	0.429008	-0.102718	0	0	0
-0.262451	-0.349245	0.47494	-0.0243838	-0.0368757	0	0
0.44112	-0.832434	0.297911	0.078081	-0.0375481	0.000226434	0
1.04974	-0.720093	-0.0664583	0.14769	-0.0223648	-0.00424815	0.0011
1.11929	-0.0895479	-0.388764	0.13064	0.00525602	-0.00710197	0.0006
0.742192	0.584359	-0.473898	0.0375496	0.0299092	-0.00633893	-0.000
0.294906	0.968893	-0.347374	-0.0671681	0.0383737	-0.00236828	-0.000

б) Построить интерполяционный монгочлен Ньютона

In[ ]:=
```
xi = data[[All, 1]];
yi = data[[All, 2]];

gr1 = Plot[f[x], {x, 0, n}, PlotStyle → Blue, PlotLegends → {"f(xi)"}]
gr2 = Plot[newtonPolynomial[f, data], {x, 0, n},
  PlotStyle → Red, PlotLegends → {"Newton Interpolation"}]
gr3 = ListPlot[data]
Show[gr1, gr2, gr3]
```

Out[ ]=

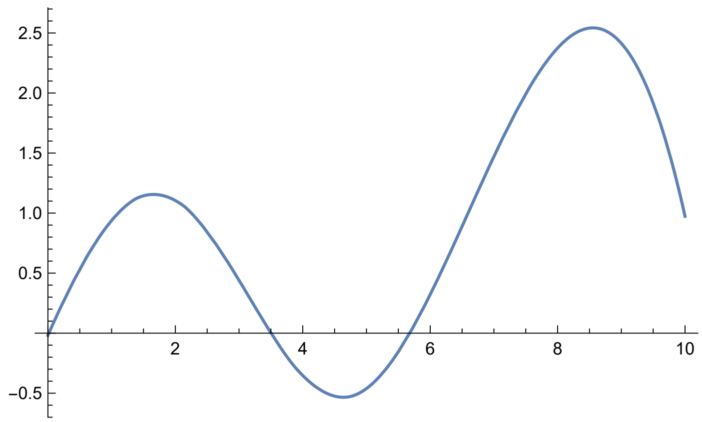


в) построить интерполирующую функцию с помощью Interpolation

In[ ]:=
```
Plot[Interpolation[data, x], {x, 0, n}]
```

InterpolatingFunction: Input value {0.000204286} lies outside the range of data in the interpolating function. Extrapolation will be used.

Out[ ]=



г) вычислить значение x = 2.4316 в функциях

In[ ]:=
```
f[xPoint]
newtonPolynomial[f, data] /. x → xPoint
Interpolation[data, xPoint]
```

Out[ ]=
```
0.894988
```

Out[ ]=
```
0.894987
```

Out[ ]=
```
0.889932
```

д)

In[ ]:=
```
FindMaximum[newtonPolynomial[f, data], {x, 0, n}]
FindMaximum[Interpolation[data, x], {x, 0, n}]
```

Out[ ]=
```
{1.16208, {x → 1.67097}}
```

Out[ ]=
```
{1.1553, {x → 1.65853}}
```

Задание 3

Вывод: по результатам работы видно, что увеличение количества узлов позволяет уменьшить погрешность интерполирования на отрезке(при некотором оптимальном количестве), а также этому способствует неравномерное размещение узлов(при определённых расположениях)

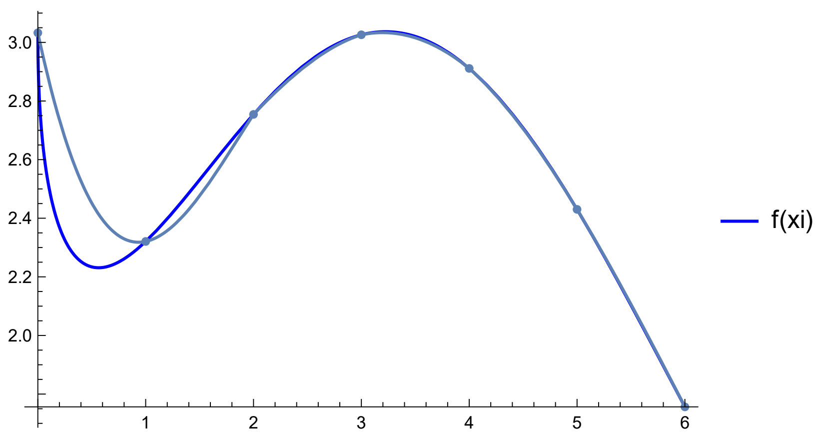
Задание 4

а) построить интерполяционный кубический сплайн дефекта 1

In[44]:=

```
spl = Interpolation[data, InterpolationOrder → 3, Method → "Hermite"];

gr2 = Plot[spl[x], {x, Min[data⟦All, 1⟧], Max[data⟦All, 1⟧]},
  Epilog → {Directive[AbsolutePointSize[0], ColorData[97, 4]], Point[data]}]
gr1 = Plot[f[x], {x, 0, n}, PlotStyle → Blue, PlotLegends → {"f(xi)"}]
gr3 = ListPlot[data]
Show[gr1, gr2, gr3]
```

Out[48]=

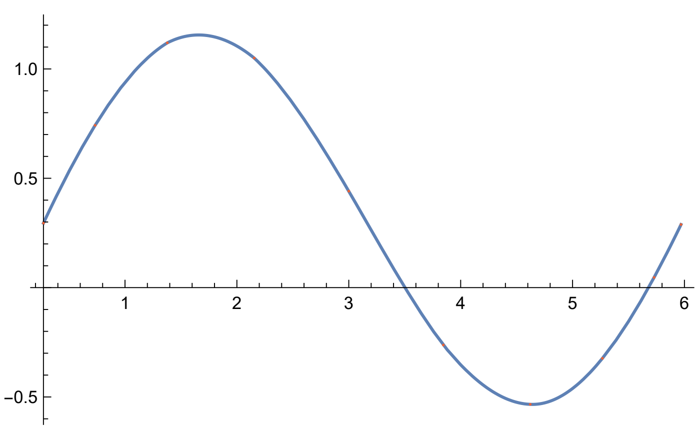


б) выполнить интерполяцию сплайном .

In[ ]:=

```
sf = Interpolation[data, Method → “Spline”];
Plot[sf[x], {x, Min[data⟦All, 1⟧], Max[data⟦All, 1⟧]},
 Epilog → {Directive[AbsolutePointSize[0], ColorData[97, 4]], Point[data]}]
```

Out[ ]=



г)

In[ ]:=
```
f[xPoint]
spl[xPoint]
sf[xPoint]
```

Out[ ]=
```
0.894988
```

Out[ ]=
```
0.889932
```

Out[ ]=
```
0.889932
```

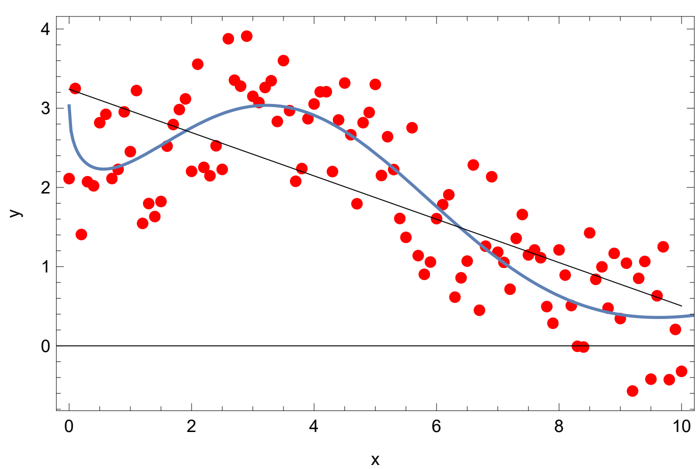
Задание 5

а)

In[180]:=

```
xData = Range[0, 10, 0.1];
yData = f[#] + RandomReal[{-1, 1}] & /@ xData;

(*Вычисляем суммы*)
n = Length[xData];
sumX = Total[xData];
sumY = Total[yData];
sumXY = Total[xData * yData];
sumX2 = Total[xData^2];

(*Вычисляем коэффициенты a и b*)
a = (n * sumXY - sumX * sumY) / (n * sumX2 - sumX^2);
b = (sumY - a * sumX) / n;

x = Range[0, 10, 0.1];
q1 = a * x + b;

(*Строим график*)
Show[ListPlot[Transpose[{xData, yData}],
  PlotStyle → Red, PlotMarkers → Automatic, PlotRange → All, Frame → True,
  FrameLabel → {"x", "y"}, Epilog → {Line[Transpose[{x, q1}]]}],
 Plot[f[x], {x, 0, n}]
]
```

Out[191]=



б)аппроксимировать с помощью метода наименьших квадратов функцию f(x) многочленом второй степени

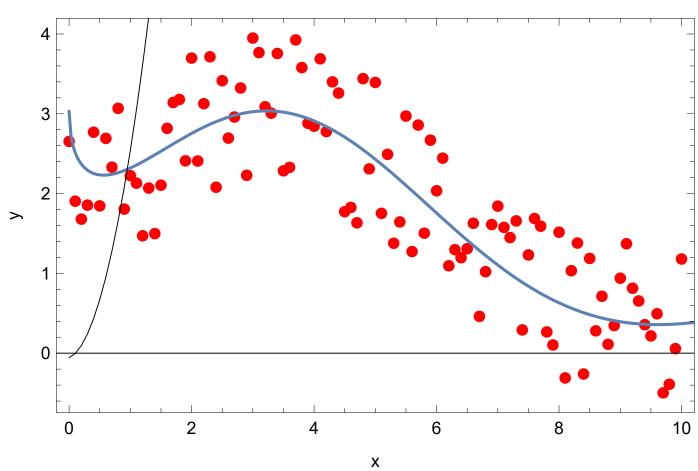
In[120]:=

```
(*Вычисляем суммы*)n = Length[xData];
sumX = Total[xData];
sumY = Total[yData];
sumXY = Total[xData * yData];
sumX2 = Total[xData^2];
sumX3 = Total[xData^3];
sumX4 = Total[xData^4];

(*Вычисляем коэффициенты a,b и c*)
X = {{n, sumX, sumX2}, {sumX, sumX2, sumX3}, {sumX2, sumX3, sumX4}};
Y = {sumY, sumXY, Total[xData^2 * yData]};
P = LinearSolve[X, Y]

(*Получаем вектор P*)
(*Результат:{c,b,a}*)

(*Построение аппроксимирующего многочлена*)
q2[x_] := P[[1]] * x^2 + P[[2]] * x + P[[3]]

(*Строим график*)
x = Range[0, 10, 0.1];
y = q2[x];

Show[ListPlot[Transpose[{xData, yData}], PlotStyle → Red,
  PlotMarkers → Automatic, PlotRange → All, Frame → True, FrameLabel → {"x", "y"},
  Epilog → {Line[Transpose[{x, y}]]}], Plot[f[x], {x, 0, n}]]
```

Out[129]=

```
{2.28795, 0.312622, -0.0576946}
```

Out[133]=



в) найти многочлены наилучшего среднеквадратичного приближения третьей и четвертой степеней с помощью функции Fit wolfram mathematica

In[49]:=
```
(*Многочлен наилучшего среднеквадратичного приближения третьей степени*)
fitPoly3 = Fit[data, {1, x, x^2, x^3}, x]

(*Многочлен наилучшего среднеквадратичного приближения четвертой степени*)
fitPoly4 = Fit[data, {1, x, x^2, x^3, x^4}, x]
```

Out[49]=

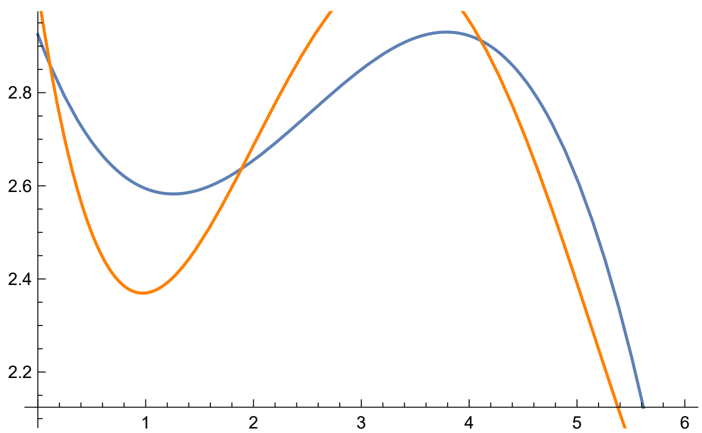
$$2.92471 - 0.612148\,x + 0.324302\,x^2 - 0.0428527\,x^3$$

Out[50]=

$$3.02078 - 1.55683\,x + 1.15424\,x^2 - 0.267016\,x^3 + 0.0186802\,x^4$$

In[54]:=
```
Show[Plot[fitPoly3, {x, 0, b}],
 Plot[fitPoly4, {x, 0, b}, PlotStyle → Orange]]
```

Out[54]=



г)

In[272]:=

```
f[xPoint]
q1 = a * xPoint + b
q2[xPoint]
fitPoly3Value = fitPoly3 /. x → xValue
fitPoly4Value = fitPoly4 /. x → xValue
```

Out[272]=

```
2.91119
```

Out[273]=

```
2.5745
```

Out[274]=

```
14.2304
```

Out[275]=

```
{2.92471, 2.8667, 2.81491, 2.7691, 2.729, 2.69436, 2.66491, 2.64042, 2.62061,
 2.60522, 2.59401, 2.58672, 2.58308, 2.58284, 2.58575, 2.59154, 2.59996,
 2.61076, 2.62367, 2.63843, 2.6548, 2.67251, 2.69131, 2.71094, 2.73114, 2.75166,
 2.77223, 2.79261, 2.81252, 2.83173, 2.84996, 2.86697, 2.8825, 2.89628, 2.90806,
 2.91759, 2.9246, 2.92884, 2.93006, 2.92799, 2.92238, 2.91297, 2.89951, 2.88173,
 2.85939, 2.83221, 2.79996, 2.76236, 2.71916, 2.67011, 2.61494, 2.55341, 2.48524,
 2.4102, 2.32801, 2.23842, 2.14118, 2.03603, 1.92271, 1.80096, 1.67052, 1.53115,
 1.38258, 1.22455, 1.05681, 0.879102, 0.691166, 0.492747, 0.283587, 0.0634288,
 -0.167984, -0.410909, -0.665603, -0.932323, -1.21133, -1.50287, -1.80721,
 -2.12461, -2.45532, -2.7996, -3.1577, -3.52989, -3.91641, -4.31754, -4.73352,
 -5.16461, -5.61107, -6.07316, -6.55112, -7.04523, -7.55574, -8.0829, -8.62697,
 -9.18821, -9.76688, -10.3632, -10.9775, -11.61, -12.2609, -12.9306, -13.6192}
```

Out[276]=

```
{3.02078, 2.87637, 2.75348, 2.65055, 2.56611, 2.49871, 2.44695, 2.40947, 2.38497, 2.37216,
 2.36985, 2.37684, 2.39202, 2.41428, 2.44259, 2.47596, 2.51342, 2.55408, 2.59707,
 2.64158, 2.68683, 2.73208, 2.77667, 2.81996, 2.86133, 2.90026, 2.93624, 2.9688,
 2.99754, 3.02208, 3.0421, 3.05733, 3.06751, 3.07248, 3.07207, 3.06619, 3.05479,
 3.03786, 3.01542, 2.98756, 2.95441, 2.91612, 2.87292, 2.82506, 2.77285, 2.71663,
 2.6568, 2.59379, 2.5281, 2.46023, 2.39078, 2.32035, 2.2496, 2.17925, 2.11005, 2.04278,
 1.9783, 1.91749, 1.86127, 1.81064, 1.76659, 1.73021, 1.70261, 1.68492, 1.67837,
 1.68419, 1.70367, 1.73814, 1.78899, 1.85764, 1.94555, 2.05425, 2.18529, 2.34027,
 2.52085, 2.72871, 2.96559, 3.23328, 3.5336, 3.86843, 4.23968, 4.64931, 5.09934,
 5.59182, 6.12883, 6.71253, 7.34509, 8.02875, 8.76579, 9.55853, 10.4093, 11.3206,
 12.2948, 13.3344, 14.442, 15.6202, 16.8715, 18.1987, 19.6046, 21.0918, 22.6632}
```

д)

In[282]:=

```
Show[Plot[fitPoly3, {x, 0, 6}],
 Plot[fitPoly4, {x, 0, 6}, PlotStyle → Orange],
 Plot[q1, {x, 0, 6}],
 Plot[q2[x], {x, 0, 6}]
]
```

Out[282]=