Лабораторная работа №5
Интерполирование
1.1.2(в)

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Группа: ПМ1801

```
PolEx[n_, x_] :=
 a0 + Sum[ToExpression[StringJoin[ToString[a], ToString[i]]] * e^(i*x) +
    ToExpression[StringJoin[ToString[b], ToString[i]]] * e^(-i*x), {i, 1, n}]

PolEx2[exp_, y_] := exp == y

mainF[n_, x_, y_] := Module[{sys, element, res, first},
  element =
   Join[{a0}, Table[ToExpression[StringJoin[ToString[a], ToString[i]]], {i, 1, n}],
    Table[ToExpression[StringJoin[ToString[b], ToString[i]]], {i, 1, n}]
   ];
  sys = Map[PolEx[n, #] &, x];
  sys = Table[PolEx2[sys[[i]], y[[i]]], {i, 1, Length@y}];
  res = NSolve[sys, element];
  first = res[[1, 1, 2]];
  res = Drop[res[[1]], 1];
  first + Sum[e^(k*x1) res[[k, 2]] + e^(-k*x1) res[[n + k, 2]], {k, 1, n}]
 ]
```

1.Пишем функцию

2.Выбираем точки по x

3.При помощи этой же функции генерируем точки по y

4. Запускаем и сверяем результат

Формула

$$g(x) = E_n(x) = a_0 + \sum_{k=1}^{n} (a'_k e^{kx} + b'_k e^{-kx})$$

Тест №1

Полином

```
f[x_] := x^3 - 3 x^2

f /@ {0, 2, 3, 5, 6}
```

```
{0, -4, 0, 50, 108}
```

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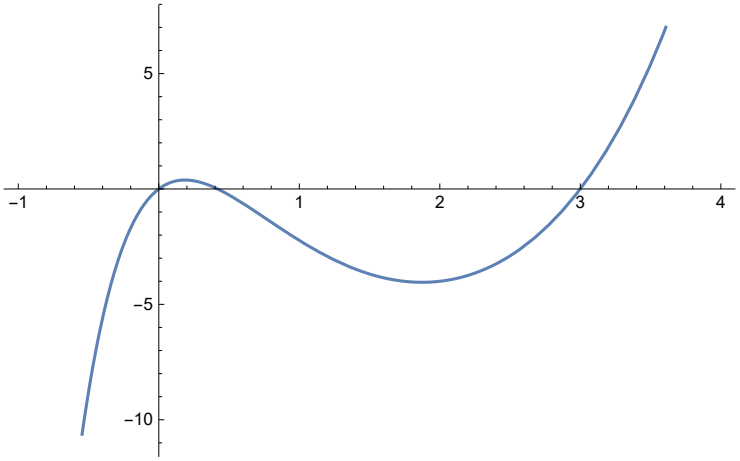
```
Plot[mainF[2, {0, 2, 3, 5, 6}, {0, -4, 0, 50, 108}], {x1, -1, 4}]
```



Тест №2

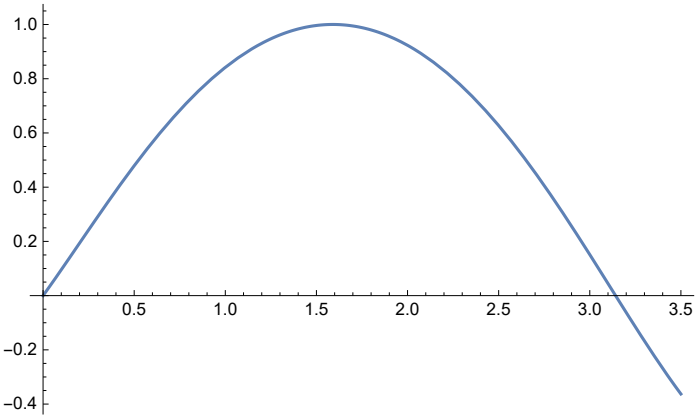
Тригонометрическая функция

```
f[x_] := Sin[x]
```

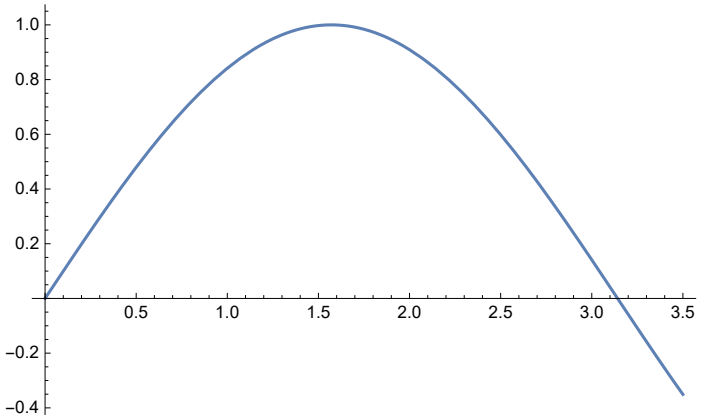
```
f /@ {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3}
```

$$\left\{0, \frac{1}{2}, \frac{\sqrt{3}}{2}, 1, 0, -\frac{1}{2}, -\frac{\sqrt{3}}{2}\right\}$$

```
Plot[mainF[3, {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3},
  {0, 1/2, Sqrt[3]/2, 1, 0, -1/2, -Sqrt[3]/2}], {x1, 0, 3.5}]
```



```
Plot[ Sin[x], {x, 0, 3.5}]
```



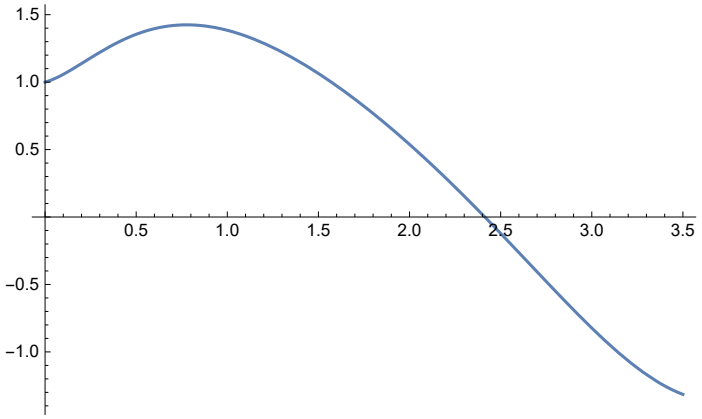
Тест №3

```
f[x_] := Sin[x] + Cos[x]
```

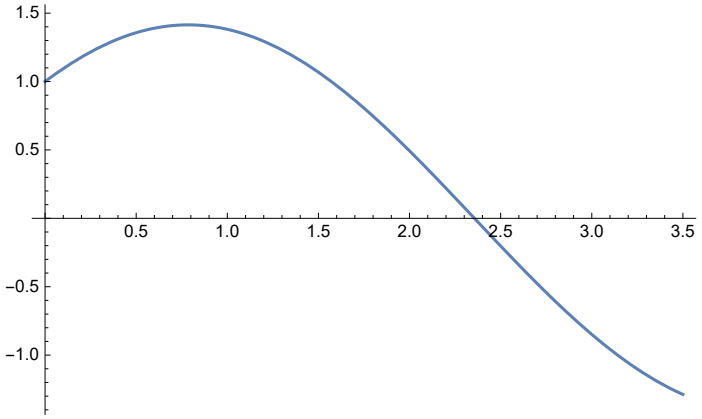
```
f /@ {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3}
```

$$\left\{1, \frac{1}{2}+\frac{\sqrt{3}}{2}, \frac{1}{2}+\frac{\sqrt{3}}{2}, 1, -1, -\frac{1}{2}-\frac{\sqrt{3}}{2}, -\frac{1}{2}-\frac{\sqrt{3}}{2}\right\}$$

```
Plot[mainF[3, {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3},
  {1, 1/2 + Sqrt[3]/2, 1/2 + Sqrt[3]/2, 1, -1, -1/2 - Sqrt[3]/2, -1/2 - Sqrt[3]/2}], {x1, 0, 3.5}]
```



```
Plot[ Sin[x] + Cos[x], {x, 0, 3.5}]
```



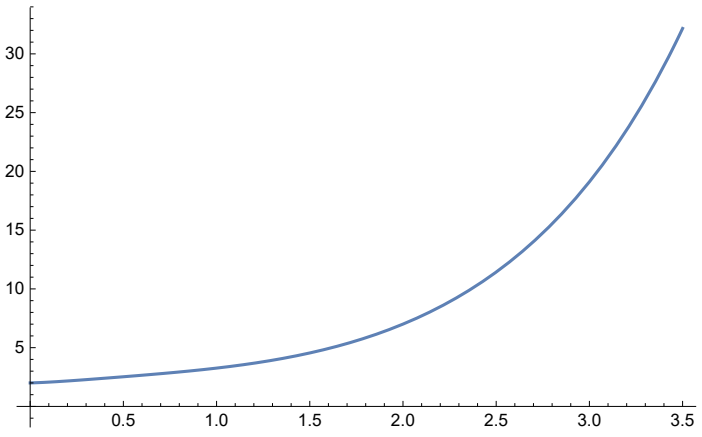
Тест №4

```
f[x_] := ℯ^x + Cos[x]
```

```
f /@ {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3}
```

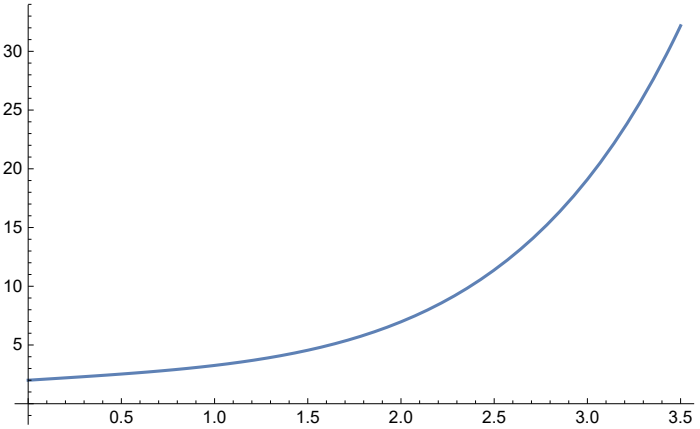
$$\left\{2, \frac{\sqrt{3}}{2} + e^{\pi/6}, \frac{1}{2} + e^{\pi/3}, e^{\pi/2}, -1 + e^{\pi}, -\frac{\sqrt{3}}{2} + e^{7\pi/6}, -\frac{1}{2} + e^{4\pi/3}\right\}$$

```
Plot[mainF[3, {0, Pi/6, Pi/3, Pi/2, Pi, 7 Pi/6, 4 Pi/3},
  {2, Sqrt[3]/2 + ℯ^(π/6), 1/2 + ℯ^(π/3), ℯ^(π/2), -1 + ℯ^π, -Sqrt[3]/2 + ℯ^(7 π/6), -1/2 + ℯ^(4 π/3)}], {x1, 0, 3.5}]
```



```
Plot[ ℯ^x + Cos[x], {x, 0, 3.5}]
```

Out[•]=



Теперь на места экспонент поставим гиперболический синус и гиперболически косинус

$$g(x) = E_n(x) = a_0 + \sum_{k=0}^{n} (a_k \operatorname{ch} kx + b_k \operatorname{sh} kx)$$

In[•]:=
```
PolTrig[n_, x_] :=
 a0 + Sum[ToExpression[StringJoin[ToString[a], ToString[i]]] * Cosh[i * x] +
    ToExpression[StringJoin[ToString[b], ToString[i]]] * Sinh[i * x], {i, 1, n}]
```

In[•]:=
```
mainF1[n_, x_, y_] := Module[{sys, element, res, first},
  element =
   Join[{a0}, Table[ToExpression[StringJoin[ToString[a], ToString[i]]], {i, 1, n}],
    Table[ToExpression[StringJoin[ToString[b], ToString[i]]], {i, 1, n}]
   ];
  sys = Map[PolTrig[n, #] &, x];
  sys = Table[PolEx2[sys[[i]], y[[i]]], {i, 1, Length@y}];
  res = NSolve[sys, element];
  first = res[[1, 1, 2]];
  res = Drop[res[[1]], 1];
  first + Sum[Cosh[k * x1] res[[k, 2]] + Sinh[k * x1] res[[n + k, 2]], {k, 1, n}]
 ]
```

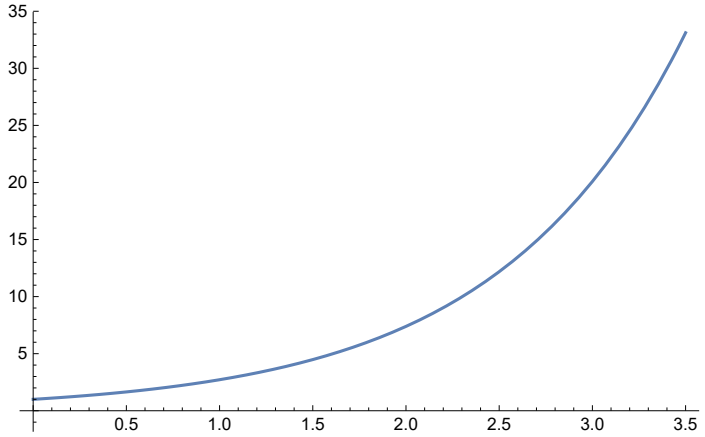
Тест №1

```
f[x_] := ℯ^x
```

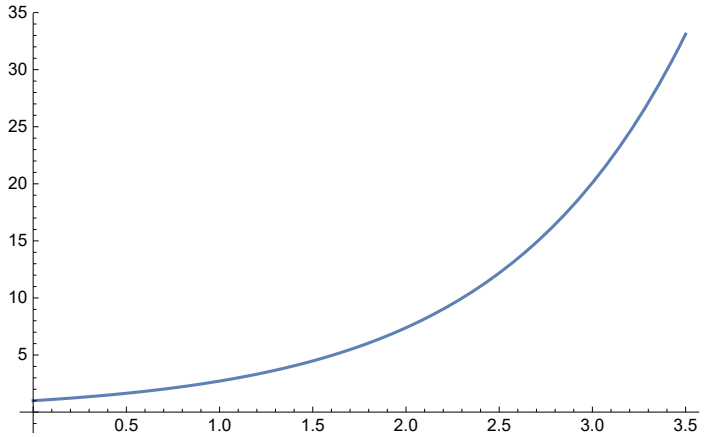
```
f /@ {-2, 0, 2, 4, 6, 8, 10}
```

$$\left\{\frac{1}{\mathrm{e}^2}, 1, \mathrm{e}^2, \mathrm{e}^4, \mathrm{e}^6, \mathrm{e}^8, \mathrm{e}^{10}\right\}$$

```
Plot[mainF1[3, {-2, 0, 2, 4, 6, 8, 10}, {1/e^2, 1, e^2, e^4, e^6, e^8, e^10}], {x1, 0, 3.5}]
```




```
Plot[e^x, {x, 0, 3.5}]
```



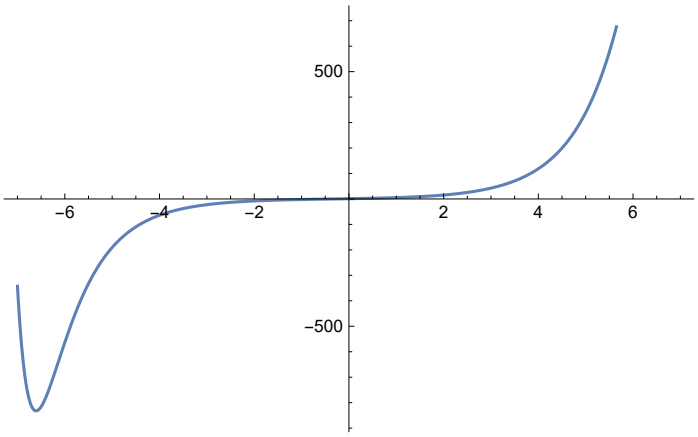
Тест №2

```
f[x_] := e^x + x^3
```

```
f /@ {-7, -4, -2, 0, 2, 4, 7}
```

$$\left\{-343+\frac{1}{e^7},\ -64+\frac{1}{e^4},\ -8+\frac{1}{e^2},\ 1,\ 8+e^2,\ 64+e^4,\ 343+e^7\right\}$$

```
Plot[mainF1[3, {-7, -4, -2, 0, 2, 4, 7},
  {-343 + 1/e^7, -64 + 1/e^4, -8 + 1/e^2, 1, 8 + e^2, 64 + e^4, 343 + e^7}], {x1, -7, 7}]
```




```
Plot[e^x + x^3, {x, -7, 7}]
```

Out[ ]=