

# Интерполационен полином на Лагранж

## Генериране на данни (съставяне на табличната функция)

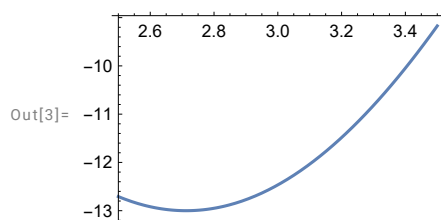
```
In[1]:= xt = Table[3 + i * 0.1, {i, -5, 5}]
```

```
Out[1]= {2.5, 2.6, 2.7, 2.8, 2.9, 3., 3.1, 3.2, 3.3, 3.4, 3.5}
```

```
In[2]:= f[x_] := 13 Sin[x + 2]
```

за да сравняваме резултатите визуализираме функцията

```
In[3]:= Plot[f[x], {x, 2.5, 3.5}]
```



```
In[4]:= yt = f[xt]
```

```
Out[4]= {-12.7079, -12.918, -12.999, -12.9501, -12.7719,  
-12.466, -12.0356, -11.4849, -10.8195, -10.0459, -9.17202}
```

```
In[17]:= n = Length[xt]
points = Table[{xt[[i]], yt[[i]]}, {i, 1, n}]
grp = ListPlot[points, PlotStyle -> Black]
```

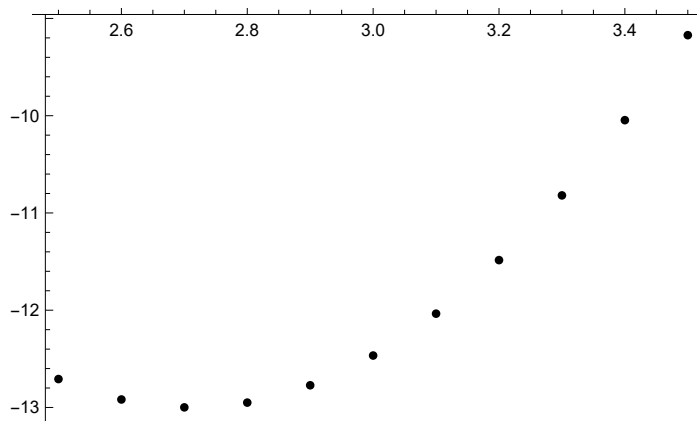
Out[17]=

11

Out[18]=

```
{ {2.5, -12.7079}, {2.6, -12.918}, {2.7, -12.999},
  {2.8, -12.9501}, {2.9, -12.7719}, {3., -12.466}, {3.1, -12.0356},
  {3.2, -11.4849}, {3.3, -10.8195}, {3.4, -10.0459}, {3.5, -9.17202} }
```

Out[19]=



## Интерполация в т. z = 2.97

### Линейна интерполация

```
In[8]:= L1[x_] := -12.7719 *  $\frac{x - 3}{2.9 - 3}$  - 12.466 *  $\frac{x - 2.9}{3 - 2.9}$ 
```

```
Expand[L1[x]]
```

Out[9]= -21.643 + 3.059 x

### Проверка на интерполационните условия

```
In[10]:= L1[2.9]
```

```
L1[3]
```

Out[10]=

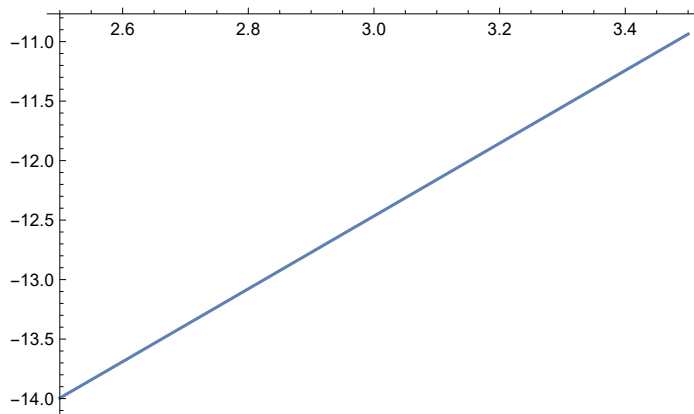
-12.7719

Out[11]=

-12.466

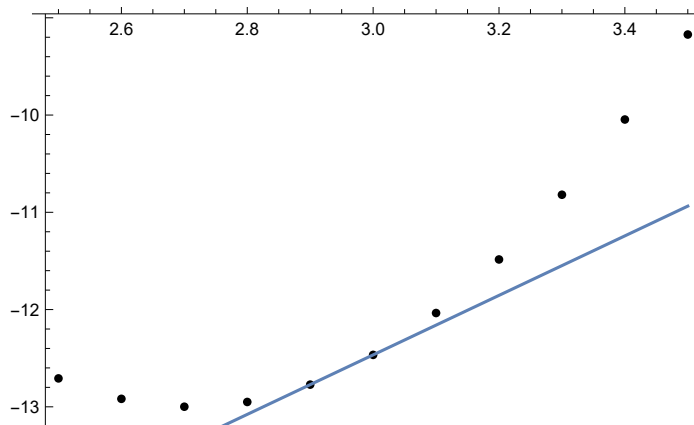
```
In[15]:= grL1 = Plot[L1[x], {x, 2.5, 3.5}]
```

```
Out[15]=
```



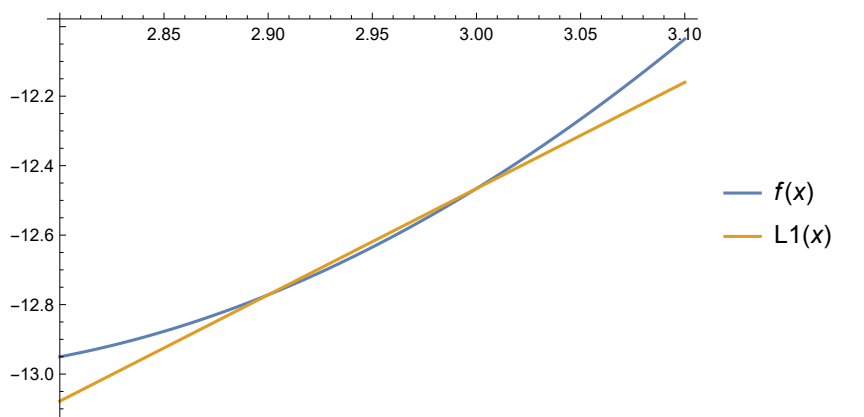
```
In[20]:= Show[grp, grL1]
```

```
Out[20]=
```



```
In[22]:= Plot[{f[x], L1[x]}, {x, 2.8, 3.1}, PlotLegends -> "Expressions"]
```

```
Out[22]=
```



Пресмятане приближена стойност на функцията в  $z = 2.97$

```
In[23]:= L1[2.97]
```

```
Out[23]=
```

```
- 12.5578
```

## Оценка на грешката

истинска грешка

In[24]:= **Abs[f[2.97] - L1[2.97]]**

Out[24]=

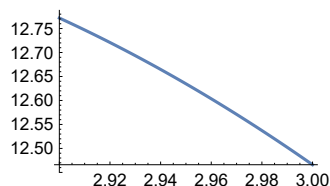
0.0132479

теоретична грешка

намираме M2

In[25]:= **Plot[Abs[f''[x]], {x, 2.9, 3}]**

Out[25]=



от графиката се вижда, че

In[26]:= **M2 = Abs[f''[2.9]]**

Out[26]=

12.7719

In[27]:=

$$R1[x_] := \frac{M2}{2!} * Abs[(x - 2.9)(x - 3)]$$

In[28]:= **R1[2.97]**

Out[28]=

0.0134105

за сравнение истинската грешка е 0.0132479

## Квадратична интерполация

$$\begin{aligned} \text{In[29]:= } L2[x_] := & -12.7719 * \frac{(x - 3)(x - 3.1)}{(2.9 - 3)(2.9 - 3.1)} - \\ & 12.466 * \frac{(x - 2.9)(x - 3.1)}{(3 - 2.9)(3 - 3.1)} - 12.0356 * \frac{(x - 2.9)(x - 3.)}{(3.1 - 2.9)(3.1 - 3.)} \end{aligned}$$

**Expand[L2[x]]**

Out[30]=

$$32.5145 - 33.6685 x + 6.225 x^2$$

## Проверка на интерполационните условия

In[31]:= **L2[2.9]**

**L2[3]**

**L2[3.1]**

Out[31]=

-12.7719

Out[32]=

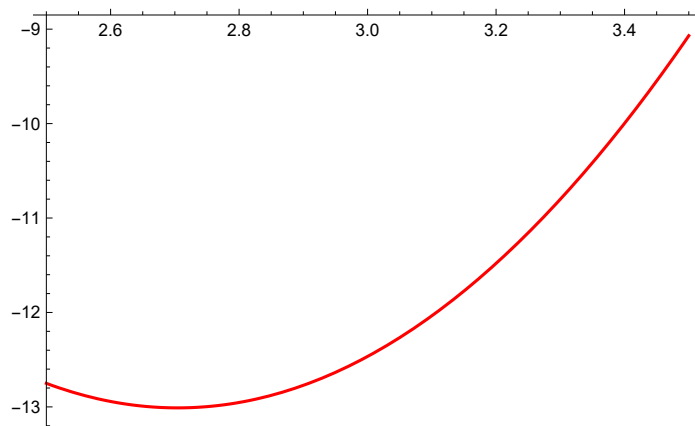
-12.466

Out[33]=

-12.0356

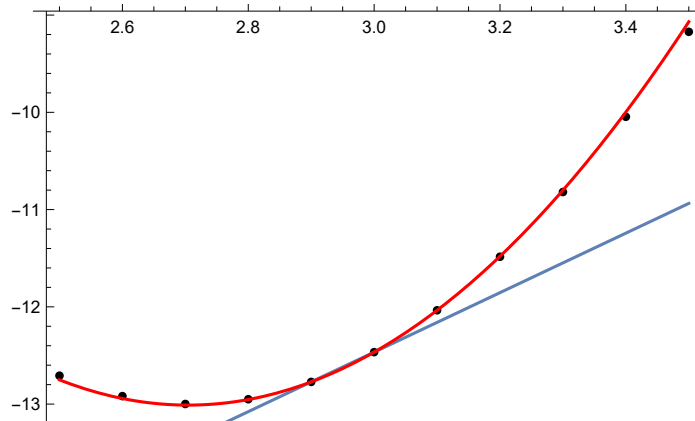
In[35]:= **grL2 = Plot[L2[x], {x, 2.5, 3.5}, PlotStyle → Red]**

Out[35]=



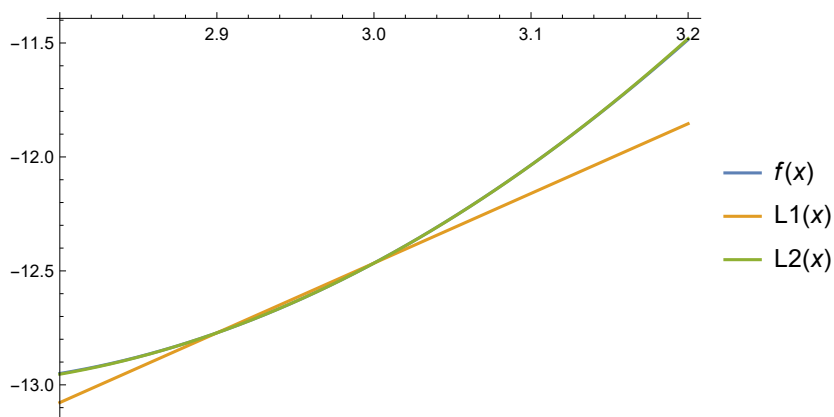
In[36]:= **Show[grp, grL1, grL2]**

Out[36]=



```
In[37]:= Plot[{f[x], L1[x], L2[x]}, {x, 2.8, 3.2}, PlotLegends → "Expressions"]
```

```
Out[37]=
```



Пресмятане приближена стойност на функцията в  $z = 2.97$

```
In[38]:= L2[2.97]
```

```
Out[38]=
```

-12.5708

Оценка на грешката

истинска грешка

```
In[39]:= Abs[f[2.97] - L2[2.97]]
```

```
Out[39]=
```

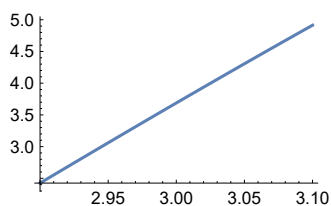
0.000175443

теоретична грешка

намираме M3

```
In[40]:= Plot[Abs[f'''[x]], {x, 2.9, 3.1}]
```

```
Out[40]=
```



от графиката се вижда, че

```
In[41]:= M3 = Abs[f'''[3.1]]
```

```
Out[41]=
```

4.91371

```
In[42]:=
```

$$R2[x_] := \frac{M3}{3!} * Abs[(x - 2.9)(x - 3)(x - 3.1)]$$

```
In[43]:= R2[2.97]
```

```
Out[43]=
```

0.000223574

за сравнение истинската грешка е 0.000175443

## Кубична интерполация

---

Естраполяция в т.  $z = 3.56$  (**близка** до дадените точки)

---

Естраполяция в т.  $z = 10$  (**далечна** от дадените точки)

```
In[44]:= L2[10]  
Out[44]= 318.329
```

```
In[45]:= R2[10]  
Out[45]= 280.843
```