

```
• begin
•   import Pkg;
•   Pkg.activate() ;
•
•   using Plots;
•   using OrderedCollections;
• end;
```

Activating project at `~/julia/environments/v1.8` ?

Метод Ньютона решения нелинейных уравнений

Вариант 85 (с 120)

$$f(x) = x^3 - 0.1x^2 + 0.3x - 0.6 = 0$$

$$f'(x) = 3x^2 - 0.2x + 0.3$$

$$f''(x) = 6x - 0.2$$

f (generic function with 1 method)

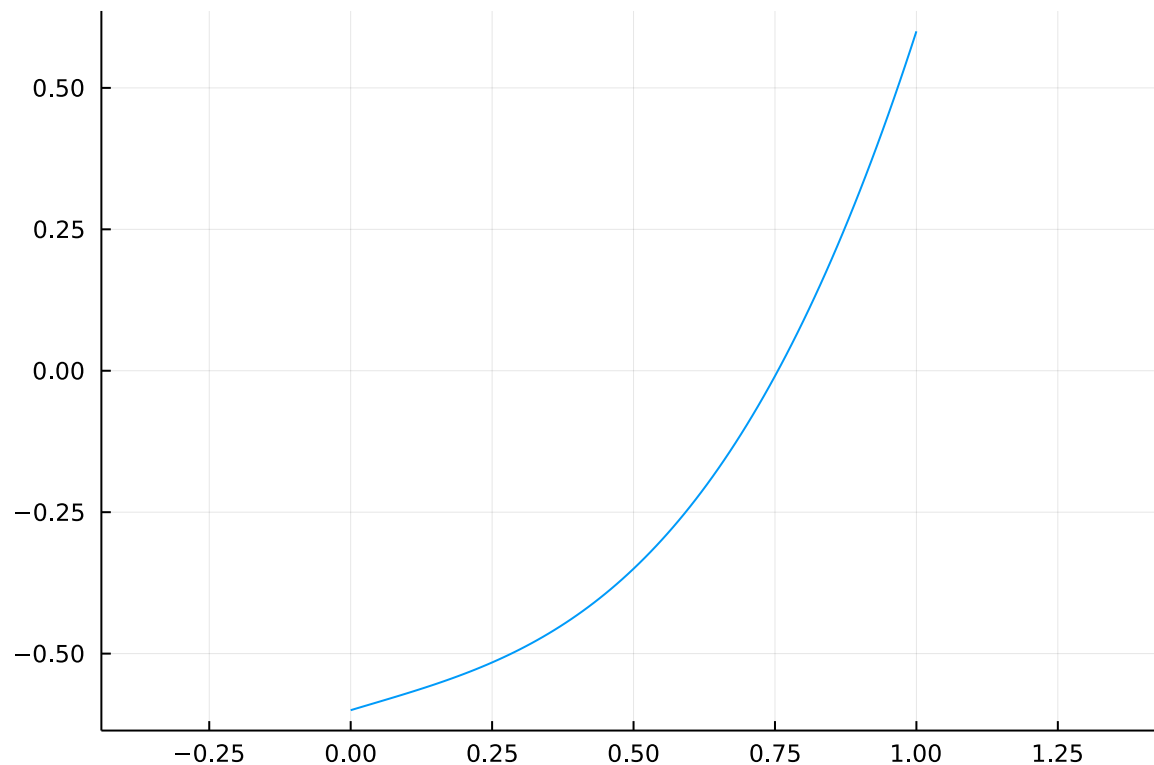
```
• f(x) = x^3 - 0.1x^2 + 0.3x - 0.6
```

df (generic function with 1 method)

```
• df(x) = 3x^2 - 0.2x + 0.3
```

ddf (generic function with 1 method)

```
• ddf(x) = 6x - 0.2
```



```
• plot(
•   0:.01:1,
•   f.(0:.01:1);
•   label=:none,
•   ratio=:equal
• )
```

Проверка условий сходимости

(0.7, 0.15)

• $x_0, \delta = .7, .15$

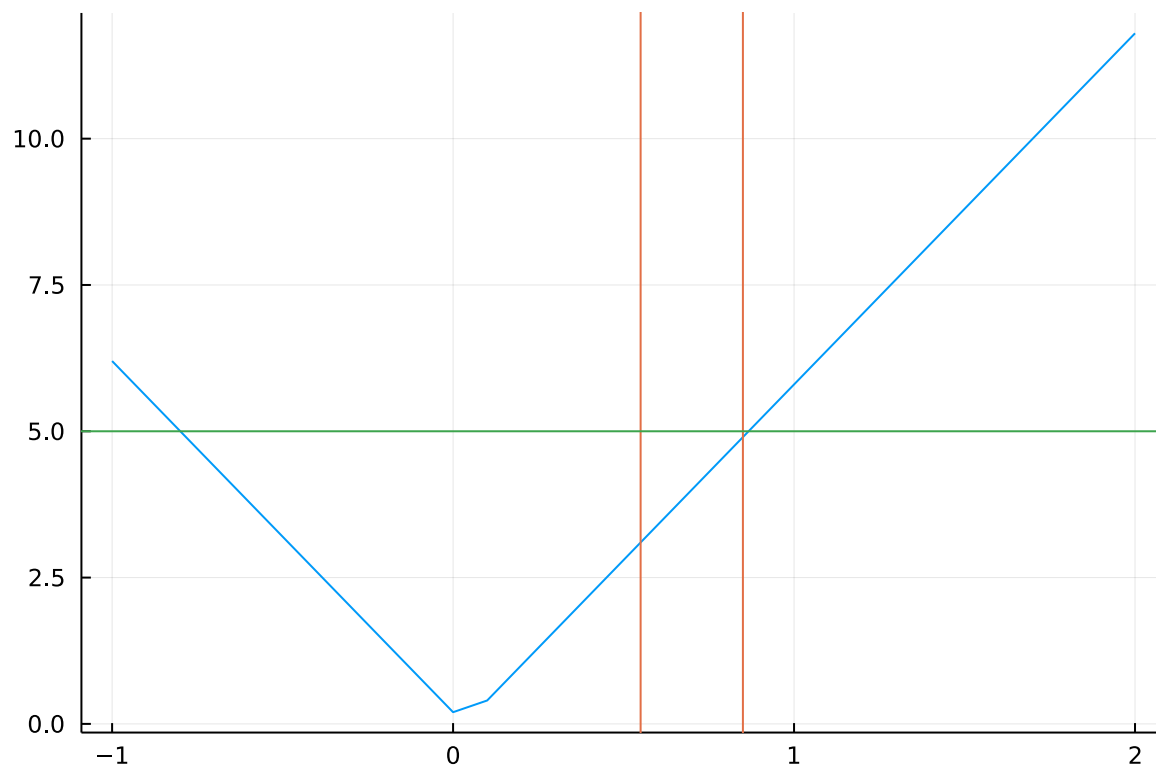
(0.55, 0.85)

• $x_1, x_2 = x_0 - \delta, x_0 + \delta$

$$1. |f''(x)| \leq K$$

$K = 5$

• $K = 5$



```

• begin
•   plot(
•     -1:.1:2,
•     abs(ddf.(-1:.1:2));
•     label=:none
•   )
•   vline!([x1, x2];label=:none)
•   hline!([K];label=:none)
• end

```

$$2. f'(x_0) \neq 0, \frac{1}{|f'(x_0)|} \leq B$$

0.6134969325153374

```
• 1 / abs(df(x0))
```

B = 0.62

```
• B = .62
```

$$3. \left| \frac{f(x_0)}{f'(x_0)} \right| \leq \eta$$

0.05889570552147245

```
• abs(f(x0) / df(x0))
```

η = 0.06

```
• n = .06
```

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$$4. h = K * B * \eta \leq \frac{1}{2}$$

h = 0.186

- `h = K * B * η`

$$5. \frac{1 - \sqrt{1 - 2h}}{h} \eta \leq \delta$$

0.06694693217859418

- `(1 - sqrt(1 - 2h)) / h * η`

true

- `(1 - sqrt(1 - 2h)) / h * η ≤ δ`

Итерационный процесс методом Ньютона

φ (generic function with 2 methods)

- `φ(x) = x - f(x) / df(x)`

XN = [0.7]

- `XN = [x₀]`

[0.7, 0.758896]

- `push!(XN, φ(XN[end]))`

- `while abs(XN[end] - XN[end-1]) > 10^(-5)`
- `push!(XN, φ(XN[end]))`
- `end`

```
OrderedCollections.OrderedDict{Float64, Float64}(  
  0.7 ⇒ -0.096  
  0.758896 ⇒ 0.0071417  
  0.755089 ⇒ 3.14904e-5  
  0.755072 ⇒ 6.21e-10  
  0.755072 ⇒ -1.11022e-16  
)
```

- `OrderedDict(XN .=> f.(XN))`

-1.1102230246251565e-16

- `f(XN[end])`

Итерационный процесс методом секущих

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φ (generic function with 1 method)

- $\varphi(x::Vector) = x[\text{end}] - \underline{f}(x[\text{end}]) * (x[\text{end}] - x[\text{end}-1]) / (\underline{f}(x[\text{end}]) - \underline{f}(x[\text{end}-1]))$

XS = [0.5, 1.0]

- **XS** = [.5, 1]

[0.5, 1.0, 0.684211]

- **push!**(**XS**, $\varphi(\underline{\text{XS}})$)

- **while** **abs**(**XS**[**end**] - **XS**[**end**-1]) > 10⁻⁵
- **push!**(**XS**, $\varphi(\underline{\text{XS}}[\text{end}])$)
- **end**

```
OrderedCollections.OrderedDict{Float64, Float64}(  
  0.5 ⇒ -0.35  
  1.0 ⇒ 0.6  
  0.684211 ⇒ -0.121242  
  0.761554 ⇒ 0.0121432  
  0.75512 ⇒ 9.01484e-5  
  0.755072 ⇒ 5.08861e-9  
  0.755072 ⇒ -1.11022e-16  
)
```

- **OrderedDict**(**XS** .=> $\underline{f}(\underline{\text{XS}})$)

-1.1102230246251565e-16

- $\underline{f}(\underline{\text{XS}}[\text{end}])$