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

Метод Галёркина

$$\begin{cases} y''(x) + \frac{0.9}{1.8x+1} y'(x) = 0 \\ y(0) = 2 \\ y(1) = 2\sqrt{2.8} \end{cases}$$

```
(0.0, 1.0)
```

```
A, B = 0., 1.
```

```
(1.0, 1.0)
```

```
α₀, α₁ = 1., 1.
```

```
(2.0, 3.34664)
```

```
γ₀, γ₁ = 2., 2*sqrt(2.8)
```

$([a_0, a_1, a_2, a_3, a_4, a_5, a_6, a_7, a_8, a_9, a_{10}], x)$

```
@syms a[0:10], x
```

```
p =
```

$$\frac{0.9}{1.8x + 1}$$

```
p = 0.9 / (1.8x + 1)
```

```
φ =  Dict{Int64, SymPy.Sym}(
```

$$0 \Rightarrow a_0 + a_1 x$$

$$4 \Rightarrow a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4 + a_5 x^5$$

$$2 \Rightarrow a_0 + a_1 x + a_2 x^2 + a_3 x^3$$

$$3 \Rightarrow a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4$$

$$1 \Rightarrow a_0 + a_1 x + a_2 x^2$$

```
)
```

```
φ = Dict(
    i-1 => a[1] + sum(a[j+1]*x^j for j in 1:i)
    for i in 1:5
)
```

φ_0

```
coeffs₀ =  []
```

```
coeffs₀ = solve([
    Eq(α₀*φ[0].subs(Dict(x=>A)), γ₀),
    Eq(α₁*φ[0].subs(Dict(x=>B)), γ₁)
], a[1:2])
```

$$1.3466401061363x + 2.0$$

```
φ[0] = φ[0].subs(coeffs₀)
```

φ_i

```
for i in 1:4
    φ[i] = φ[i].subs(
        solve([
            Eq(α₀*φ[i].subs(Dict(x=>A)), 0),
            Eq(α₁*φ[i].subs(Dict(x=>B)), 0)
        ], a[1:(i+2)])
    ).subs(Dict(
        a[1:(i+2)] .=> rand(i+2)
    ))
end
```

```
Dict{Int64, SymPy.Sym}(
```

$$0 \Rightarrow 1.3466401061363x + 2.0$$

$$4 \Rightarrow 0.609098707085452x^5 + 0.705527029916172x^4 + 0.683831910888615x^3 + 0.0648127322381$$

$$2 \Rightarrow 0.343569270336129x^3 + 0.533547074326024x^2 - 0.877116344662153x$$

$$3 \Rightarrow 0.500290879731623x^4 + 0.370635781787695x^3 + 0.728971182841161x^2 - 1.5998978443604$$

$$1 \Rightarrow 0.492943787530063x^2 - 0.492943787530063x$$

```
)
```

```
φ
```

C, D, A

```
C = 4×4 Matrix{Float64}:
     -0.0789802  -0.169541  -0.355956  -0.589412
     -0.166774   -0.363887  -0.77525   -1.31085
     -0.345198   -0.764381  -1.65097   -2.84556
     -0.559772   -1.26679   -2.79068   -4.93957
```

```
C = [
    integrate(
        (diff(φ[k], x, 2) + p*diff(φ[k], x))*φ[i],
        (x, A, B)
    ) |> N
    for k in 1:4, i in 1:4
]
```

```
D =  [0.0550176, 0.115147, 0.236413, 0.378682]
```

```
D = [
    integrate(
        -(diff(φ[0], x, 2) + p*diff(φ[0], x))*φ[i],
        (x, A, B)
    ) |> N
    for i in 1:4
]
```

```
A =  [-1.13536, 0.197313, 0.0164078, -0.00787227]
```

```
A = C \ D
```

Y_n

```
Y (generic function with 1 method)
```

```
Y(X::Number; n=3) = (φ[0] + sum(A[i] * φ[i] for i in 1:n)).subs(Dict(x=>X))
```

$$2.75263423393744$$

```
Y(0.5; n=3)
```

$$2.75945809646474$$

```
Y(0.5; n=4)
```