

5-1. naloga: izračunajte integral

$$I_n = \int_{xS}^{xZ} \frac{x^n}{x+5} dx, \quad 0 \leq n \leq 20$$

z rekurzivno formulo

$$I_n = \frac{1}{5} \left(\frac{xZ^n - xS^n}{n} - I_{n+1} \right)$$

ter izračunajte relativno napako glede na z Matlab-ovo funkcijo *quad* izračunanim integralom

$$\mathcal{E}_{RN} = \frac{\left| I_n^{quad} - I_n \right|}{\left| I_n^{quad} \right|}$$

5-1. naloga: izračunajte integral z rekurzivno formulo

The image shows a MATLAB environment with a script editor and a Command Window. The script defines a recursive function to calculate the integral of $\frac{1}{x^5}$ from $x=1$ to $x=2$. The Command Window displays the execution results for each iteration, showing the current value of I_q , the recursive call I_r , and the absolute difference $|I_q - I_r|$.

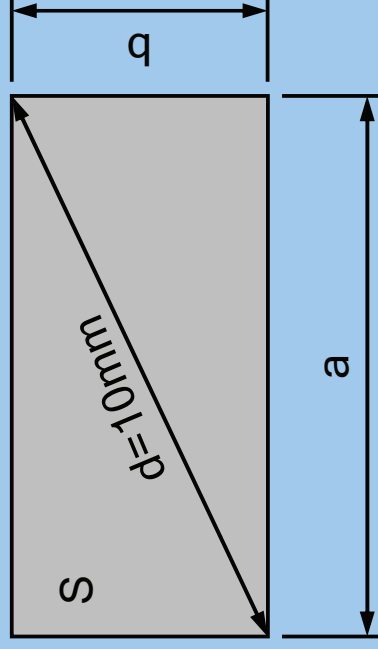
```

1 %
2 % Izracun integrala rekurzivno
3 - clc;
4 - clear all;
5 - f=@(x,n) (x.^n) ./ (x+5);
6 - xs=0.0;
7 - xz=0.5;
8 - tol=1.e-15;
9 - n=25;
10 - Iq(n+1)=quad(f(x),x,n),xs,xz,tol);
11 - Ir(n+1)=0;
12 - RM=abs(Iq(n+1)-Ir(n+1))/abs(Iq(n+1));
13 - disp('  n      Iq      Ir      |Iq-Ir|/|Ir|');
14 - fprintf(' %4i %6.6e %6.6e %6.5f\n',n,Iq(n+1),Ir(n+1),RM);
15 - pause;
16 - n1=n;
17 - for n=n1-1:-1:0
18 -     Ir(n+1) = ((xz^(n+1) - xs^(n+1)) / (n+1) - Ir(n+2)) / 5;
19 -     Iq(n+1) = quad(f(x),x,n),xs,xz,tol);
20 -     RM=abs(Iq(n+1)-Ir(n+1))/abs(Iq(n+1));
21 -     fprintf(' %4i %6.6e %6.6e %6.5f\n',n,Iq(n+1),Ir(n+1),RM);
22 -     pause;
23 - end
  
```

Command Window Output:

n	Iq	Ir	Iq-Ir / Ir
25	+1.045380e-010	+0.000000e+000	1.00000
24	+2.175073e-010	+2.384186e-010	0.09614
23	+4.532041e-010	+4.490217e-010	0.00923
22	+9.459618e-010	+9.467982e-010	0.00088
21	+1.978249e-009	+1.978082e-009	0.00008
20	+4.145657e-009	+4.145690e-009	0.00001
19	+8.707612e-009	+8.707605e-009	0.00000
18	+1.833583e-008	+1.833583e-008	0.00000
17	+3.871836e-008	+3.871836e-008	0.00000
16	+8.201391e-008	+8.201391e-008	0.00000
15	+1.743321e-007	+1.743321e-007	0.00000
14	+3.720346e-007	+3.720346e-007	0.00000
13	+7.975239e-007	+7.975239e-007	0.00000
12	+1.718500e-006	+1.718500e-006	0.00000
11	+3.725310e-006	+3.725310e-006	0.00000
10	+8.132779e-006	+8.132779e-006	0.00000
9	+1.790469e-005	+1.790469e-005	0.00000
8	+3.982184e-005	+3.982184e-005	0.00000
7	+8.969188e-005	+8.969188e-005	0.00000
6	+2.052759e-004	+2.052759e-004	0.00000
5	+4.797782e-004	+4.797782e-004	0.00000
4	+1.154044e-003	+1.154044e-003	0.00000
3	+2.894191e-003	+2.894191e-003	0.00000
2	+7.754495e-003	+7.754495e-003	0.00000
1	+2.344910e-002	+2.344910e-002	0.00000
0	+9.531018e-002	+9.531018e-002	0.00000

5-2. naloga: ob znani ploščini S in diagonali d pravokotnika izračunajte stranici a in b pravokotnika



$$S_1 = 48\text{mm}^2, \quad S_{n+1} = \frac{S_n}{10}, \quad 1 \leq n \leq 20$$

$$a_n = \frac{1}{2} \left[\sqrt{(d^2 + 2S_n)} + \sqrt{(d^2 - 2S_n)} \right]$$

$$b_{1n} = \frac{1}{2} \left[\sqrt{(d^2 + 2S_n)} - \sqrt{(d^2 - 2S_n)} \right]$$

$$b_{2n} = \frac{S_n}{a_n}$$

5-2. naloga: ob znani ploščini S in diagonali d pravokotnika izračunajte stranici a in b pravokotnika

The MATLAB interface displays the following script in the Editor window:

```

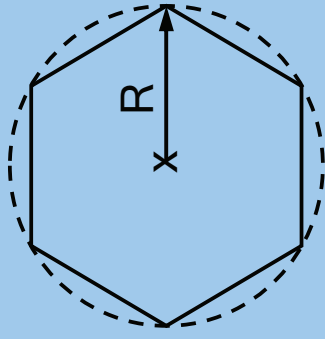
1 %
2 - clc;
3 - clear all;
4 - d=10; % [cm]
5 - S=48; % [cm2]
6 - disp(' S [xmm2]      a [xmm]      b1 [xmm]      b2 [xmm] ');
7 - for i=1:20
8 -     a=0.5*((d^2+2*S)^(1/2)+(d^2-2*S)^(1/2));
9 -     b1=0.5*((d^2+2*S)^(1/2)-(d^2-2*S)^(1/2));
10 -    b2=S/a;
11 -    fprintf('%6.1e %10.6f %15.6e \n', S, a, b1, b2);
12 -    S=S/10;
13 -    pause;
14 - end

```

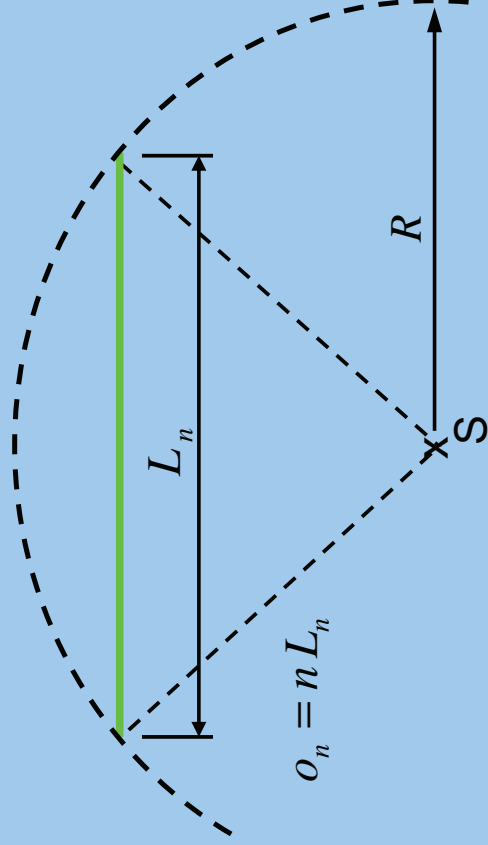
The Command Window shows the output for each iteration of the loop:

S [xmm2]	a [xmm]	b1 [xmm]	b2 [xmm]
4.8e+001	8.000000	6.000000e+000	6.000000e+000
4.8e+000	9.988447	4.805552e-001	4.805552e-001
4.8e-001	9.999885	4.800055e-002	4.800055e-002
4.8e-002	9.999999	4.800001e-003	4.800001e-003
4.8e-003	10.000000	4.800000e-004	4.800000e-004
4.8e-004	10.000000	4.800000e-005	4.800000e-005
4.8e-005	10.000000	4.800000e-006	4.800000e-006
4.8e-006	10.000000	4.800000e-007	4.800000e-007
4.8e-007	10.000000	4.800000e-008	4.800000e-008
4.8e-008	10.000000	4.800000e-009	4.800000e-009
4.8e-009	10.000000	4.800000e-010	4.800000e-010
4.8e-010	10.000000	4.800071e-011	4.800000e-011
4.8e-011	10.000000	4.799716e-012	4.800000e-012
4.8e-012	10.000000	4.796163e-013	4.800000e-013
4.8e-013	10.000000	4.796163e-014	4.800000e-014
4.8e-014	10.000000	5.329071e-015	4.800000e-015
4.8e-015	10.000000	0.000000e+000	4.800000e-016
4.8e-016	10.000000	0.000000e+000	4.800000e-017
4.8e-017	10.000000	0.000000e+000	4.800000e-018
4.8e-018	10.000000	0.000000e+000	4.800000e-019

5-3. naloga: izračunajte število ¶



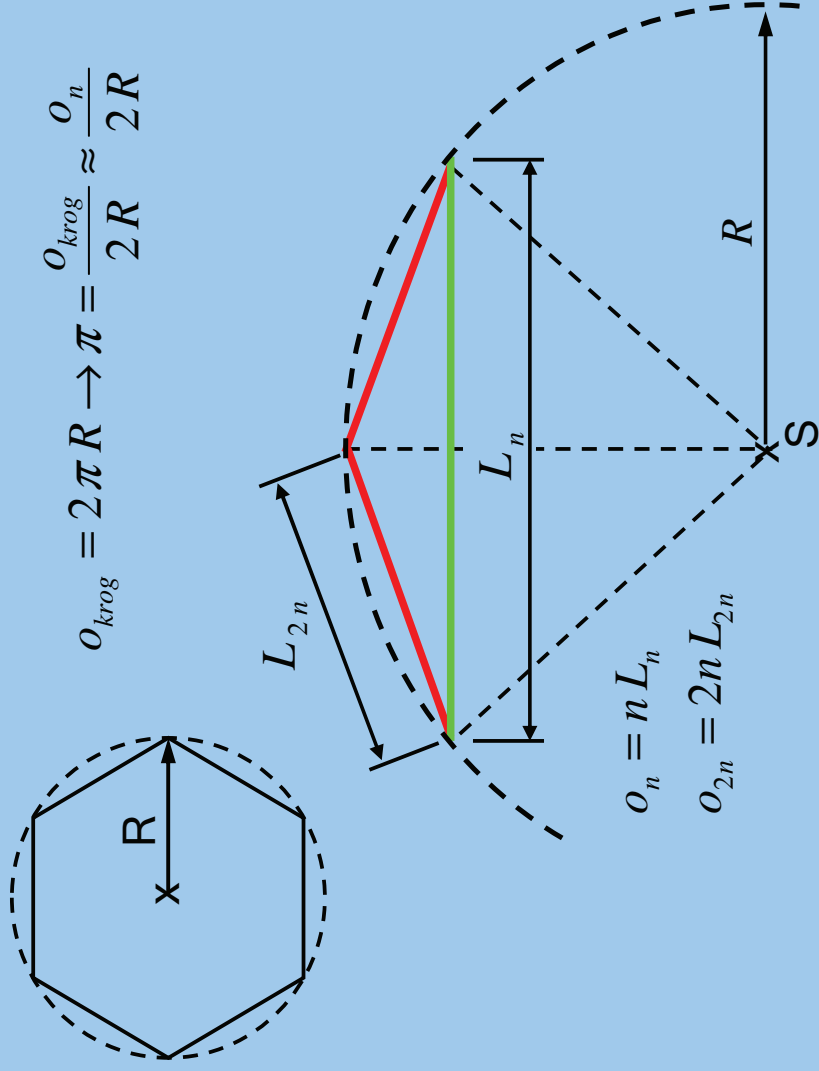
$$O_{krog} = 2\pi R \rightarrow \pi = \frac{O_{krog}}{2R} \approx \frac{O_n}{2R}$$



$$O_n = n L_n$$

5-3. naloga: izračunajte število ¶

$$O_{krog} = 2\pi R \rightarrow \pi = \frac{O_{krog}}{2R} \approx \frac{O_n}{2R}$$



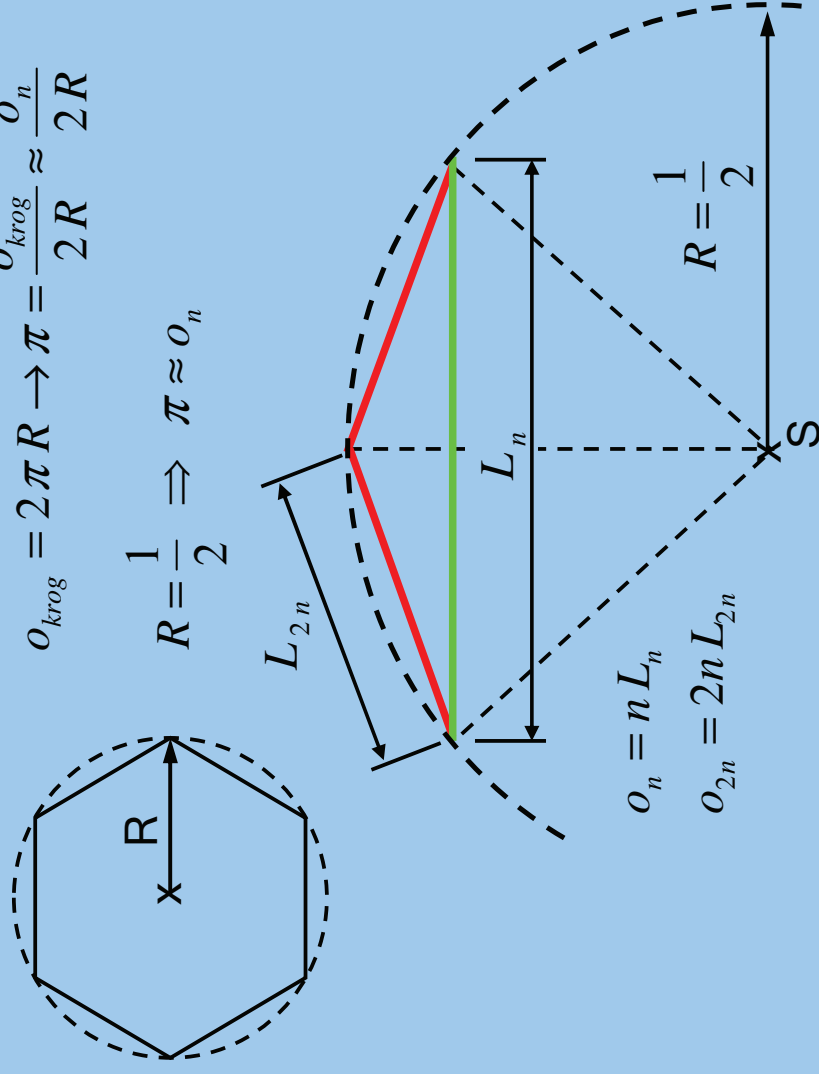
$$O_n = nL_n$$

$$O_{2n} = 2nL_{2n}$$

5-3. naloga: izračunajte število Π

$$o_{krog} = 2\pi R \rightarrow \pi = \frac{o_{krog}}{2R} \approx \frac{o_n}{2R}$$

$$R = \frac{1}{2} \Rightarrow \pi \approx o_n$$



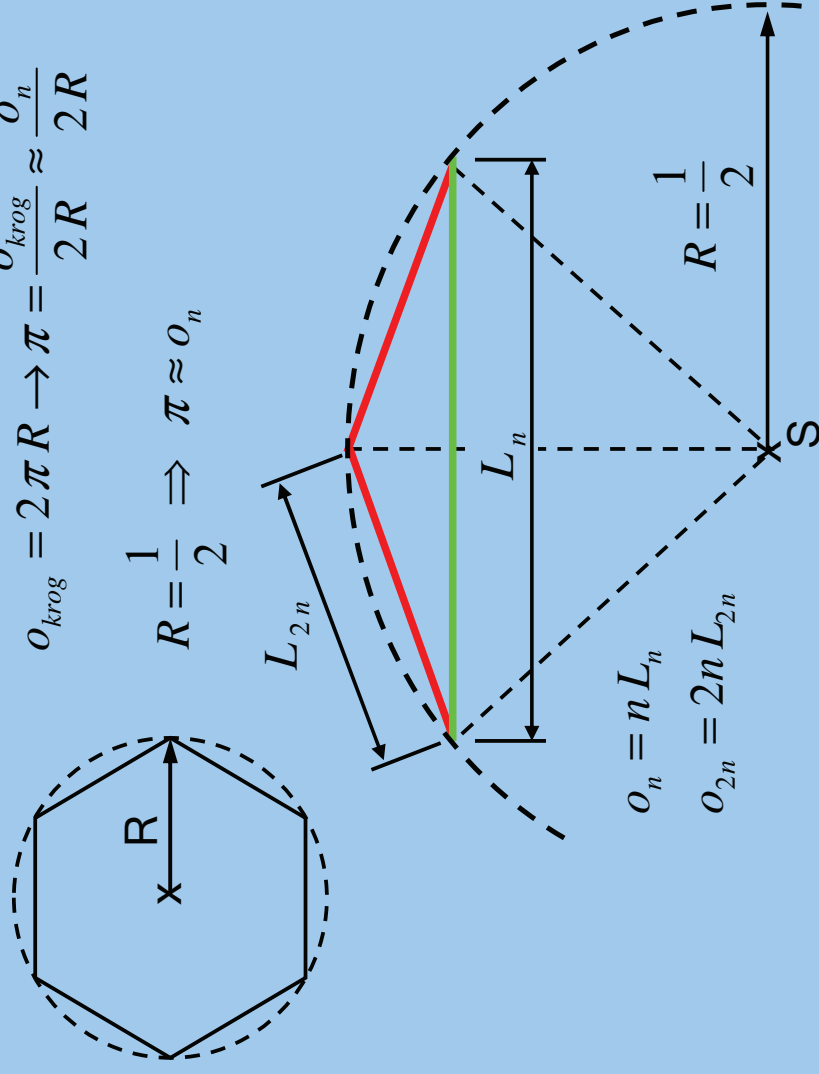
$$L_{2n} = \sqrt{\left(\frac{L_n}{2}\right)^2 + \left(R - \sqrt{R^2 - \left(\frac{L_n}{2}\right)^2}\right)^2} = \sqrt{2R^2 - 2R\sqrt{R^2 - \left(\frac{L_n}{2}\right)^2}}$$

$$= \sqrt{\frac{1}{2} - \sqrt{\left(\frac{1}{2}\right)^2 - \left(\frac{L_n}{2}\right)^2}} = \sqrt{\frac{1 - \sqrt{1 - L_n^2}}{2}}$$

5-3. naloga: izračunajte število Π

$$o_{krog} = 2\pi R \rightarrow \pi = \frac{o_{krog}}{2R} \approx \frac{o_n}{2R}$$

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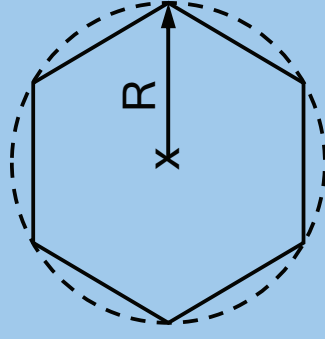


$$o_n = n L_n$$

$$o_{2n} = 2n L_{2n}$$

$$o_{2n} = 2n L_{2n} = 2n \sqrt{\frac{1 - \sqrt{1 - L_n^2}}{2}} = 2n \sqrt{\frac{1 - \sqrt{1 - \left(\frac{o_n}{n}\right)^2}}{2}}$$

5-3. naloga: izračunajte število \uparrow



$$O_{krog} = 2\pi R \rightarrow \pi = \frac{O_{krog}}{2R} \approx \frac{O_n}{2R}$$

$$R = \frac{1}{2} \Rightarrow \pi \approx O_n$$

$$O_{n=6} = 6R = 3$$

1. varianta rekurzivnega izračuna:

$$O_{2n} = 2n \sqrt{\frac{1 - \sqrt{1 - \left(\frac{O_n}{n}\right)^2}}{2}}$$

2. varianta rekurzivnega izračuna:

$$O_{2n} = O_n \sqrt{\frac{2}{1 + \sqrt{1 - \left(\frac{O_n}{n}\right)^2}}}$$

5-3. naloga: izračunajte število π

The image shows a MATLAB Command Window with a script and its output. The script calculates the value of pi using a series approximation and prints the results for different values of n.

```

1 %
2 %Izracun števila PI
3 - clc;
4 - clear all;
5 - n=6;
6 - R=0.5;
7 - o1=n*R;
8 - RN1=abs(o1-pi)/pi*100;
9 - o2=n*R;
10 - RN2=abs(o2-pi)/pi*100;
11 - disp(' n obseg1 RN1[%] obseg2 RN2[%] ');
12 - fprintf(' %12i %6.4f %6.4f %6.4f \n',n,o1,RN1,o2,RN2);
13 - pause;
14 - for i=1:25
15 - o1=2*n*sqrt(1-sqrt(1-(o1/n)^2))/2);
16 - RN1=abs(o1-pi)/pi*100;
17 - o2=2*sqrt(2/(1+sqrt(1-(o2/n)^2)));
18 - RN2=abs(o2-pi)/pi*100;
19 - n=n*2;
20 - fprintf(' %12i %6.4f %6.4f %6.4f \n',n,o1,RN1,o2,RN2);
21 - pause;
22 - end

```

The output table shows the results for n values from 6 to 201326592. The columns are n, obseg1, RN1[%], obseg2, and RN2[%].

n	obseg1	RN1[%]	obseg2	RN2[%]
6	3.0000	4.5070	3.0000	4.5070
12	3.1058	1.1384	3.1058	1.1384
24	3.1326	0.2853	3.1326	0.2853
48	3.1394	0.0714	3.1394	0.0714
96	3.1410	0.0178	3.1410	0.0178
192	3.1415	0.0045	3.1415	0.0045
384	3.1416	0.0011	3.1416	0.0011
768	3.1416	0.0003	3.1416	0.0003
1536	3.1416	0.0001	3.1416	0.0001
3072	3.1416	0.0000	3.1416	0.0000
6144	3.1416	0.0000	3.1416	0.0000
12288	3.1416	0.0000	3.1416	0.0000
24576	3.1416	0.0000	3.1416	0.0000
49152	3.1416	0.0000	3.1416	0.0000
98304	3.1416	0.0000	3.1416	0.0000
196608	3.1416	0.0000	3.1416	0.0000
393216	3.1416	0.0000	3.1416	0.0000
786432	3.1416	0.0000	3.1416	0.0000
1572864	3.1416	0.0005	3.1416	0.0000
3145728	3.1416	0.0002	3.1416	0.0000
6291456	3.1417	0.0026	3.1416	0.0000
12582912	3.1417	0.0026	3.1416	0.0000
25165824	3.1431	0.0471	3.1416	0.0000
50331648	3.1598	0.5798	3.1416	0.0000
100663296	3.1820	1.2856	3.1416	0.0000
201326592	3.3541	6.7644	3.1416	0.0000