

8-1. naloga: izračunajte integral najprej po analitični formuli

$$I_n = \int_{xs}^{xz} \frac{x^n}{x+5} dx = \sum_{k=1}^n \frac{(-5)^{n-k} x^k}{k} + (-5)^n \ln(x+5) \Big|_{xs}^{xz}$$

$$1 \leq n \leq 20$$

nato pa še 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* izračunanem integralom

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

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NM: V-VIII/1

8-1A. naloga: izračunajte integral z rekurzivno formulo

```

1 %naloga 8.1A
2 %Izracun integrala iz analitične formule
3 %
4 -log;
5 -clear all;
6 f=@(x,n) (x.^n)/(x+5);
7 xs=0.5;
8 xz=0.5;
9 tol=1.e-15;
10 disp(' n      Iq      Ia      |Iq-Ia|/|Iq|');
11 for n=1:20
12     Ia(n+1)=(-5)^n*log((xz+5)/(xs+5));
13     for k=1:n
14         Ia(n+1)=Ia(n+1)+((-5)^(n-k)*(xz^k-xs^k))/k;
15     end
16     Iq=quad(f(x),xs,xz,tol);
17     RN=abs(Iq-Ia(n+1))/abs(Iq);
18     fprintf(' %4i %+6.6e %+6.6e %13.5f\n',n,Iq,Ia(n+1),RN);
19     pause;
20 end
    
```

n	Iq	Ia	Iq-Ia / Iq
1	+2.344910e-002	+2.344910e-002	0.00000
2	+7.754495e-003	+7.754495e-003	0.00000
3	+2.894191e-003	+2.894191e-003	0.00000
4	+1.154044e-003	+1.154044e-003	0.00000
5	+4.797782e-004	+4.797782e-004	0.00000
6	+2.052759e-004	+2.052759e-004	0.00000
7	+8.969188e-005	+8.969188e-005	0.00000
8	+3.982184e-005	+3.982187e-005	0.00000
9	+1.790469e-005	+1.790454e-005	0.00011
10	+8.132779e-006	+8.133529e-006	0.00009
11	+3.725310e-006	+3.721782e-006	0.00094
12	+1.718500e-006	+1.737028e-006	0.01078
13	+7.975239e-007	+7.012043e-007	0.12077
14	+3.720346e-007	+8.687083e-007	1.33502
15	+1.743321e-007	-2.190059e-006	13.56257
16	+8.201391e-008	+1.189839e-005	144.07766
17	+3.871836e-008	-6.097283e-005	1575.77838
18	+1.833583e-008	+2.593295e-004	14142.21930
19	+8.707612e-009	-1.539873e-003	176854.64102
20	+4.145657e-009	+6.237928e-003	1504689.04781

NM: V-VIII/2

8-1B. naloga: izračunajte integral z rekurzivno formulo

The image shows a MATLAB Command Window with a script on the left and its output on the right. The script calculates the integral of $f(x) = x^n / (x+5)$ from $x=0$ to $x=1$ using a recursive formula. The output table shows the results for n from 1 to 25, including the integral value I_n and the relative error $|I_n - I_{n-1}| / |I_n|$.

```

1 %analoga 8.1B
2 %Iracun integrala rekurzivno
3
4 clear all;
5 f=@(x,n) (x.^n)/(x+5);
6 xs=0:0.5;
7 xs=0.5;
8 tol=1.e-15;
9 n=25;
10 Iq=quad(f(x),(x,n),xs,xs,tol);
11 Ir(n+1)=0;
12 RN=abs(Iq-Ir(n+1))/abs(Iq);
13 diap('  n      Iq          Ir          |Iq-Ir|/|Iq|');
14 fprintf(' %4i %*6.6e %*6.6e %*6.5f\n',n,Iq,Ir(n+1),RN);
15
16 pause;
17 n1=n;
18 for n=n1-1:-1:1
19     Ir(n+1)=(xs^(n+1)-xs^(n+1))/(n+1)-Ir(n+2)/5;
20     Iq=quad(f(x),(x,n),xs,xs,tol);
21     RN=abs(Iq-Ir(n+1))/abs(Iq);
22     fprintf(' %4i %*6.6e %*6.6e %*6.5f\n',n,Iq,Ir(n+1),RN);
23     pause;
24 end

```

n	Iq	Ir	Iq-Ir / Iq
25	+1.045580e-010	+1.000000e+001	95640730435.13342
24	+2.175073e-010	-2.000000e+000	9195095440.71193
23	+4.532041e-010	+4.000000e-001	882604507.19052
22	+9.459618e-010	-8.000000e-002	84570008.74707
21	+1.978249e-009	+1.600000e-002	8087959.06573
20	+4.145577e-009	-3.199996e-003	771892.19063
19	+8.707612e-009	+6.400007e-004	73493.90855
18	+1.833583e-008	-1.279817e-004	6980.86685
17	+3.871836e-008	+2.563872e-005	661.18505
16	+8.201391e-008	-5.037986e-006	62.42843
15	+1.743321e-007	+1.198332e-006	5.87385
14	+3.720346e-007	+1.672346e-007	0.55049
13	+7.975239e-007	+8.384839e-007	0.05136
12	+1.718500e-006	+1.710309e-006	0.00477
11	+3.725310e-006	+3.726949e-006	0.00044
10	+8.132779e-006	+8.132451e-006	0.00004
9	+1.790469e-005	+1.790476e-005	0.00000
8	+3.982184e-005	+3.982183e-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