## VI. РЯДЫ

### Расчетные задания.

**Задача 1.** Найти сумму ряда.

1.1. $\displaystyle\sum_{n=1}^{\infty} \frac{6}{9n^2+12n-5}$.

1.2. $\displaystyle\sum_{n=2}^{\infty} \frac{24}{9n^2-12n-5}$.

1.3. $\displaystyle\sum_{n=1}^{\infty} \frac{6}{9n^2+6n-8}$.

1.4. $\displaystyle\sum_{n=1}^{\infty} \frac{9}{9n^2+21n-8}$.

1.5. $\displaystyle\sum_{n=0}^{\infty} \frac{2}{4n^2+8n+3}$.

1.6. $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2-28n-45}$.

1.7. $\displaystyle\sum_{n=1}^{\infty} \frac{3}{9n^2+3n-2}$.

1.8. $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2-7n-12}$.

1.9. $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n^2+n-2}$.

1.10. $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2-14n-48}$.

1.11. $\displaystyle\sum_{n=1}^{\infty} \frac{6}{36n^2-24n-5}$.

1.12 $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2-84n-13}$.

1.13 $\displaystyle\sum_{n=1}^{\infty} \frac{4}{4n^2+4n-3}$.

1.14 $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2+35n-6}$.

1.15. $\displaystyle\sum_{n=1}^{\infty} \frac{9}{9n^2+3n-20}$.

1.16 $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2-42n-40}$.

1.17. $\displaystyle\sum_{n=1}^{\infty} \frac{8}{16n^2-8n-15}$.

1.18. $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2-21n-10}$.

1.19. $\displaystyle\sum_{n=1}^{\infty} \frac{5}{25n^2+5n-6}$.

1.20. $\displaystyle\sum_{n=1}^{\infty} \frac{6}{4n^2-9}$.

1.21. $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2-35n-6}$.

1.22. $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n^2+n-2}$.

1.23. $\displaystyle\sum_{n=2}^{\infty} \frac{12}{36n^2+12n-35}$.

1.24. $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2+21n-10}$.

1.25 $\displaystyle\sum_{n=1}^{\infty} \frac{3}{9n^2-3n-2}$.

1.26. $\displaystyle\sum_{n=1}^{\infty} \frac{5}{25n^2-5n-6}$.

1.27. $\displaystyle\sum_{n=1}^{\infty} \frac{8}{16n^2 + 8n - 15}$.

1.28. $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2 - 56n - 33}$.

1.29. $\displaystyle\sum_{n=1}^{\infty} \frac{12}{36n^2 - 12n - 35}$.

1.30. $\displaystyle\sum_{n=1}^{\infty} \frac{7}{49n^2 + 7n - 12}$.

1.31. $\displaystyle\sum_{n=1}^{\infty} \frac{14}{49n^2 - 70n - 24}$.

**Задача 2.** Найти сумму ряда.

2.1. $\displaystyle\sum_{n=3}^{\infty} \frac{4 - 5n}{n(n-1)(n-2)}$.

2.2 $\displaystyle\sum_{n=1}^{\infty} \frac{n+6}{n(n+3)(n+2)}$.

2.3. $\displaystyle\sum_{n=1}^{\infty} \frac{5n+3}{n(n+1)(n+3)}$.

2.4. $\displaystyle\sum_{n=3}^{\infty} \frac{4n-2}{(n^2-1)(n-2)}$.

2.5. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n(n+1)(n+3)}$.

2.6. $\displaystyle\sum_{n=3}^{\infty} \frac{3n-5}{n(n^2-1)}$.

2.7. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n(n+2)(n+3)}$.

2.8. $\displaystyle\sum_{n=3}^{\infty} \frac{1}{n(n^2-4)}$.

2.9. $\displaystyle\sum_{n=1}^{\infty} \frac{3n-2}{n(n+1)(n+2)}$.

2.10. $\displaystyle\sum_{n=3}^{\infty} \frac{n+2}{n(n-1)(n-2)}$.

2.11. $\displaystyle\sum_{n=3}^{\infty} \frac{5n-2}{(n-1)n(n+2)}$.

2.12. $\displaystyle\sum_{n=1}^{\infty} \frac{2}{(n+2)(n+1)n}$.

2.13. $\displaystyle\sum_{n=1}^{\infty} \frac{3n+2}{n(n+1)(n+2)}$.

2.14. $\displaystyle\sum_{n=3}^{\infty} \frac{n+5}{(n^2-1)(n+2)}$.

2.15. $\displaystyle\sum_{n=3}^{\infty} \frac{8n-10}{(n-1)(n-2)(n+1)}$.

2.16. $\displaystyle\sum_{n=3}^{\infty} \frac{3n-1}{n(n^2-1)}$.

2.17. $\displaystyle\sum_{n=3}^{\infty} \frac{n-4}{n(n-1)(n-2)}$.

2.18. $\displaystyle\sum_{n=1}^{\infty} \frac{5n+9}{n(n+1)(n+3)}$.

2.19. $\displaystyle\sum_{n=2}^{\infty} \frac{5n-2}{(n-1)n(n+2)}$.

2.20. $\displaystyle\sum_{n=1}^{\infty} \frac{n-1}{n(n+1)(n+2)}$.

2.21. $\displaystyle\sum_{n=1}^{\infty}\frac{3n+4}{n(n+1)(n+2)}$.

2.22. $\displaystyle\sum_{n=3}^{\infty}\frac{2-n}{n(n+1)(n+2)}$.

2.23. $\displaystyle\sum_{n=1}^{\infty}\frac{n+6}{n(n+1)(n+2)}$.

2.24. $\displaystyle\sum_{n=3}^{\infty}\frac{n-2}{(n-1)n(n+1)}$.

2.25. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{n(n^2-1)}$.

2.26. $\displaystyle\sum_{n=1}^{\infty}\frac{1-n}{n(n+1)(n+3)}$.

2.27. $\displaystyle\sum_{n=3}^{\infty}\frac{3n+1}{(n-1)n(n+1)}$.

2.28. $\displaystyle\sum_{n=1}^{\infty}\frac{4-n}{n(n+1)(n+2)}$.

2.29. $\displaystyle\sum_{n=3}^{\infty}\frac{4}{n(n-1)(n-2)}$.

2.30. $\displaystyle\sum_{n=1}^{\infty}\frac{3-n}{(n+3)(n+1)n}$.

2.31. $\displaystyle\sum_{n=1}^{\infty}\frac{3n+8}{n(n+1)(n+2)}$.

**Задача 1.** Исследовать на сходимость ряд.

3.1. $\displaystyle\sum_{n=1}^{\infty}\frac{\sin^2 n\sqrt{n}}{n\sqrt{n}}$.

3.2. $\displaystyle\sum_{n=1}^{\infty}n\sin\frac{2+(-1)^n}{n^3}$.

3.3. $\displaystyle\sum_{n=1}^{\infty}\frac{\cos^2(n\pi/2)}{n(n+1)(n+2)}$.

3.4. $\displaystyle\sum_{n=1}^{\infty}\frac{\ln n}{\sqrt[3]{n^7}}$.

3.5. $\displaystyle\sum_{n=1}^{\infty}\frac{2+(-1)^n}{n-\ln n}$.

3.6. $\displaystyle\sum_{n=1}^{\infty}\frac{\operatorname{arctg}\dfrac{1+(-1)^n}{2}n}{n^3+2}$.

3.7. $\displaystyle\sum_{n=1}^{\infty}\frac{n(2+\cos n\pi)}{2n^2-1}$.

3.8. $\displaystyle\sum_{n=2}^{\infty}\frac{\arcsin\dfrac{n-1}{n}}{\sqrt[3]{n^3-3n}}$.

3.9. $\displaystyle\sum_{n=1}^{\infty}\frac{\sin^2 n}{n^2+1}$.

3.10. $\displaystyle\sum_{n=2}^{\infty}\frac{\ln\sqrt{n^2+3n}}{\sqrt{n^2-n}}$.

3.11. $\displaystyle\sum_{n=2}^{\infty}\frac{\arccos\dfrac{(-1)^n n}{n+1}}{n^2+2}$.

3.12. $\displaystyle\sum_{n=1}^{\infty}\frac{n\cos^2 n}{n^3+5}$.

3.13. $\displaystyle\sum_{n=2}^{\infty}\frac{n\ln n}{n^2-3}$.

3.14. $\displaystyle\sum_{n=1}^{\infty}\frac{n^2+3}{n^3\left(2+\sin\left(n\pi/2\right)\right)}$.

3.15. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{\sqrt[4]{n^3}}\sin\frac{2+(-1)^n}{6}\pi$.

3.16. $\displaystyle\sum_{n=1}^{\infty}\frac{\ln n}{n^3+n+1}$.

3.17. $\displaystyle\sum_{n=1}^{\infty}\frac{1+\sin\dfrac{\pi n}{2}}{n^2}$.

3.18. $\displaystyle\sum_{n=1}^{\infty}\frac{\cos^2\dfrac{\pi n}{3}}{3^n+2}$.

3.19. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(2+\cos\dfrac{n\pi}{2}\right)\sqrt{n}}{\sqrt[4]{n^7+5}}$.

3.20. $\displaystyle\sum_{n=1}^{\infty}\frac{2+\sin\dfrac{n\pi}{4}}{n^2}ctg\frac{1}{\sqrt{n}}$.

3.21. $\displaystyle\sum_{n=1}^{\infty}\frac{\sin^2 2^n}{n^2}$.

3.22. $\displaystyle\sum_{n=1}^{\infty}\frac{\ln n}{\sqrt{n^5+n}}$.

3.23. $\displaystyle\sum_{n=3}^{\infty}\frac{1}{n^2\ln n+\sqrt[3]{\ln^2 n}}$.

3.24. $\displaystyle\sum_{n=1}^{\infty}\frac{\dfrac{3}{\pi}\operatorname{arctg}\sqrt{n^2-1}}{\sqrt{n^2-n}}$.

3.25. $\displaystyle\sum_{n=1}^{\infty}\frac{\sin\dfrac{\pi}{2n+1}}{n\left(3+\sin\dfrac{\pi n}{4}\right)}$.

3.26. $\displaystyle\sum_{n=2}^{\infty}\frac{2\cos\dfrac{2\pi}{3n}}{\sqrt[4]{n^4-1}}$.

3.27. $\displaystyle\sum_{n=1}^{\infty}\frac{3+(-1)^n}{2^{n+2}}$.

3.28. $\displaystyle\sum_{n=1}^{\infty}\frac{\operatorname{arctg}\left[2+(-1)^n\right]}{\ln(1+n)}$.

3.29. $\displaystyle\sum_{n=1}^{\infty}\frac{\operatorname{arcctg}(-1)^n}{\sqrt{n\left(2+n^2\right)}}$.

3.30. $\displaystyle\sum_{n=1}^{\infty}\frac{\arcsin\dfrac{3+(-1)^n}{4}}{2^n+n}$.

3.31. $\displaystyle\sum_{n=1}^{\infty}\frac{\sqrt{n^3+2}}{n^2\sin^2 n}$.

**Задача 4.** Исследовать на сходимость ряд.

4.1. $\displaystyle\sum_{n=1}^{\infty}\frac{2}{5^{n-1}+n-1}$.

4.2. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{n}\cdot tg\frac{1}{\sqrt{n}}$.

4.3. $\sum\limits_{n=1}^{\infty} \ln \dfrac{n^2+5}{n^2+4}$.

4.4. $\sum\limits_{n=1}^{\infty} \dfrac{1}{\sqrt{n}} \sin \dfrac{1}{n}$.

4.5. $\sum\limits_{n=2}^{\infty} \dfrac{1}{n-1} arctg \dfrac{1}{\sqrt[3]{n-1}}$.

4.6. $\sum\limits_{n=1}^{\infty} \dfrac{\left(n^2+3\right)^2}{n^5+\ln^4 n}$.

4.7. $\sum\limits_{n=1}^{\infty} \dfrac{n^3+2}{n^5+\sin 2^n}$.

4.8. $\sum\limits_{n=1}^{\infty} \dfrac{2^n+\cos n}{3^n+\sin n}$.

4.9. $\sum\limits_{n=1}^{\infty} \dfrac{1}{n-\cos^2 6n}$.

4.10. $\sum\limits_{n=1}^{\infty} \dfrac{1}{\sqrt[5]{n+1}} \sin \dfrac{1}{\sqrt{n}}$.

4.11. $\sum\limits_{n=1}^{\infty} \dfrac{1}{\sqrt[3]{n}} arctg \dfrac{\pi}{4\sqrt{n}}$.

4.12. $\sum\limits_{n=1}^{\infty} \dfrac{1}{n^2-\ln n}$.

4.13. $\sum\limits_{n=2}^{\infty} \dfrac{1}{\sqrt[3]{n+5}} \sin \dfrac{1}{n-1}$.

4.14 $\sum\limits_{n=1}^{\infty} \dfrac{1}{\sqrt[3]{n}+2} arctg \dfrac{n+3}{n^2+5}$.

4.15. $\sum\limits_{n=1}^{\infty} \dfrac{1}{\sqrt{n+3}}\left(e^{1/\sqrt{n}}-1\right)$.

4.16. $\sum\limits_{n=1}^{\infty} \ln \dfrac{n^2+1}{n^2+n+2}$.

4.17. $\sum\limits_{n=1}^{\infty} \sqrt[3]{n} arctg \dfrac{1}{n^3}$.

4.18. $\sum\limits_{n=1}^{\infty} \ln \dfrac{n^3}{n^3+1}$.

4.19. $\sum\limits_{n=3}^{\infty} n^3 tg^5 \dfrac{\pi}{n}$.

4.20. $\sum\limits_{n=2}^{\infty} \dfrac{n+1}{\left(\sqrt[3]{n}-1\right)\left(n\sqrt[4]{n^3}-1\right)}$.

4.21. $\sum\limits_{n=1}^{\infty} \left(1-\cos \dfrac{\pi}{n}\right)$.

4.22. $\sum\limits_{n=1}^{\infty} \sin \dfrac{\sqrt[3]{n}}{\sqrt{n^5+2}}$.

4.23. $\sum\limits_{n=2}^{\infty} \left(e^{\sqrt{n}/\left(n^3-1\right)}-1\right)$.

4.24. $\sum\limits_{n=1}^{\infty} \sin \dfrac{2n+1}{n^2(n+1)^2}$.

4.25. $\sum\limits_{n=1}^{\infty} \dfrac{\sin \dfrac{2\pi}{2n+1}}{\sqrt{n}}$.

4.26. $\sum\limits_{n=1}^{\infty} \dfrac{3+7n}{5^n+n}$.

4.27. $\sum\limits_{n=1}^{\infty} n\left(e^{1/n}-1\right)^2$.

4.28. $\sum\limits_{n=1}^{\infty} n\sin \dfrac{1}{\sqrt[3]{n^4}}$.

4.29. $\displaystyle\sum_{n=1}^{\infty} arctg\,\frac{1}{(n-1)\sqrt[5]{n^2+1}}$.

4.30. $\displaystyle\sum_{n=1}^{\infty} \sin\frac{n}{n^2\sqrt[3]{n}+5}$.

4.31. $\displaystyle\sum_{n=1}^{\infty} \arcsin\frac{n}{\left(n^2+3\right)^{5/2}}$.

**Задача 5.** Исследовать на сходимость ряд.

5.1. $\displaystyle\sum_{n=2}^{\infty} \frac{n+1}{2^n\left(n-1\right)!}$.

5.2. $\displaystyle\sum_{n=1}^{\infty} \frac{\left(n!\right)^2}{2^{n^2}}$.

5.3. $\displaystyle\sum_{n=1}^{\infty} \frac{2^{n+1}\left(n^3+1\right)}{\left(n+1\right)!}$.

5.4. $\displaystyle\sum_{n=1}^{\infty} \frac{10^n 2n!}{\left(2n\right)!}$.

5.5. $\displaystyle\sum_{n=1}^{\infty} \frac{\left(2n+2\right)!}{3n+5}\cdot\frac{1}{2^n}$.

5.6. $\displaystyle\sum_{n=1}^{\infty} \frac{n+5}{n!}\sin\frac{2}{3^n}$.

5.7. $\displaystyle\sum_{n=1}^{\infty} \frac{arctg\,\dfrac{5}{n}}{n!}$.

5.8. $\displaystyle\sum_{n=1}^{\infty} \frac{n^n}{3^n n!}$.

5.9. $\displaystyle\sum_{n=1}^{\infty} \frac{n}{\left(2n\right)!}tg\frac{1}{5^n}$.

5.10. $\displaystyle\sum_{n=1}^{\infty} \frac{6^n\left(n^2-1\right)}{n!}$.

5.11. $\displaystyle\sum_{n=1}^{\infty} \frac{n^2}{\left(n+2\right)!}$.

5.12. $\displaystyle\sum_{n=1}^{\infty} \frac{n^n}{\left(n!\right)^2}$.

5.13. $\displaystyle\sum_{n=1}^{\infty} \frac{7^{2n}}{\left(2n-1\right)!}$.

5.14. $\displaystyle\sum_{n=1}^{\infty} \frac{n!}{\left(3n!\right)}$.

5.15. $\displaystyle\sum_{n=1}^{\infty} \frac{1\cdot3\cdot5...\left(2n-1\right)}{3^n\left(n+1\right)!}$.

5.16. $\displaystyle\sum_{n=1}^{\infty} \frac{n!}{n^{n-1}}$. **?**

5.17. $\displaystyle\sum_{n=1}^{\infty} \frac{\left(n!\right)^2}{\left(3^n+1\right)\left(2n\right)!}$.

5.18. $\displaystyle\sum_{n=1}^{\infty} n!\sin\frac{\pi}{2^n}$.

5.19. $\displaystyle\sum_{n=1}^{\infty} \frac{\left(n+1\right)!}{n^n}$.

5.20. $\displaystyle\sum_{n=1}^{\infty} \frac{5^n\sqrt[3]{n^2}}{\left(n+1\right)!}$.

5.21. $\displaystyle\sum_{n=1}^{\infty}\frac{2^n n!}{n^n}$.

5.22. $\displaystyle\sum_{n=1}^{\infty}\frac{5^n (n+1)!}{(2n)!}$.

5.23. $\displaystyle\sum_{n=1}^{\infty}\frac{3^n}{(n+2)!\,4^n}$.

5.24. $\displaystyle\sum_{n=1}^{\infty}\frac{3\cdot 5\cdot 7...(2n+1)}{2\cdot 5\cdot 8...(3n-1)}$.

5.25. $\displaystyle\sum_{n=1}^{\infty}\frac{1\cdot 4\cdot 7...(3n-2)}{7\cdot 9\cdot 11...(2n+5)}$.

5.26. $\displaystyle\sum_{n=1}^{\infty}\frac{2n!}{\sqrt{2^n+3}}$.

5.27. $\displaystyle\sum_{n=1}^{\infty}\frac{(3n+2)!}{10^n n^2}$.

5.28. $\displaystyle\sum_{n=2}^{\infty}\frac{4^{n-1}\sqrt{n^2+5}}{(n-1)!}$.

5.29. $\displaystyle\sum_{n=1}^{\infty}\frac{n!\sqrt[3]{n}}{3^n+2}$.

5.30. $\displaystyle\sum_{n=1}^{\infty}\frac{n!(2n+1)!}{(3n)!}$.

5.31. $\displaystyle\sum_{n=1}^{\infty}\frac{1\cdot 4\cdot 7...(3n-2)}{2^{n+1} n!}$.

**Задача 6.** Исследовать на сходимость ряд.

6.1. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{3^n}\left(\frac{n}{n+1}\right)^{-n^2}$.

6.2. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{4^n}\left(1+\frac{1}{n}\right)^{n^2}$.

6.3. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n^2+1}{n^2+1}\right)^{n^2}$.

6.4. $\displaystyle\sum_{n=1}^{\infty}n^4\left(\frac{2n}{3n+5}\right)^{n}$.

6.5. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n+1}{3n-2}\right)^{n^2}$.

6.6. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n+2}{3n+1}\right)^{n}(n+1)^3$.

6.7. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{4n-3}{5n+1}\right)^{n^3}$.

6.8. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n}{10n+5}\right)^{n^2}$.

6.9. $\displaystyle\sum_{n=1}^{\infty}n\arcsin^n\frac{\pi}{4n}$.

6.10. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n+2}{3n-1}\right)^{n^2}$.

6.11. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n-1}{n}\right)^{n}\frac{n}{5^n}$.

6.12. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n+3}{n+1}\right)^{n^2}$.

6.13. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{3n+2}{4n-1}\right)^{n}(n-1)^{2}$.

6.14. $\displaystyle\sum_{n=2}^{\infty}\left(\frac{n+1}{2n-3}\right)^{n^{2}}$.

6.15. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n}{3n+1}\right)^{2n+1}$.

6.16. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n-1}{3n+1}\right)^{n/2}$.

6.17. $\displaystyle\sum_{n=1}^{\infty}\frac{2^{n+1}}{n^{n}}$.

6.18. $\displaystyle\sum_{n=1}^{\infty}n^{2}\sin^{n}\frac{\pi}{2n}$.

6.19. $\displaystyle\sum_{n=2}^{\infty}\frac{n^{3}}{(\ln n)^{n}}$.

6.20. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n}{3n-1}\right)^{n^{3}}$.

6.21. $\displaystyle\sum_{n=1}^{\infty}n^{3}arctg^{n}\frac{\pi}{3n}$.

6.22. $\displaystyle\sum_{n=1}^{\infty}\frac{n^{5}3^{n}}{(2n+1)^{n}}$.

6.23. $\displaystyle\sum_{n=1}^{\infty}2^{n-1}e^{-n}$.

6.24. $\displaystyle\sum_{n=1}^{\infty}n\left(\frac{3n-1}{4n+2}\right)^{2n}$.

6.25. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{2n}{4n+3}\right)^{n^{2}}$.

6.26. $\displaystyle\sum_{n=1}^{\infty}\frac{n^{n+2}}{(2n^{2}+1)^{n/2}}$.

6.27. $\displaystyle\sum_{n=1}^{\infty}\sqrt{n}\left(\frac{n}{3n-1}\right)^{2n}$.

6.28. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{n+1}{n}\right)^{n^{2}}\frac{1}{2^{n}}$.

6.29. $\displaystyle\sum_{n=1}^{\infty}\frac{n\cdot 3^{n+2}}{5^{n}}$.

6.30. $\displaystyle\sum_{n=2}^{\infty}\sqrt[3]{n}\left(\frac{n-2}{2n+1}\right)^{3n}$.

6.31. $\displaystyle\sum_{n=1}^{\infty}n^{4}arctg^{2n}\frac{\pi}{4n}$.

**Задача 7.** Исследовать на сходимость ряд.

7.1. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{n\ln^{2}(3n+1)}$.

7.2. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{n\ln^{2}(2n+1)}$.

7.3. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(2n+3)\ln^{2}(2n+1)}$.

7.4. $\displaystyle\sum_{n=3}^{\infty}\frac{1}{(3n-5)\ln^{2}(4n-7)}$.

7.5. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(3n+4)\ln^2(5n+2)}$.

7.6. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(2n+1)\ln^2\left(n\sqrt{5}+2\right)}$.

7.7. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\left(n\sqrt{2}+1\right)\ln^2\left(n\sqrt{3}+1\right)}$.

7.8. $\displaystyle\sum_{n=5}^{\infty}\frac{1}{(n-2)\ln(n-3)}$.

7.9. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(2n-1)\ln(2n)}$.

7.10. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{(n+1)\ln(2n)}$.

7.11. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(3n-1)\ln n}$.

7.12. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(2n-1)\ln(n+1)}$.

7.13. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(2n-3)\ln(3n+1)}$.

7.14. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(n+2)\ln^2 n}$.

7.15. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(n+3)\ln^2(2n)}$.

7.16. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(2n+3)\ln^2(n+1)}$.

7.17. $\displaystyle\sum_{n=3}^{\infty}\frac{1}{n\ln(n-1)}$.

7.18. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{2n\sqrt{\ln(3n-1)}}$.

7.19. $\displaystyle\sum_{n=5}^{\infty}\frac{1}{(n-2)\sqrt{\ln(n-3)}}$.

7.20. $\displaystyle\sum_{n=4}^{\infty}\frac{1}{(3n-1)\sqrt{\ln(n-2)}}$.

7.21. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(n+5)\ln^2(n+1)}$.

7.22. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(n/3)\ln^2(n+7)}$.

7.23. $\displaystyle\sum_{n=2}^{\infty}\frac{n^2}{(n^3+1)\ln n}$.

7.24. $\displaystyle\sum_{n=3}^{\infty}\frac{n}{(n^2-3)\ln^2 n}$.

7.25. $\displaystyle\sum_{n=4}^{\infty}\frac{1}{(n/3-1)\ln^2(n/2)}$.

7.26. $\displaystyle\sum_{n=2}^{\infty}\frac{n}{(n^2+5)\ln n}$.

7.27. $\displaystyle\sum_{n=2}^{\infty}\frac{3n}{(2n^2+3)\ln n}$.

7.28. $\displaystyle\sum_{n=4}^{\infty}\frac{n+1}{(5n^2-9)\ln(n-2)}$.

7.29. $\displaystyle\sum_{n=3}^{\infty}\frac{2n+1}{(3n^2/2+2)\ln(n/2)}$.

7.30. $\displaystyle\sum_{n=2}^{\infty}\frac{n}{(n^2-1)\ln n}$.

7.31. $\displaystyle\sum_{n=2}^{\infty}\frac{3n}{\left(n^2-2\right)\ln(2n)}$.

**Задача 8.** Исследовать на сходимость ряд.

8.1. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\frac{2n+1}{n(n+1)}$.

8.2. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\left(\frac{n}{2n+1}\right)^n$.

8.3. $\displaystyle\sum_{n=2}^{\infty}\frac{(-1)^{n+1}}{\ln(n+1)}$.

8.4. $\displaystyle\sum_{n=3}^{\infty}\frac{(-1)^n}{n(\ln\ln n)\ln n}$.

8.5. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n 2n^2}{n^4-n^2+1}$.

8.6. $\displaystyle\sum_{n=3}^{\infty}\frac{(-1)^n}{(n+1)\ln n}$.

8.7. $\displaystyle\sum_{n=3}^{\infty}\frac{(-1)^n}{n\ln(n+1)}$.

8.8. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n\sqrt[4]{2n+3}}$.

8.9. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n\sin\dfrac{\pi}{2\sqrt{n}}}{\sqrt{3n+1}}$.

8.10. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\cos\frac{\pi}{6n}$.

8.11. $\displaystyle\sum_{n=1}^{\infty}\frac{\sin n}{n!}$.

8.12. $\displaystyle\sum_{n=3}^{\infty}\frac{(-1)^n}{n\ln(2n)}$.

8.13. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\, tg\frac{1}{n}$.

8.14. $\displaystyle\sum_{n=1}^{\infty}\frac{\cos n}{n^2}$.

8.15. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{(n+1)2^{2n}}$.

8.16. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n}{\cos\dfrac{\pi}{3\sqrt{n}}\sqrt[3]{3n+\ln n}}$.

8.17. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{(n+1)(3/2)^n}$.

8.18. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{2n-1}{3n}$.

8.19. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n(n+3)}{\ln(n+4)}$.

8.20. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{n+1}{\sqrt{n^3}}$.

8.21. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \, tg \dfrac{\pi}{4\sqrt{n}}}{\sqrt{5n-1}}$.

8.22. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)\,2^{2n+1}}$.

8.23. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \frac{\sin\left(n\sqrt{n}\right)}{n\sqrt{n}}$.

8.24. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n + \cos\left(2/\sqrt{n+4}\right)}$.

8.25. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \sin\frac{\pi}{2^n}$.

8.26. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2 + \sin^2 n}$.

8.27. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \frac{\sin 3^n}{3^n}$.

8.28. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \ln\left(1+\frac{1}{n^2}\right)$.

8.29. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \sin\frac{1}{n}\cdot tg\frac{1}{n}$.

8.30. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \left(1-\cos\frac{1}{\sqrt{n}}\right)$.

8.31. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \frac{n^3}{(n+1)!}$.

**Задача 9.** Вычислить сумму ряда с точностью $\alpha$.

9.1. $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{3n^2}$, $\alpha = 0{,}01$.

9.2. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n!}$, $\alpha = 0{,}01$.

9.3. $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{(2n)^3}$, $\alpha = 0{,}001$.

9.4. $\displaystyle\sum_{n=0}^{\infty} (-1)^n \frac{1}{n!(2n+1)}$, $\alpha = 0{,}001$.

9.5. $\displaystyle\sum_{n=1}^{\infty} (-1)^n \frac{2n+1}{n^3(n+1)}$, $\alpha = 0{,}01$.

9.6. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!}$, $\alpha = 0{,}0001$.

9.7. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{2^n}$, $\alpha = 0{,}1$.

9.8. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n^2}{3^n}$, $\alpha = 0{,}1$.

9.9. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{(2n-1)^2(2n+1)^2}$, $\alpha = 0{,}001$.

9.10. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!!}$, $\alpha = 0{,}0001$.

9.11. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!!}$, $\alpha = 0{,}001$.

9.12. $\displaystyle\sum_{n=0}^{\infty} \left(-\frac{2}{5}\right)^n$, $\alpha = 0{,}01$.

9.13. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{7^n}$, $\alpha = 0,0001$.

9.14. $\displaystyle\sum_{n=0}^{\infty} \left(-\frac{2}{3}\right)^n$, $\alpha = 0,1$.

9.15. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!}$, $\alpha = 0,001$.

9.16. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{3n!}$, $\alpha = 0,01$.

9.17. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!2n}$, $\alpha = 0,00001$.

9.18. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n \cdot (2n+1)}{(2n)!n!}$, $\alpha = 0,001$.

9.19. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{2^n \cdot n!}$, $\alpha = 0,001$.

9.20. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{3^n \cdot n!}$, $\alpha = 0,001$.

9.21. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!n!}$, $\alpha = 0,00001$.

9.22. $\displaystyle\sum_{n=0}^{\infty} \frac{\cos \pi n}{3^n (n+1)}$, $\alpha = 0,001$.

9.23. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{4^n (2n+1)}$, $\alpha = 0,001$.

9.24. $\displaystyle\sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3}$, $\alpha = 0,01$.

9.25. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n \cdot 2^n}{(n+1)^n}$, $\alpha = 0,001$.

9.26. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{(n+1)^n}$, $\alpha = 0,001$.

9.27. $\displaystyle\sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3 + 1}$, $\alpha = 0,01$.

9.28. $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n^3 (n+3)}$, $\alpha = 0,01$.

9.29. $\displaystyle\sum_{n=0}^{\infty} \frac{\cos(\pi n)}{(n^3 + 1)^2}$, $\alpha = 0,001$.

9.30. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n}{1 + n^2}$, $\alpha = 0,01$.

9.31. $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n \cdot n}{(1 + n^3)^2}$, $\alpha = 0,001$.

**Задача 10.** Доказать справедливость равенства. (Ответом служит число $\rho$, получаемое при применении признака Даламбера или признака Коши.)

10.1. $\displaystyle\lim_{n\to\infty} \frac{n!}{n^n} = 0$.

10.2. $\displaystyle\lim_{n\to\infty} \frac{n^n}{(2n)!} = 0$.

10.3. $\lim\limits_{n\to\infty}\dfrac{2n!!}{n^n}=0$.

10.4. $\lim\limits_{n\to\infty}\dfrac{(2n)^n}{(2n-1)!}=0$.

10.5. $\lim\limits_{n\to\infty}\dfrac{(2n)!}{2n^2!}=0$.

10.6. $\lim\limits_{n\to\infty}\dfrac{n^n}{(n!)^2}=0$.

10.7. $\lim\limits_{n\to\infty}\dfrac{(2n)!!}{5^{n^2}}=0$.

10.8. $\lim\limits_{n\to\infty}\dfrac{n^2}{n!}=0$.

10.9. $\lim\limits_{n\to\infty}\dfrac{(n+1)!}{n^n}=0$.

10.10. $\lim\limits_{n\to\infty}\dfrac{n^n}{(2n+1)!}=0$.

10.11. $\lim\limits_{n\to\infty}\dfrac{(2n-1)!!}{n^n}=0$.

10.12. $\lim\limits_{n\to\infty}\dfrac{(3n)^n}{(2n-1)!}=0$.

10.13. $\lim\limits_{n\to\infty}\dfrac{(3n)!}{2^{n^2}}=0$.

10.14. $\lim\limits_{n\to\infty}\dfrac{n^n}{(n!)^3}=0$.

10.15. $\lim\limits_{n\to\infty}\dfrac{n^5}{(2n)!}=0$.

10.16. $\lim\limits_{n\to\infty}\dfrac{2^{3n}}{n!}=0$.

10.17. $\lim\limits_{n\to\infty}\dfrac{(n+2)!}{n^n}=0$.

10.18. $\lim\limits_{n\to\infty}\dfrac{n^n}{(2n-1)!}=0$.

10.19. $\lim\limits_{n\to\infty}\dfrac{(2n+1)!!}{n^n}=0$.

10.20. $\lim\limits_{n\to\infty}\dfrac{(2n)^n}{(2n+1)!}=0$.

10.21. $\lim\limits_{n\to\infty}\dfrac{(4n)!}{2^{n^2}}=0$.

10.22. $\lim\limits_{n\to\infty}\dfrac{n^n}{\left[(n+1)!\right]^2}=0$.

10.23. $\lim\limits_{n\to\infty}\dfrac{n^3}{4^{n^2}}=0$.

10.24. $\lim\limits_{n\to\infty}\dfrac{n!}{2^{n^2}}=0$.

10.25. $\lim\limits_{n\to\infty}\dfrac{(n+3)!}{n^n}=0$.

10.26. $\lim\limits_{n\to\infty}\dfrac{n^n}{(2n+3)!}=0$.

10.27. $\lim\limits_{n\to\infty}\dfrac{(2n+3)!!}{n^n}=0$.

10.28. $\lim\limits_{n\to\infty}\dfrac{(5n)^n}{(2n+1)!}=0$.

10.29. $\lim\limits_{n\to\infty}\dfrac{(5n)!}{2^{n^2}}=0$.

10.30. $\lim\limits_{n\to\infty}\dfrac{n^n}{\left[(n+2)!\right]^2}=0$.

10.31. $\lim\limits_{n\to\infty}\dfrac{n^2+1}{(2n)!!}=0$.

**Задача 11.** Найти область сходимости функционального ряда.

11.1. $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{(x+n)^{-1/5}}$.

11.2. $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{2n-1}\left(\dfrac{1-x}{1+x}\right)^n$.

11.3. $\sum\limits_{n=1}^{\infty}\dfrac{n}{n+1}\dfrac{1}{\left(3x^2+4x+2\right)^n}$.

11.4. $\sum\limits_{n=1}^{\infty}\dfrac{n+1}{3^n}\left(x^2-4x+6\right)^n$.

11.5. $\sum\limits_{n=1}^{\infty}\dfrac{x^n}{1-x^n}$.

11.6. $\sum\limits_{n=1}^{\infty}\dfrac{n+3}{n+1}\dfrac{1}{\left(27x^2+12x+2\right)^n}$.

11.7. $\sum\limits_{n=1}^{\infty}\dfrac{x^n}{1+x^{2n}}$.

11.8. $\sum\limits_{n=1}^{\infty}\dfrac{n2^n}{n+1}\dfrac{1}{\left(3x^2+8x+6\right)^n}$.

11.9. $\sum\limits_{n=1}^{\infty}\dfrac{1}{n+3}\left(\dfrac{1+x}{1-x}\right)^n$.

11.10. $\sum\limits_{n=1}^{\infty}\dfrac{\left(x^2-6x+12\right)^n}{4^n\left(n^2+1\right)}$.

11.11. $\sum\limits_{n=1}^{\infty}\dfrac{1}{\left(\sqrt[3]{n^2}+\sqrt{n}+1\right)^{2x+1}}$.

11.12. $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{(x+n)^3}$.

11.13. $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{\sqrt[3]{x+n}}$.

11.14. $\sum\limits_{n=1}^{\infty}\dfrac{\left(x^2-5x+11\right)^n}{5^n\left(n^2+5\right)}$.

11.15. $\sum\limits_{n=1}^{\infty}\dfrac{(n+x)^n}{n^n}$.

11.16. $\sum\limits_{n=1}^{\infty}\dfrac{1}{n(n+x)}$.

11.17. $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{(x+n)^2}$.

11.18. $\sum\limits_{n=1}^{\infty}\dfrac{1+x^n}{1-x^n}$.

11.19. $\displaystyle\sum_{n=1}^{\infty}\frac{n+1}{xn^x}$.

11.20. $\displaystyle\sum_{n=1}^{\infty}\frac{\sqrt{n}}{n^{x^2-1}}$.

11.21. $\displaystyle\sum_{n=1}^{\infty}\frac{n^2}{2^n\left(n^2+1\right)}\left(25x^2+1\right)^n$.

11.22. $\displaystyle\sum_{n=1}^{\infty}\frac{\sqrt[3]{n}}{x^2+n^2}$.

11.23. $\displaystyle\sum_{n=1}^{\infty}\frac{2n^3}{n^3+2}\frac{1}{\left(3x^2+10x+9\right)^n}$.

11.24. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(-1\right)^n}{x+2^n}$.

11.25. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\left(x+n\right)\left(x+n+1\right)}$.

11.26. $\displaystyle\sum_{n=1}^{\infty}\frac{|x|^n+|x|^{-n}}{2}$.

11.27. $\displaystyle\sum_{n=1}^{\infty}\frac{x}{n\left(n+e^x\right)}$.

11.28. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(-1\right)^n n}{\left(n-e^x\right)\left(n^2+1\right)}$.

11.29. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(-1\right)^n}{\left(n-x\right)^{1/3}}$.

11.30. $\displaystyle\sum_{n=1}^{\infty}\frac{\sqrt{x}}{3^{nx}+2}$.

11.31. $\displaystyle\sum_{n=1}^{\infty}\frac{x}{n+x^2}$.

**Задача 12.** Найти область сходимости функционального ряда.

12.1. $\displaystyle\sum_{n=1}^{\infty}\frac{9^n}{n}x^{2n}\sin\left(x+\pi n\right)$.

12.2. $\displaystyle\sum_{n=1}^{\infty}\frac{4^n}{n}x^{4n}\sin\left(2x-\pi n\right)$.

12.3. $\displaystyle\sum_{n=1}^{\infty}\frac{3^n}{n}x^{4n}\cos\left(x+\pi n\right)$.

12.4. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{5}{3}\right)^n\frac{1}{\sqrt{n}}x^{2n}\cos\left(x-\pi n\right)$.

12.5. $\displaystyle\sum_{n=1}^{\infty}\frac{2^{3n}}{\sqrt[3]{n}}x^{4n}\sin\left(3x+\pi n\right)$.

12.6. $\displaystyle\sum_{n=1}^{\infty}\frac{6^n}{n}x^{2n}\sin\left(5x-\pi n\right)$.

12.7. $\displaystyle\sum_{n=1}^{\infty}\frac{5^n}{\sqrt[4]{3n}}x^{2n}\cos\left(x+\pi n\right)$.

12.8. $\displaystyle\sum_{n=1}^{\infty}\frac{9^n}{2n}x^{2n}\sin\left(3x-\pi n\right)$.

12.9. $\displaystyle\sum_{n=1}^{\infty}2^n x^{3n}\sin\frac{x}{n}$.

12.10. $\displaystyle\sum_{n=1}^{\infty}3^{2n}x^n\sin\frac{x}{2n}$.

12.11. $\displaystyle\sum_{n=1}^{\infty}2^{3n}x^n\sin\frac{2x}{n}$.

12.12. $\displaystyle\sum_{n=1}^{\infty}3^n x^{3n}\sin\frac{3x}{\sqrt{n}}$.

12.13. $\displaystyle\sum_{n=1}^{\infty} 3^n x^n \operatorname{tg}\frac{3x}{n}$.

12.14. $\displaystyle\sum_{n=1}^{\infty} 8^n x^{3n} \operatorname{tg}\frac{x}{4\sqrt{n}}$.

12.15. $\displaystyle\sum_{n=1}^{\infty} x^{3n} \operatorname{tg}\frac{2x}{3n}$.

12.16. $\displaystyle\sum_{n=1}^{\infty} 2^n x^{3n} \arcsin\frac{x}{3n}$.

12.17. $\displaystyle\sum_{n=1}^{\infty} 16^n x^{3n} \arcsin\frac{x}{\sqrt[3]{n}}$.

12.18. $\displaystyle\sum_{n=1}^{\infty} 32^n x^{5n} \arcsin\frac{x}{\sqrt{n}}$.

12.19. $\displaystyle\sum_{n=1}^{\infty} 2^n x^n \operatorname{arctg}\frac{2x}{n+1}$.

12.20. $\displaystyle\sum_{n=1}^{\infty} 2^n x^{3n} \operatorname{arctg}\frac{x}{2(n+3)}$.

12.21. $\displaystyle\sum_{n=1}^{\infty} 27^n x^{3n} \operatorname{arctg}\frac{3x}{2n+3}$.

12.22. $\displaystyle\sum_{n=1}^{\infty} \frac{8^n}{n^2} \sin^{3n} x$.

12.23. $\displaystyle\sum_{n=1}^{\infty} 8^n n^2 \sin^{3n} x$.

12.24. $\displaystyle\sum_{n=1}^{\infty} \frac{2^n}{\sqrt{n}} \sin^{2n}(2x)$.

12.25. $\displaystyle\sum_{n=1}^{\infty} \frac{3^n}{n} \operatorname{tg}^{2n} x$.

12.26. $\displaystyle\sum_{n=1}^{\infty} \frac{2^n}{n^4} \sin^n(3x)$.

12.27. $\displaystyle\sum_{n=1}^{\infty} \frac{4^n}{n^2} \sin^{2n} x$.

12.28. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^3} \operatorname{tg}^n(2x)$.

12.29. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2} \operatorname{tg}^n x$.

12.30. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n \cdot 3^{n/2}} \operatorname{tg}^n x$.

12.31. $\displaystyle\sum_{n=1}^{\infty} \frac{4 \cdot 3^{n/2}}{\sqrt{n}} \operatorname{tg}^n(2x)$.

**Задача 13.** Найти область сходимости функционального ряда.

13.1. $\displaystyle\sum_{n=1}^{\infty} 2n^2 \sqrt{x-2} \cdot e^{-n^2/(x-1)^3}$.

13.2. $\displaystyle\sum_{n=1}^{\infty} \frac{\ln^n(x+1/n)}{\sqrt{x-e}}$.

13.3. $\displaystyle\sum_{n=1}^{\infty} \left(1+\frac{2}{n}\right)^n \cdot 5^{-n/(x+1)^2}$.

13.4. $\displaystyle\sum_{n=1}^{\infty} n^2 \sqrt{x-1} \cdot e^{-n/x}$.

13.5. $\displaystyle\sum_{n=1}^{\infty} e^{-\left(1-x\sqrt{n}\right)^2}$.

13.6. $\displaystyle\sum_{n=1}^{\infty} \left(1+\frac{1}{n}\right)^n \cdot 3^{n/(x-1)}$.

13.7. $\displaystyle\sum_{n=1}^{\infty} 5^{-n^3 \cdot \sin\left(x^2+1\right)/n}$.

13.8. $\displaystyle\sum_{n=1}^{\infty} \frac{1}{\ln^n(x-1)}$.

13.9. $\displaystyle\sum_{n=1}^{\infty} 5^{nx}\operatorname{arctg}\frac{x}{7^{nx}(x-1)}$.

13.10. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\ln^n(x+2)}$.

13.11. $\displaystyle\sum_{n=1}^{\infty}\left(1+\frac{5}{n}\right)^n\cdot 3^{-n/x^2}$.

13.12. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\ln^n(x+e)}$.

13.13. $\displaystyle\sum_{n=1}^{\infty} e^{n^2\cdot\sin(x^2+1)/n}$.

13.14. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1} e^{-n/\cos x}$.

13.15. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(\ln(1+1/n)+\ln\ln x\right)^n}{\sqrt{x-e^{1/e}}}$.

13.16. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^{\ln|x|}}$.

13.17. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\ln^n(x+1/e)}$.

13.18. $\displaystyle\sum_{n=1}^{\infty}\sin^n\frac{x\ln n}{x-n}$.

13.19. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{e^{n\sin x}}$.

13.20. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\, 5^{-n^2\cdot\arctan(1/(n|x|))}$.

13.21. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\, 3^{-n^2\cdot\ln(1+x/n)}$.

13.22. $\displaystyle\sum_{n=1}^{\infty}\frac{\cos(n/(x-1))}{e^{n\sqrt{x}}}$.

13.23. $\displaystyle\sum_{n=1}^{\infty} n^{\sqrt{x}}\arcsin\frac{x}{3^{nx}}$.

13.24. $\displaystyle\sum_{n=1}^{\infty} n^{2x}\operatorname{arctg}\frac{\sqrt{x}}{2^{nx}}$.

13.25. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\, 2^{-n^2\cdot\left(\ln n/(x^2+1)\right)}$.

13.26. $\displaystyle\sum_{n=1}^{\infty} n\ln\left(x-\frac{1}{2}\right)\cdot e^{n/\ln x}$.

13.27. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{\ln^n x}$.

13.28. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\, 5^{-n\left(\ln n/x^2\right)}$.

13.29. $\displaystyle\sum_{n=1}^{\infty} e^{-n^4\left(\sin 1/n^2 x^2\right)}$.

13.30. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^{\ln(1+x^2)}}$.

13.31. $\displaystyle\sum_{n=1}^{\infty}\left(3+\frac{1}{n}\right)^n\cdot 4^{-n^2/x}$.

**Задача 14.** Найти область сходимости функционального ряда.

14.1. $\displaystyle\sum_{n=1}^{\infty}\frac{(n-2)^3(x+3)^{2n}}{2n+3}$.

14.2. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n(x-3)^n}{(n+1)5^n}$.

14.3. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-1)^{2n}}{n9^n}$.

14.4. $\displaystyle\sum_{n=1}^{\infty}\frac{2n+3}{(n+1)^5 x^{2n}}$.

14.5. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\frac{(x-2)^{2n}}{2n}$.

14.6. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-5)^{2n+1}}{3n+8}$.

14.7. $\displaystyle\sum_{n=1}^{\infty}\frac{n^3+1}{3^n(x-2)^n}$.

14.8. $\displaystyle\sum_{n=1}^{\infty}\frac{n!}{x^n}$.

14.9. $\displaystyle\sum_{n=1}^{\infty}\frac{(x+5)^{2n-1}}{4^n(2n-1)}$.

14.10. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-7)^{2n-1}}{(2n^2-5n)4^n}$.

14.11. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-2)^n}{(3n+1)2^n}$.

14.12. $\displaystyle\sum_{n=2}^{\infty}\frac{3n(x-2)^{3n}}{(5n-8)^3}$.

14.13. $\displaystyle\sum_{n=1}^{\infty}(x+5)^n \operatorname{tg}\frac{1}{3^n}$.

14.14. $\displaystyle\sum_{n=1}^{\infty}\sin\frac{\sqrt{n}}{n^2+1}(x-2)^n$.

14.15. $\displaystyle\sum_{n=1}^{\infty}\frac{1}{n\cdot 9^n(x-1)^{2n}}$.

14.16. $\displaystyle\sum_{n=1}^{\infty}3^{n^2}x^{n^2}$.

14.17. $\displaystyle\sum_{n=1}^{\infty}\frac{(x+2)^{n^2}}{n^n}$.

14.18. $\displaystyle\sum_{n=1}^{\infty}\frac{n^5}{(n+1)!}(x+5)^{2n+1}$.

14.19. $\displaystyle\sum_{n=1}^{\infty}\frac{(3n-2)(x-3)^n}{(n+1)^2 2^{n+1}}$.

14.20. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-5)^n}{(n+4)\ln(n+4)}$.

14.21. $\displaystyle\sum_{n=2}^{\infty}\frac{1}{(n+2)\ln(n+2)(x-3)^{2n}}$.

14.22. $\displaystyle\sum_{n=5}^{\infty}\frac{1}{2^n n^2(x+2)^n}$.

14.23. $\displaystyle\sum_{n=1}^{\infty}\frac{(x-4)^{n^2}}{n^{n+1}}$.

14.24. $\displaystyle\sum_{n=1}^{\infty}\frac{n^5}{x^n}$.

14.25. $\displaystyle\sum_{n=5}^{\infty}\frac{\sqrt{n+1}}{3^n(x+3)^n}$.

14.26. $\displaystyle\sum_{n=1}^{\infty}\frac{4^n(x+1)^{2n}}{n}$.

14.27. $\displaystyle\sum_{n=1}^{\infty}\frac{3n+5}{(2n+9)^5(x+2)^{2n}}$.

14.28. $\displaystyle\sum_{n=5}^{\infty}\frac{n^2+1}{5^n(x+4)^n}$.

14.29. $\displaystyle\sum_{n=1}^{\infty}\frac{(x+2)^n}{(2n+1)3^n}$.

14.30. $\displaystyle\sum_{n=1}^{\infty}\frac{n^2(x-3)^n}{(n^4+1)^2}$.

14.31. $\displaystyle\sum_{n=1}^{\infty}\frac{(n+1)^5 x^{2n}}{2n+1}$.

**Задача 15.** Доказать, исходя из определения, равномерную сходимость функционального ряда на отрезке $[0,1]$. При каких $n$ абсолютная величина остаточного члена ряда не превосходит $0.1$ $\forall x \in [0,1]$?

15.1. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{7n-11}$.

15.2. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{5n-6}$.

15.3. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{4n-6}$.

15.4. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{\sqrt[3]{n^3-5}}$.

15.5. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{4n-5}$.

15.6. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{5n-9}$.

15.7. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{3n-4}$.

15.8. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{\sqrt[3]{n^3-2}}$.

15.9. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{6n-11}$.

15.10. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{\sqrt[3]{n^3-7}}$.

15.11. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{7n-10}$.

15.12. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{6n-8}$.

15.13. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{\sqrt[3]{n^3-4}}$.

15.14. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{2n-3}$.

15.15. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{8n-12}$.

15.16. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{6n-7}$.

15.17. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{5n-8}$.

15.18. $\displaystyle\sum_{n=1}^{\infty}(-1)^n\frac{x^n}{6n-10}$.

15.19. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{4n-7}$.

15.20. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{5n-7}$.

15.21. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{7n-13}$.

15.22. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{8n^3-21}}$.

15.23. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{3n-5}$.

15.24. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{8n^3-19}}$.

15.25. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{8n-11}$.

15.26. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{8n^3-11}}$.

15.27. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{8n^3-12}}$.

15.28. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{n^3-3}}$.

15.29. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{9n-15}$.

15.30. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{10n-12}$.

15.31. $\sum_{n=1}^{\infty}(-1)^n \dfrac{x^n}{\sqrt[3]{n^3-6}}$.

**Задача 16.** Для данного функционального ряда построить мажорирующий ряд и доказать равномерную сходимость на указанном отрезке.

16.1. $\sum_{n=0}^{\infty} \dfrac{\sqrt{x+1}\cos nx}{\sqrt[3]{n^5+1}}$, $[0,\ 2]$.

16.2. $\sum_{n=1}^{\infty} \dfrac{x^n}{n2^n}$, $\left[-\dfrac{3}{2},\ \dfrac{3}{2}\right]$.

16.3. $\sum_{n=1}^{\infty} \dfrac{x^n}{n^n}$, $[-2,\ 2]$.

16.4. $\sum_{n=1}^{\infty} \dfrac{n}{n+1}\left(\dfrac{x}{2}\right)^n$, $\left[-\dfrac{3}{2},\ \dfrac{3}{2}\right]$.

16.5. $\sum_{n=1}^{\infty} x^{n!}$, $\left[-\dfrac{1}{2},\ \dfrac{1}{2}\right]$.

16.6. $\sum_{n=1}^{\infty} \dfrac{(x-3)^n}{n5^n}$, $[-1,\ 6]$.

16.7. $\sum_{n=0}^{\infty}(-1)^n \dfrac{(x-3)^n}{(2n+1)\sqrt{n+1}}$, $[2,\ 4]$.

16.8. $\sum_{n=0}^{\infty} \dfrac{(\pi-x)\cos^2 nx}{\sqrt[4]{n^7+1}}$, $[0,\ \pi]$.

16.9. $\sum_{n=1}^{\infty} \dfrac{(x-1)^{2n}}{n9^n}$, $[-1,\ 3]$.

16.10. $\sum_{n=1}^{\infty} \dfrac{n!(x+3)^n}{n^n}$, $[-5,\ -1]$.

16.11. $\displaystyle\sum_{n=1}^{\infty}\left(-1\right)^{n}\frac{\left(x-2\right)^{2n}}{\left(n+1\right)^{2}\ln\left(n+1\right)}$, $[1,\ 3]$.

16.12. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{n}}{n!}$, $[-3,\ 3]$.

16.13. $\displaystyle\sum_{n=1}^{\infty}\frac{2^{n-1}x^{2n-1}}{\left(4n-3\right)^{2}}$, $[-\frac{1}{\sqrt{2}},\ \frac{1}{\sqrt{2}}]$.

16.14. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{n-1}}{n3^{n}\ln n}$, $[-2,\ 2]$.

16.15. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+5\right)^{2n-1}}{n^{2}4^{n}}$, $[-7,\ -3]$.

16.16. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+2\right)^{n^{2}}}{n^{n}}$, $[-3,\ \text{-}1]$.

16.17. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(-1\right)^{n-1}x^{n}}{n}$, $[-\frac{1}{2},\ \frac{1}{2}]$.

16.18. $\displaystyle\sum_{n=0}^{\infty}\frac{\left(n+1\right)^{4}x^{2n}}{2n+1}$, $[-\frac{1}{2},\ \frac{1}{2}]$.

16.19. $\displaystyle\sum_{n=1}^{\infty}\left(-1\right)^{n-1}\frac{\left(x-2\right)^{2n}}{n}$, $[\frac{3}{2},\ \frac{5}{2}]$.

16.20. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+5\right)^{n}}{n^{2}}$, $[-6,\ -4]$.

16.21. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x-2\right)^{n}}{\left(2n-1\right)2^{n}}$, $[1,\ 3]$.

16.22. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+1\right)\sin^{2}nx}{n\sqrt{n+1}}$, $[-3,\ 0]$.

16.23. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{n}}{n\left(n+2\right)}$, $[-1,\ 1]$.

16.24. $\displaystyle\sum_{n=0}^{\infty}\frac{\left(x+5\right)^{n}}{\sqrt[3]{n+1}\sqrt{n^{2}+1}}$, $[-6,\ -4]$.

16.25. $\displaystyle\sum_{n=0}^{\infty}\frac{x^{n^{2}}}{3^{n^{2}}}$, $[-2,\ 2]$.

16.26. $\displaystyle\sum_{n=0}^{\infty}\left(\sin\frac{\pi}{2^{n}}\right)\left(x-2\right)^{n}$, $[1,\ 3]$.

16.27. $\displaystyle\sum_{n=0}^{\infty}\frac{\left(x-1\right)^{n}}{2^{n}\left(n+3\right)}$, $[0,\ 2]$.

16.28. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+1\right)^{2n}}{n4^{n}}$, $[-1,\ 0]$.

16.29. $\displaystyle\sum_{n=0}^{\infty}\left(-1\right)^{n-1}\frac{n\left(x+2\right)^{n}}{\left(n+1\right)\sqrt[3]{n+2}}$, $[-3,\ -1]$.

16.30. $\displaystyle\sum_{n=0}^{\infty}\frac{\left(x-3\right)^{2n}}{n\sqrt{n+1}}$, $[2,\ 4]$.

16.31. $\displaystyle\sum_{n=1}^{\infty}\frac{\left(x+1\right)^{n}}{\left(n+1\right)\ln^{2}\left(n+1\right)}$, $[-2,\ 0]$.

**Задача 17.** Найти сумму ряда.

17.1. $\displaystyle\sum_{n=1}^{\infty}\left(-1\right)^{n-1}\left(1+\frac{1}{n}\right)x^{n-1}$.

17.2. $\displaystyle\sum_{n=2}^{\infty}\frac{x^{2n}}{\left(2n-3\right)\left(2n-2\right)}$.

17.3. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n+1}\left(\frac{1}{n}-\frac{1}{n+2}\right)x^{n+2}$ .

17.4. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n-1}x^{2n-1}}{4^{n}(2n-1)}$ .

17.5. $\displaystyle\sum_{n=0}^{\infty}\frac{1+(-1)^{n}}{2n+1}x^{2n+1}$ .

17.6. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\left(1-\frac{1}{n}\right)\frac{1}{x^{n}}$ .

17.7. $\displaystyle\sum_{n=2}^{\infty}\frac{(-1)^{n-1}x^{n}}{n(n-1)}$ .

17.8. $\displaystyle\sum_{n=0}^{\infty}\frac{1+(-1)^{n-1}}{2n+1}x^{2n+1}$ .

17.9. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{n}}{n(n+1)}$ .

17.10. $\displaystyle\sum_{n=0}^{\infty}\frac{(-1)^{n-1}x^{2n+2}}{16^{n}(2n+1)}$ .

17.11. $\displaystyle\sum_{n=0}^{\infty}\frac{x^{2n+2}}{(2n+1)(2n+2)}$ .

17.12. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\left(\frac{1}{n}+\frac{1}{n+1}\right)x^{n}$ .

17.13. $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}\frac{x^{n+1}}{n(n+1)}$ .

17.14. $\displaystyle\sum_{n=1}^{\infty}\frac{e^{-nx}}{n}$ .

17.15. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{2n-1}}{2n(2n-1)}$ .

17.16. $\displaystyle\sum_{n=1}^{\infty}\left[(-1)^{n}+\frac{1}{n}\right]x^{2n}$ .

17.17. $\displaystyle\sum_{n=1}^{\infty}\left[1+\frac{(-1)^{n+1}}{n}\right]x^{n-1}$ .

17.18. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n(n+1)x^{n+1}}$ .

17.19. $\displaystyle\sum_{n=0}^{\infty}\frac{(-1)^{n}x^{n+1}}{(n+1)(n+2)}$ .

17.20. $\displaystyle\sum_{n=2}^{\infty}\frac{\sin^{n}x}{n(n-1)}$ .

17.21. $\displaystyle\sum_{n=1}^{\infty}\frac{x^{2n+1}}{2n(2n+1)}$ .

17.22. $\displaystyle\sum_{n=1}^{\infty}\left(\frac{1}{n}+\frac{1}{n+1}\right)x^{n}$ .

17.23. $\displaystyle\sum_{n=0}^{\infty}\frac{x^{n+2}}{(n+1)(n+2)}$ .

17.24. $\displaystyle\sum_{n=1}^{\infty}\left[2^{n}+\frac{(-1)^{n}}{n}\right]x^{n}$ .

17.25. $\displaystyle\sum_{n=2}^{\infty}\frac{x^{2n}}{(2n-2)(2n-1)}$ .

17.26. $\displaystyle\sum_{n=2}^{\infty}\frac{x^{n}}{n(n-1)}$ .

17.27. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}\cos^{n+1}x}{n(n+1)}$ .

17.28. $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^{n+1}\operatorname{tg}^{n}x}{n(n+1)}$ .

17.29. $\displaystyle\sum_{n=0}^{\infty}\frac{3^n}{(n+1)x^{n+1}}$ .

17.30. $\displaystyle\sum_{n=2}^{\infty}\frac{n+(-1)^n}{n(n-1)}x^n$ .

17.31. $\displaystyle\sum_{n=0}^{\infty}\frac{x^{2n+2}}{(2n+2)(2n+3)}$ .

**Задача 18.** Найти сумму ряда.

18.1. $\displaystyle\sum_{n=0}^{\infty}\left(4n^2+9n+5\right)x^{n+1}$ .

18.2. $\displaystyle\sum_{n=0}^{\infty}\left(3n^2+7n+4\right)x^n$ .

18.3. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+n+1\right)x^{n+3}$ .

18.4. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+4n+3\right)x^{n+2}$ .

18.5. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+5n+3\right)x^n$ .

18.6. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+5n+3\right)x^{n+1}$ .

18.7. $\displaystyle\sum_{n=0}^{\infty}\left(3n^2+8n+5\right)x^{n+2}$ .

18.8. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+8n+5\right)x^n$ .

18.9. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+7n+5\right)x^{n+1}$ .

18.10. $\displaystyle\sum_{n=0}^{\infty}\left(3n^2+7n+5\right)x^n$ .

18.11. $\displaystyle\sum_{n=0}^{\infty}n(2n-1)x^{n+2}$ .

18.12. $\displaystyle\sum_{n=0}^{\infty}\left(n^2-n+1\right)x^n$ .

18.13. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2-n-1\right)x^n$ .

18.14. $\displaystyle\sum_{n=0}^{\infty}\left(3n^2+5n+4\right)x^{n+1}$ .

18.15. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+7n+4\right)x^n$ .

18.16. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2-n-2\right)x^{n+1}$ .

18.17. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+2n+1\right)x^n$ .

18.18. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+2n-1\right)x^{n+1}$ .

18.19. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+2n+2\right)x^{n+2}$ .

18.20. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+4n+3\right)x^{n+1}$ .

19.21. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+5n+4\right)x^{n+2}$ .

18.22. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2-2n+1\right)x^n$ .

18.23. $\displaystyle\sum_{n=0}^{\infty}\left(n^2-2n-1\right)x^{n+1}$ .

18.24. $\displaystyle\sum_{n=0}^{\infty}\left(n^2-2n+2\right)x^n$ .

18.25. $\displaystyle\sum_{n=0}^{\infty}\left(n^2-2n-2\right)x^{n+1}$.

18.26. $\displaystyle\sum_{n=0}^{\infty}\left(4n^2+6n+5\right)x^{n}$.

18.27. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+6n+5\right)x^{n+1}$.

18.28. $\displaystyle\sum_{n=0}^{\infty}n\left(2n+1\right)x^{n+2}$.

18.29. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+n+1\right)x^{n+1}$.

18.30. $\displaystyle\sum_{n=0}^{\infty}\left(2n^2+n-1\right)x^{n}$.

18.31. $\displaystyle\sum_{n=0}^{\infty}\left(n^2+9n+5\right)x^{n+1}$.

**Задача 19.** Разложить функцию в ряд Тейлора по степеням $x$.

19.1. $\dfrac{9}{20-x-x^2}$.

19.2. $\dfrac{x^2}{\sqrt{4-5x}}$.

19.3. $\ln\left(1-x-6x^2\right)$.

19.4. $2x\cos^2\left(x/2\right)-x$.

19.5. $\dfrac{\operatorname{sh}2x}{x}-2$.

19.6. $\dfrac{7}{12+x-x^2}$.

19.7. $\dfrac{x}{\sqrt[3]{27-2x}}$.

19.8. $\ln\left(1+x-6x^2\right)$.

19.9. $(x-1)\sin 5x$.

19.10. $\dfrac{\operatorname{ch}3x-1}{x^2}$.

19.11. $\dfrac{6}{8+2x-x^2}$.

19.12. $\dfrac{1}{\sqrt[4]{16-3x}}$.

19.13. $\ln\left(1-x-12x^2\right)$.

19.14. $\left(3+e^{-x}\right)^2$.

19.15. $\dfrac{\arcsin x}{x}-1$.

19.16. $\dfrac{7}{12-x-x^2}$.

19.17. $x^2\sqrt{4-3x}$.

19.18. $\ln\left(1+2x-8x^2\right)$.

19.19. $2x\sin^2\left(x/2\right)-x$.

19.20. $(x-1)\operatorname{sh}x$.

19.21. $\dfrac{5}{6+x-x^2}$.

19.22. $x\sqrt[3]{27-2x}$.

19.23. $\ln\left(1 + x - 12x^2\right)$.

19.24. $\dfrac{\sin 3x}{x} - \cos 3x$.

19.25. $\dfrac{\operatorname{arctg} x}{x}$.

19.26. $\dfrac{5}{6 - x - x^2}$.

19.27. $\sqrt[4]{16 - 5x}$.

19.28. $\ln\left(1 - x - 20x^2\right)$.

19.29. $\left(2 - e^x\right)^2$.

19.30. $(x - 1)\operatorname{ch} x$.

19.31. $\dfrac{3}{2 - x - x^2}$.

**Задача 20**. Вычислить интеграл с точностью до 0,001.

20.1. $\displaystyle\int_0^{0,1} e^{-6x^2} dx$.

20.2. $\displaystyle\int_0^{0,1} \sin\left(100x^2\right) dx$.

20.3. $\displaystyle\int_0^1 \cos x^2 dx$.

20.4. $\displaystyle\int_0^{0,5} \dfrac{dx}{\sqrt[4]{1 + x^4}}$.

20.5. $\displaystyle\int_0^{0,1} \dfrac{1 - e^{-2x}}{x} dx$.

20.6. $\displaystyle\int_0^1 \dfrac{\ln\left(1 + x/5\right)}{x} dx$.

20.7. $\displaystyle\int_0^{1,5} \dfrac{dx}{\sqrt[3]{27 + x^3}}$.

20.8. $\displaystyle\int_0^{0,2} e^{-3x^2} dx$.

20.9. $\displaystyle\int_0^{0,2} \sin\left(25x^2\right) dx$.

20.10. $\displaystyle\int_0^{0,5} \cos\left(4x^2\right) dx$.

20.11. $\displaystyle\int_0^1 \dfrac{dx}{\sqrt[4]{16 + x^4}}$.

20.12. $\displaystyle\int_0^{0,2} \dfrac{1 - e^{-x}}{x} dx$.

20.13. $\displaystyle\int_0^{0,4} \dfrac{\ln\left(1 + x/2\right)}{x} dx$.

20.14. $\displaystyle\int_0^2 \dfrac{dx}{\sqrt[3]{64 + x^3}}$.

20.15. $\displaystyle\int_0^{0,3} e^{-2x^2} dx$.

20.16. $\displaystyle\int_0^{0,4} \sin\left(5x/2\right)^2 dx$.

20.17. $\displaystyle\int_0^{0,2} \cos\left(25x^2\right) dx$.

20.18. $\displaystyle\int_0^{1,5} \dfrac{dx}{\sqrt[4]{81 + x^4}}$.

20.19. $\displaystyle\int_0^{0,4} \frac{1-e^{-x/2}}{x}\,dx$.

20.20. $\displaystyle\int_0^{0,1} \frac{\ln(1+2x)}{x}\,dx$.

20.21. $\displaystyle\int_0^{2,5} \frac{dx}{\sqrt[3]{125+x^3}}$.

20.22. $\displaystyle\int_0^{0,4} e^{-3x^2/4}\,dx$.

20.23. $\displaystyle\int_0^{0,5} \sin\left(4x^2\right)dx$.

20.24. $\displaystyle\int_0^{0,4} \cos(5x/2)^2\,dx$.

20.25. $\displaystyle\int_0^{2} \frac{dx}{\sqrt[4]{256+x^4}}$.

20.26. $\displaystyle\int_0^{0,5} \frac{dx}{\sqrt[3]{1+x^3}}$.

20.27. $\displaystyle\int_0^{2,5} \frac{dx}{\sqrt[4]{625+x^4}}$.

20.28. $\displaystyle\int_0^{1} \frac{dx}{\sqrt[3]{8+x^3}}$.

20.29. $\displaystyle\int_0^{0,5} e^{-3x^2/25}\,dx$.

20.30. $\displaystyle\int_0^{1} \sin x^2\,dx$.

20.31. $\displaystyle\int_0^{0,1} \cos\left(100x^2\right)dx$.