

## Домашнее задание 1: РЯДЫ

Задача 1. Найти сумму числового ряда.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Задача 2. Найти сумму числового ряда.**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**Задача 3. Доказать сходимость числового ряда и найти его сумму.**

$$3.1. \sum_{n=1}^{\infty} \frac{(-2)^n + 6^n}{15^n}$$

$$3.12. \sum_{n=1}^{\infty} \frac{5^n - 3^n}{(-15)^n}$$

$$3.23. \sum_{n=1}^{\infty} \frac{3^n - 6^n}{(-18)^n}$$

$$3.2. \sum_{n=1}^{\infty} \frac{3^n + 4^n}{(-12)^n}$$

$$3.13. \sum_{n=1}^{\infty} \frac{6^n - (-3)^n}{18^n}$$

$$3.24. \sum_{n=1}^{\infty} \frac{(-7)^n - 3^n}{21^n}$$

$$3.3. \sum_{n=1}^{\infty} \frac{6^n - (-2)^n}{15^n}$$

$$3.14. \sum_{n=1}^{\infty} \frac{2^n + 7^n}{(-14)^n}$$

$$3.25. \sum_{n=1}^{\infty} \frac{8^n - 5^n}{(-40)^n}$$

$$3.4. \sum_{n=1}^{\infty} \frac{2^n + 5^n}{(-10)^n}$$

$$3.15. \sum_{n=1}^{\infty} \frac{(-4)^n + 9^n}{36^n}$$

$$3.26. \sum_{n=1}^{\infty} \frac{3^n + (-8)^n}{24^n}$$

$$3.5. \sum_{n=1}^{\infty} \frac{7^n - (-4)^n}{28^n}$$

$$3.16. \sum_{n=1}^{\infty} \frac{(-7)^n - 2^n}{14^n}$$

$$3.27. \sum_{n=1}^{\infty} \frac{4^n + 6^n}{(-18)^n}$$

$$3.6. \sum_{n=1}^{\infty} \frac{5^n - 2^n}{(-10)^n}$$

$$3.17. \sum_{n=1}^{\infty} \frac{2^n + 9^n}{(-18)^n}$$

$$3.28. \sum_{n=1}^{\infty} \frac{8^n - (-3)^n}{24^n}$$

$$3.7. \sum_{n=1}^{\infty} \frac{(-4)^n + 7^n}{28^n}$$

$$3.18. \sum_{n=1}^{\infty} \frac{(-4)^n + 5^n}{20^n}$$

$$3.29. \sum_{n=1}^{\infty} \frac{5^n + 8^n}{(-40)^n}$$

$$3.8. \sum_{n=1}^{\infty} \frac{4^n - 3^n}{(-12)^n}$$

$$3.19. \sum_{n=1}^{\infty} \frac{9^n - 4^n}{(-36)^n}$$

$$3.30. \sum_{n=1}^{\infty} \frac{9^n - (-2)^n}{18^n}$$

$$3.9. \sum_{n=1}^{\infty} \frac{5^n + (-7)^n}{35^n}$$

$$3.20. \sum_{n=1}^{\infty} \frac{(-5)^n - 4^n}{20^n}$$

$$3.31. \sum_{n=1}^{\infty} \frac{6^n - 4^n}{(-24)^n}$$

$$3.10. \sum_{n=1}^{\infty} \frac{3^n + 5^n}{(-15)^n}$$

$$3.21. \sum_{n=1}^{\infty} \frac{9^n + 5^n}{(-45)^n}$$

$$3.11. \sum_{n=1}^{\infty} \frac{7^n - (-5)^n}{35^n}$$

$$3.22. \sum_{n=1}^{\infty} \frac{7^n - (-3)^n}{21^n}$$

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

$$4.1. \sum_{n=1}^{\infty} \frac{\sin^2 n \sqrt{n}}{n \sqrt{n}}.$$

$$4.2. \sum_{n=1}^{\infty} n \sin \frac{2 + (-1)^n}{n^3}.$$

$$4.3. \sum_{n=1}^{\infty} \frac{\cos^2(n\pi/2)}{n(n+1)(n+2)}.$$

$$4.4. \sum_{n=1}^{\infty} \frac{\ln n}{\sqrt[3]{n^7}}.$$

$$4.5. \sum_{n=1}^{\infty} \frac{2 + (-1)^n}{n - \ln n}.$$

$$4.6. \sum_{n=1}^{\infty} \frac{\operatorname{arctg} \frac{1 + (-1)^n}{2} n}{n^3 + 2}.$$

$$4.7. \sum_{n=1}^{\infty} \frac{n(2 + \cos n\pi)}{2n^2 - 1}.$$

$$4.8. \sum_{n=2}^{\infty} \frac{\arcsin \frac{n-1}{n}}{\sqrt[3]{n^3 - 3n}}.$$

$$4.9. \sum_{n=1}^{\infty} \frac{\sin^2 n}{n^2 + 1}.$$

$$4.10. \sum_{n=2}^{\infty} \frac{\ln \sqrt{n^2 + 3n}}{\sqrt{n^2 - n}}.$$

$$4.11. \sum_{n=2}^{\infty} \frac{\arccos \frac{(-1)^n n}{n+1}}{n^2 + 2}.$$

$$4.12. \sum_{n=1}^{\infty} \frac{n \cos^2 n}{n^3 + 5}.$$

$$4.13. \sum_{n=2}^{\infty} \frac{n \ln n}{n^2 - 3}.$$

$$4.14. \sum_{n=1}^{\infty} \frac{n^2 + 3}{n^3 (2 + \sin(n\pi/2))}.$$

$$4.15. \sum_{n=2}^{\infty} \frac{1}{\sqrt[4]{n^3}} \sin \frac{2 + (-1)^n}{6} \pi.$$

$$4.16. \sum_{n=1}^{\infty} \frac{\ln n}{n^3 + n + 1}.$$

$$4.17. \sum_{n=1}^{\infty} \frac{1 + \sin \frac{\pi n}{2}}{n^2}.$$

$$4.18. \sum_{n=1}^{\infty} \frac{\cos^2 \frac{\pi n}{2}}{3^n + 2}.$$

$$4.19. \sum_{n=1}^{\infty} \frac{(2 + \cos \frac{n\pi}{2})\sqrt{n}}{\sqrt[4]{n^7 + 5}}.$$

$$4.20. \sum_{n=1}^{\infty} \frac{2 + \sin \frac{n\pi}{4}}{n^2} \operatorname{ctg} \frac{1}{\sqrt{n}}.$$

$$4.21. \sum_{n=1}^{\infty} \frac{\sin^2 2^n}{n^2}.$$

$$4.22. \sum_{n=1}^{\infty} \frac{\ln n}{\sqrt{n^5 + n}}.$$

$$4.23. \sum_{n=3}^{\infty} \frac{1}{n^2 \ln n + \sqrt[3]{\ln^2 n}}.$$

$$4.24. \sum_{n=1}^{\infty} \frac{\frac{3}{\pi} \operatorname{arctg} \sqrt{n^2 - 1}}{\sqrt{n^2 - n}}.$$

$$4.25. \sum_{n=1}^{\infty} \frac{\sin \frac{\pi}{2n+1}}{n \left( 3 + \sin \frac{\pi n}{4} \right)}.$$

$$4.26. \sum_{n=2}^{\infty} \frac{2 \cos \frac{2\pi}{3n}}{\sqrt[4]{n^4 - 1}}.$$

$$4.27. \sum_{n=1}^{\infty} \frac{3 + (-1)^n}{2^{n+2}}.$$

$$4.28. \sum_{n=1}^{\infty} \frac{\operatorname{arctg} \left[ 2 + (-1)^n \right]}{\ln(1+n)}.$$

$$4.29. \sum_{n=1}^{\infty} \frac{\operatorname{arcctg} (-1)^n}{\sqrt{n(2+n^2)}}.$$

$$4.30. \sum_{n=1}^{\infty} \frac{\arcsin \frac{3 + (-1)^n}{4}}{2^n + n}.$$

$$4.31. \sum_{n=1}^{\infty} \frac{\sqrt{n^3 + 2}}{n^2 \sin^2 n}.$$

**Задача 5. Исследовать на сходимость числовой ряд с положительными членами**

$$5.1. \sum_{n=1}^{\infty} \frac{3^n (n+2)!}{n^5}$$

$$5.2. \sum_{n=1}^{\infty} \frac{7n-1}{5^n (n+1)!}$$

$$5.3. \sum_{n=1}^{\infty} \left( \frac{7}{8} \right)^n \left( \frac{1}{n} \right)^7$$

$$5.4. \sum_{n=1}^{\infty} (2n+1) \operatorname{tg} \frac{\pi}{3^n}$$

$$5.5. \sum_{n=1}^{\infty} \frac{n^{n/2}}{3^n}$$

$$5.6. \sum_{n=1}^{\infty} \frac{4 \cdot 5 \cdot 6 \cdots (n+3)}{5 \cdot 7 \cdot 9 \cdots (2n+3)}$$

$$5.7. \sum_{n=1}^{\infty} \left( \frac{9}{10} \right)^n n^7$$

$$5.8. \sum_{n=1}^{\infty} \frac{1 \cdot 7 \cdot 13 \cdots (6n-5)}{2 \cdot 3 \cdot 4 \cdots (n+1)}$$

$$5.9. \sum_{n=1}^{\infty} \frac{3n(n+1)}{5^n}$$

$$5.10. \sum_{n=1}^{\infty} \frac{(n+2)!}{n^n}$$

$$5.11. \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{2 \cdot 7 \cdot 12 \cdots (5n-3)}$$

$$5.12. \sum_{n=1}^{\infty} \frac{(n+1)^{n/2}}{n!}$$

$$5.13. \sum_{n=1}^{\infty} \frac{n!}{5^n (n+3)!}$$

$$5.14. \sum_{n=1}^{\infty} \frac{1 \cdot 6 \cdot 11 \cdots (5n-4)}{3 \cdot 7 \cdot 11 \cdots (4n-1)}$$

$$5.15. \sum_{n=1}^{\infty} \frac{n^n}{(n+3)!}$$

$$5.16. \sum_{n=1}^{\infty} \frac{2 \cdot 5 \cdot 8 \cdots (3n-1)}{3 \cdot 7 \cdot 11 \cdots (4n-1)}$$

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

$$5.18. \sum_{n=1}^{\infty} \frac{n}{(2n+3)!}$$

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

$$5.20. \sum_{n=1}^{\infty} n^3 \operatorname{tg} \frac{2\pi}{5^n}$$

$$5.21. \sum_{n=1}^{\infty} (3n-1) \sin \frac{\pi}{4^n}$$

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

$$5.23. \sum_{n=1}^{\infty} \frac{3n-1}{\sqrt{n \cdot 7^n}}$$

$$5.24. \sum_{n=1}^{\infty} \frac{2^n}{5^n (2n-1)}$$

$$5.25. \sum_{n=1}^{\infty} \frac{5^n}{4n!}$$

$$5.26. \sum_{n=1}^{\infty} n \sin \frac{2\pi}{3^n}$$

$$5.27. \sum_{n=1}^{\infty} \frac{2n+1}{\sqrt{n \cdot 2^n}}$$

$$5.28. \sum_{n=1}^{\infty} \frac{(2n-1)^3}{(2n)!}$$

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

$$5.29. \sum_{n=1}^{\infty} \frac{1 \cdot 5 \cdot 9 \cdots (4n-3)}{1 \cdot 4 \cdot 7 \cdots (3n-2)}$$

$$5.31. \sum_{n=1}^{\infty} \frac{(n-1)^4}{n!}$$

**Задача 6. Исследовать на сходимость числовой ряд с положительными членами**

$$6.1. \sum_{n=1}^{\infty} \frac{10^n}{\left(\frac{n+1}{n}\right)^n}$$

$$6.9. \sum_{n=1}^{\infty} \frac{1}{(\ln(n+1))^{2n}}$$

$$6.2. \sum_{n=1}^{\infty} \left(\frac{5n-1}{5n}\right)^{n^2}$$

$$6.10. \sum_{n=1}^{\infty} \left(\operatorname{tg} \frac{\pi}{5^n}\right)^{3n}$$

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

$$6.11. \sum_{n=1}^{\infty} \frac{1}{(\ln(n+3))^n}$$

$$6.4. \sum_{n=1}^{\infty} \frac{1}{(\ln(n+2))^n}$$

$$6.12. \sum_{n=1}^{\infty} \left(\frac{3n^2+4n+5}{6n^2-3n-1}\right)^n$$

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

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

$$6.6. \sum_{n=1}^{\infty} \left(\frac{n^2+5n+8}{3n^2-2}\right)^n$$

$$6.14. \sum_{n=1}^{\infty} \left(\sin \frac{\pi}{n^3}\right)^{2n}$$

$$6.7. \sum_{n=1}^{\infty} \left(\operatorname{arctg} \frac{1}{5^n}\right)^n$$

$$6.15. \sum_{n=1}^{\infty} \left(\frac{n+1}{4n}\right)^{3n}$$

$$6.8. \sum_{n=1}^{\infty} \frac{(n/(n+1))^{n^2}}{2^n}$$

$$6.16. \sum_{n=1}^{\infty} \frac{4^n}{((n+1)/n)^{n^2}}$$



$$6.17. \sum_{n=1}^{\infty} \frac{1}{(\ln(n+1))^{3^n}}$$

$$6.25. \sum_{n=1}^{\infty} \frac{((n+1)/n)^{n^2}}{5^n}$$

$$6.18. \sum_{n=1}^{\infty} \left( \frac{3n-1}{3n} \right)^{n^2}$$

$$6.26. \sum_{n=1}^{\infty} \left( \operatorname{tg} \frac{\pi}{2n+1} \right)^n$$

$$6.19. \sum_{n=1}^{\infty} \left( \arcsin \frac{1}{3^n} \right)^n$$

$$6.27. \sum_{n=1}^{\infty} \left( \sin \frac{\pi}{5n+1} \right)^n$$

$$6.20. \sum_{n=1}^{\infty} \left( \frac{n+1}{2n} \right)^{n^2}$$

$$6.28. \sum_{n=1}^{\infty} \left( \operatorname{arctg} \frac{1}{2n-1} \right)^{2n}$$

$$6.21. \sum_{n=1}^{\infty} \left( \frac{3n^2 - n - 1}{7n^2 + 3n + 4} \right)^n$$

$$6.29. \sum_{n=1}^{\infty} \frac{10^n}{(\ln(n+5))^2}$$

$$6.22. \sum_{n=1}^{\infty} \left( \frac{n}{3n+1} \right)^n$$

$$6.30. \sum_{n=1}^{\infty} \left( \arcsin \frac{n+3}{2n+5} \right)^n$$

$$6.23. \sum_{n=1}^{\infty} \left( \arcsin \frac{1}{3n} \right)^{2n}$$

$$6.31. \sum_{n=1}^{\infty} \frac{15^n}{(n+1)^n}$$

$$6.24. \sum_{n=1}^{\infty} \left( \frac{n+1}{2n} \right)^{5n}$$

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

$$7.1. \sum_{n=2}^{\infty} \frac{n+1}{2^n (n-1)!}.$$

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

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

$$7.4. \sum_{n=1}^{\infty} \frac{10^n 2n!}{(2n)!}.$$

$$7.5. \sum_{n=1}^{\infty} \frac{(2n+2)!}{3n+5} \cdot \frac{1}{2^n}.$$

$$7.6. \sum_{n=1}^{\infty} \frac{n+5}{n!} \sin \frac{2}{3^n}.$$

$$7.7. \sum_{n=1}^{\infty} \frac{\arctg \frac{5}{n}}{n!}.$$

$$7.8. \sum_{n=1}^{\infty} \frac{n^n}{3^n n!}.$$

$$7.9. \sum_{n=1}^{\infty} \frac{n}{(2n)!} \operatorname{tg} \frac{1}{5^n}.$$

$$7.10. \sum_{n=1}^{\infty} \frac{6^n (n^2 - 1)}{n!}.$$

$$7.11. \sum_{n=1}^{\infty} \frac{n^2}{(n+2)!}.$$

$$7.12. \sum_{n=1}^{\infty} \frac{n^n}{(n!)^2}.$$

$$7.13. \sum_{n=1}^{\infty} \frac{7^{2n}}{(2n-1)!}.$$

$$7.14. \sum_{n=1}^{\infty} \frac{n!}{(3n)!}.$$

$$7.15. \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \dots (2n-1)}{3^n (n+1)!}.$$

$$7.16. \sum_{n=1}^{\infty} \frac{n!}{n^{n-1}}.$$

$$7.17. \sum_{n=1}^{\infty} \frac{(n!)^2}{(3^n + 1)(2n)!}.$$

$$7.18. \sum_{n=1}^{\infty} n! \sin \frac{\pi}{2^n}.$$

$$7.19. \sum_{n=1}^{\infty} \frac{(n+1)!}{n^n}.$$

$$7.20. \sum_{n=1}^{\infty} \frac{5^n \sqrt[3]{n^2}}{(n+1)!}.$$

$$7.21. \sum_{n=1}^{\infty} \frac{2^n n!}{n^n}.$$

$$7.22. \sum_{n=1}^{\infty} \frac{5^n (n+1)!}{(2n)!}.$$

$$7.23. \sum_{n=1}^{\infty} \frac{3^n}{(n+2)! 4^n}.$$

$$7.24. \sum_{n=1}^{\infty} \frac{3 \cdot 5 \cdot 7 \dots (2n+1)}{2 \cdot 5 \cdot 8 \dots (3n-1)}.$$

$$7.25. \sum_{n=1}^{\infty} \frac{1 \cdot 4 \cdot 7 \dots (3n-2)}{7 \cdot 9 \cdot 11 \dots (2n+5)}.$$

$$7.26. \sum_{n=1}^{\infty} \frac{2n!}{\sqrt{2^n + 3}}.$$

$$7.27. \sum_{n=1}^{\infty} \frac{(3n+2)!}{10^n n^2}.$$

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

$$7.29. \sum_{n=1}^{\infty} \frac{n! \sqrt[3]{n}}{3^n + 2}.$$

$$7.30. \sum_{n=1}^{\infty} \frac{n!(2n+1)!}{(3n)!}.$$

$$7.31. \sum_{n=1}^{\infty} \frac{1 \cdot 4 \cdot 7 \dots (3n-2)}{2^{n+1} n!}.$$

**Задача 8. Исследовать на сходимость ряд**

$$8.1. \sum_{n=1}^{\infty} \frac{1}{3^n} \left( \frac{n}{n+1} \right)^{-n^2}.$$

$$8.2. \sum_{n=1}^{\infty} \frac{1}{4^n} \left( 1 + \frac{1}{n} \right)^{n^2}.$$

$$8.3. \sum_{n=1}^{\infty} \left( \frac{2n^2+1}{n^2+1} \right)^{n^2}.$$

$$8.4. \sum_{n=1}^{\infty} n^4 \left( \frac{2n}{3n+5} \right)^n.$$

$$8.5. \sum_{n=1}^{\infty} \left( \frac{2n+1}{3n-2} \right)^{n^2}.$$

$$8.6. \sum_{n=1}^{\infty} \left( \frac{2n+2}{3n+1} \right)^n (n+1)^3.$$

$$8.7. \sum_{n=1}^{\infty} \left( \frac{4n-3}{5n+1} \right)^{n^3}.$$

$$8.8. \sum_{n=1}^{\infty} \left( \frac{n}{10n+5} \right)^{n^2}.$$

$$8.9. \sum_{n=1}^{\infty} n \arcsin^n \frac{\pi}{4n}.$$

$$8.10. \sum_{n=1}^{\infty} \left( \frac{n+2}{3n-1} \right)^{n^2}.$$

$$8.11. \sum_{n=1}^{\infty} \left( \frac{n-1}{n} \right)^n \frac{n}{5^n}.$$

$$8.12. \sum_{n=1}^{\infty} \left( \frac{2n+3}{n+1} \right)^{n^2}.$$

$$8.13. \sum_{n=1}^{\infty} \left( \frac{3n+2}{4n-1} \right)^n (n-1)^2.$$

$$8.14. \sum_{n=2}^{\infty} \left( \frac{n+1}{2n-3} \right)^{n^2}.$$

$$8.15. \sum_{n=1}^{\infty} \left( \frac{n}{3n+1} \right)^{2n+1}.$$

$$8.16. \sum_{n=1}^{\infty} \left( \frac{2n-1}{3n+1} \right)^{n/2}.$$

$$8.17. \sum_{n=1}^{\infty} \frac{2^{n+1}}{n^n}.$$

$$8.18. \sum_{n=1}^{\infty} n^2 \sin^n \frac{\pi}{2n}.$$

$$8.19. \sum_{n=2}^{\infty} \frac{n^3}{(\ln n)^n}.$$

$$8.20. \sum_{n=1}^{\infty} \left( \frac{n}{3n-1} \right)^{n^3}.$$

$$8.21. \sum_{n=1}^{\infty} n^3 \operatorname{arctg}^n \frac{\pi}{3n}.$$

$$8.22. \sum_{n=1}^{\infty} \frac{n^5 3^n}{(2n+1)^n}.$$

$$8.23. \sum_{n=1}^{\infty} 2^{n-1} e^{-n}.$$

$$8.24. \sum_{n=1}^{\infty} n \left( \frac{3n-1}{4n+2} \right)^{2n}.$$

$$8.25. \sum_{n=1}^{\infty} \left( \frac{2n}{4n+3} \right)^{n^2}.$$

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

$$8.27. \sum_{n=1}^{\infty} \sqrt{n} \left( \frac{n}{3n-1} \right)^{2n}.$$

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

$$8.29. \sum_{n=1}^{\infty} \frac{n \cdot 3^{n+2}}{5^n}.$$

$$8.30. \sum_{n=2}^{\infty} \sqrt[3]{n} \left( \frac{n-2}{2n+1} \right)^{3n}.$$

$$8.31. \sum_{n=1}^{\infty} n^4 \operatorname{arctg}^{2n} \frac{\pi}{4n}.$$

**Задача 9. Исследовать на сходимость числовой ряд**

$$9.1. \sum_{n=2}^{\infty} \frac{1}{n \ln^2 (3n+1)}.$$

$$9.2. \sum_{n=1}^{\infty} \frac{1}{n \ln^2 (2n+1)}.$$

$$9.3. \sum_{n=1}^{\infty} \frac{1}{(2n+3)\ln^2(2n+1)}.$$

$$9.4. \sum_{n=3}^{\infty} \frac{1}{(3n-5)\ln^2(4n-7)}.$$

$$9.5. \sum_{n=1}^{\infty} \frac{1}{(3n+4)\ln^2(5n+2)}.$$

$$9.6. \sum_{n=1}^{\infty} \frac{1}{(2n+1)\ln^2(n\sqrt{5}+2)}.$$

$$9.7. \sum_{n=1}^{\infty} \frac{1}{(n\sqrt{2}+1)\ln^2(n\sqrt{3}+1)}.$$

$$9.8. \sum_{n=5}^{\infty} \frac{1}{(n-2)\ln(n-3)}.$$

$$9.9. \sum_{n=1}^{\infty} \frac{1}{(2n-1)\ln(2n)}.$$

$$9.10. \sum_{n=1}^{\infty} \frac{1}{(n+1)\ln(2n)}.$$

$$9.11. \sum_{n=2}^{\infty} \frac{1}{(3n-1)\ln n}.$$

$$9.12. \sum_{n=2}^{\infty} \frac{1}{(2n-1)\ln(n+1)}.$$

$$9.13. \sum_{n=2}^{\infty} \frac{1}{(2n-3)\ln(3n+1)}.$$

$$9.14. \sum_{n=2}^{\infty} \frac{1}{(n+2)\ln^2 n}.$$

$$9.15. \sum_{n=2}^{\infty} \frac{1}{(n+3)\ln^2(2n)}.$$

$$9.16. \sum_{n=2}^{\infty} \frac{1}{(2n+3)\ln^2(n+1)}.$$

$$9.17. \sum_{n=3}^{\infty} \frac{1}{n\ln(n-1)}.$$

$$9.18. \sum_{n=2}^{\infty} \frac{1}{2n\sqrt{\ln(3n-1)}}.$$

$$9.19. \sum_{n=5}^{\infty} \frac{1}{(n-2)\sqrt{\ln(n-3)}}.$$

$$9.20. \sum_{n=4}^{\infty} \frac{1}{(3n-1)\sqrt{\ln(n-2)}}.$$

$$9.21. \sum_{n=2}^{\infty} \frac{1}{(n+5)\ln^2(n+1)}.$$

$$9.22. \sum_{n=2}^{\infty} \frac{1}{(n/3)\ln^2(n+7)}.$$

$$9.23. \sum_{n=2}^{\infty} \frac{n^2}{(n^3+1)\ln n}.$$

$$9.24. \sum_{n=3}^{\infty} \frac{n}{(n^2-3)\ln^2 n}.$$

$$9.25. \sum_{n=4}^{\infty} \frac{1}{(n/3-1)\ln^2(n/2)}.$$

$$9.26. \sum_{n=2}^{\infty} \frac{n}{(n^2+5)\ln n}.$$

$$9.27. \sum_{n=2}^{\infty} \frac{3n}{(2n^2+3)\ln n}.$$

$$9.28. \sum_{n=4}^{\infty} \frac{n+1}{(5n^2-9)\ln(n-2)}.$$

$$9.29. \sum_{n=3}^{\infty} \frac{2n+1}{(3n^2/2+2)\ln(n/2)}.$$

$$9.30. \sum_{n=2}^{\infty} \frac{n}{(n^2-1)\ln n}.$$

$$9.31. \sum_{n=2}^{\infty} \frac{3n}{(n^2-2)\ln(2n)}.$$

**Задача 10. Исследовать на сходимость и абсолютную сходимость  
знакопеременные числовые ряды**

$$10.1. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{(n+1) \cdot 3^n}$$

$$10.7. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{1}{n^2}$$

$$10.2. \sum_{n=0}^{\infty} \frac{(-1)^n}{\sqrt{2n+1}}$$

$$10.8. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{(2n+5)n}$$

$$10.3. \sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{\ln n}$$

$$10.9. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{\sqrt{n+1}}$$

$$10.4. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{n}{6n+5}$$

$$10.10. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^3 \sqrt{n}}$$

$$10.5. \sum_{n=1}^{\infty} (-1)^n \frac{1}{\sqrt[4]{n^5}}$$

$$10.11. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2n+1}{n(n+1)}$$

$$10.6. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{\sqrt{n}}$$

$$10.12. \sum_{n=1}^{\infty} (-1)^n \frac{n+5}{3^n}$$

$$10.13. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{n}{3n-1}$$

$$10.23. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2n+1}{5n(n+1)}$$

$$10.14. \sum_{n=1}^{\infty} \frac{(-1)^n}{2n-1}$$

$$10.24. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2n+1}$$

$$10.15. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n-1) \cdot 3^n}$$

$$10.25. \sum_{n=1}^{\infty} \frac{(-1)^{n+1} \cdot 3^n}{(2n+1)^n}$$

$$10.16. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n}$$

$$10.26. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{\sqrt{n+5}}$$

$$10.17. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2n+1}{n}$$

$$10.27. \sum_{n=1}^{\infty} (-1)^n \frac{n+5}{3^n}$$

$$10.18. \sum_{n=1}^{\infty} \frac{(-1)^n}{3n^2+1}$$

$$10.28. \sum_{n=1}^{\infty} (-1)^{n+1} \left( \frac{1}{2n+7} \right)^n$$

$$10.19. \sum_{n=1}^{\infty} \frac{(-1)^n}{n\sqrt{n}}$$

$$10.29. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(3n-2)!}$$

$$10.20. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n \cdot 5^n}$$

$$10.30. \sum_{n=1}^{\infty} (-1)^n \ln \left( 1 + \frac{1}{n^2} \right)$$

$$10.21. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n!}$$

$$10.31. \sum_{n=1}^{\infty} (-1)^{n+1} \operatorname{arctg} n$$

$$10.22. \sum_{n=1}^{\infty} (-1)^n \frac{3}{\ln(n+1)}$$

**Задача 11. Исследовать на сходимость числовой ряд**

$$11.1. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2n+1}{n(n+1)}.$$

$$11.2. \sum_{n=1}^{\infty} (-1)^{n+1} \left( \frac{n}{2n+1} \right)^n.$$

$$11.3. \sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{\ln(n+1)}.$$

$$11.4. \sum_{n=3}^{\infty} \frac{(-1)^n}{n(\ln \ln n) \ln n}.$$

$$11.5. \sum_{n=1}^{\infty} \frac{(-1)^n 2n^2}{n^4 - n^2 + 1}.$$

$$11.6. \sum_{n=3}^{\infty} \frac{(-1)^n}{(n+1) \ln n}.$$

$$11.7. \sum_{n=3}^{\infty} \frac{(-1)^n}{n \ln(n+1)}.$$

$$11.8. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^4 \sqrt[4]{2n+3}}.$$

$$11.9. \sum_{n=1}^{\infty} \frac{(-1)^n \sin \frac{\pi}{2\sqrt{n}}}{\sqrt{3n+1}}.$$

$$11.10. \sum_{n=1}^{\infty} (-1)^n \cos \frac{\pi}{6n}.$$

$$11.11. \sum_{n=1}^{\infty} \frac{\sin n}{n!}.$$

$$11.12. \sum_{n=3}^{\infty} \frac{(-1)^n}{n \ln(2n)}.$$

$$11.13. \sum_{n=1}^{\infty} (-1)^n \operatorname{tg} \frac{1}{n}.$$

$$11.14. \sum_{n=1}^{\infty} \frac{\cos n}{n^2}.$$

$$11.15. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(n+1)2^{2n}}.$$

$$11.16. \sum_{n=1}^{\infty} \frac{(-1)^n}{\cos \frac{\pi}{3\sqrt{n}} \sqrt[3]{3n + \ln n}}.$$

$$11.17. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(n+1)(3/2)^n}.$$

$$11.18. \sum_{n=1}^{\infty} (-1)^n \frac{2n-1}{3n}.$$

$$11.19. \sum_{n=1}^{\infty} \frac{(-1)^n (n+3)}{\ln(n+4)}.$$

$$11.20. \sum_{n=1}^{\infty} (-1)^n \frac{n+1}{\sqrt{n^3}}.$$

$$11.21. \sum_{n=1}^{\infty} \frac{(-1)^n \operatorname{tg} \frac{\pi}{4\sqrt{n}}}{\sqrt{5n-1}}.$$

$$11.22. \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)2^{2n+1}}.$$



$$11.23. \sum_{n=1}^{\infty} (-1)^n \frac{\sin(n\sqrt{n})}{n\sqrt{n}}.$$

$$11.24. \sum_{n=1}^{\infty} \frac{(-1)^n}{n + \cos\left(2/\sqrt{n+4}\right)}.$$

$$11.25. \sum_{n=1}^{\infty} (-1)^n \sin \frac{\pi}{2^n}.$$

$$11.26. \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2 + \sin^2 n}.$$

$$11.27. \sum_{n=1}^{\infty} (-1)^n \frac{\sin 3^n}{3^n}.$$

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

$$11.29. \sum_{n=1}^{\infty} (-1)^n \sin \frac{1}{n} \cdot \operatorname{tg} \frac{1}{n}.$$

$$11.30. \sum_{n=1}^{\infty} (-1)^n \left(1 - \cos \frac{1}{\sqrt{n}}\right).$$

$$11.31. \sum_{n=1}^{\infty} (-1)^n \frac{n^3}{(n+1)!}.$$

**Задача 12. Вычислить сумму числового ряда с точностью  $\alpha$**

$$12.1. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{3n^2}, \quad \alpha = 0,01.$$

$$12.2. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n!}, \quad \alpha = 0,01.$$

$$12.3. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{(2n)^3}, \quad \alpha = 0,001.$$

$$12.4. \sum_{n=0}^{\infty} (-1)^n \frac{1}{n!(2n+1)}, \quad \alpha = 0,001.$$

$$12.5. \sum_{n=1}^{\infty} (-1)^n \frac{2n+1}{n^3(n+1)}, \quad \alpha = 0,01.$$

$$12.6. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!}, \quad \alpha = 0,0001.$$

$$12.7. \sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{2^n}, \quad \alpha = 0,1.$$

$$12.8. \sum_{n=1}^{\infty} \frac{(-1)^n \cdot n^2}{3^n}, \quad \alpha = 0,1.$$

$$12.9. \sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{(2n-1)^2 (2n+1)^2}, \quad \alpha = 0,001.$$

$$12.10. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!!}, \quad \alpha = 0,0001.$$

$$12.11. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!!}, \quad \alpha = 0,001.$$

$$12.12. \sum_{n=0}^{\infty} \left(-\frac{2}{5}\right)^n, \quad \alpha = 0,01.$$

$$12.13. \sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{7^n}, \quad \alpha = 0,0001.$$

$$12.14. \sum_{n=0}^{\infty} \left(-\frac{2}{3}\right)^n, \quad \alpha = 0,1.$$

$$12.15. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!}, \quad \alpha = 0,001.$$

$$12.16. \sum_{n=0}^{\infty} \frac{(-1)^n}{3n!}, \quad \alpha = 0,01.$$

$$12.17. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!2n}, \quad \alpha = 0,00001.$$

$$12.18. \sum_{n=1}^{\infty} \frac{(-1)^n \cdot (2n+1)}{(2n)!n!}, \quad \alpha = 0,001.$$

$$12.19. \sum_{n=1}^{\infty} \frac{(-1)^n}{2^n \cdot n!}, \quad \alpha = 0,001.$$

$$12.20. \sum_{n=1}^{\infty} \frac{(-1)^n}{3^n \cdot n!}, \quad \alpha = 0,001.$$

$$12.21. \sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!n!}, \quad \alpha = 0,00001.$$

$$12.22. \sum_{n=0}^{\infty} \frac{\cos \pi n}{3^n (n+1)}, \quad \alpha = 0,001.$$

$$12.23. \sum_{n=0}^{\infty} \frac{(-1)^n}{4^n (2n+1)}, \quad \alpha = 0,001.$$

$$12.24. \sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3}, \quad \alpha = 0,01.$$

$$12.25. \sum_{n=0}^{\infty} \frac{(-1)^n \cdot 2^n}{(n+1)^n}, \quad \alpha = 0,001.$$

$$12.26. \sum_{n=0}^{\infty} \frac{(-1)^n}{(n+1)^n}, \quad \alpha = 0,001.$$

$$12.27. \sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3 + 1}, \quad \alpha = 0,01.$$

$$12.28. \sum_{n=1}^{\infty} \frac{(-1)^n}{n^3 (n+3)}, \quad \alpha = 0,01.$$

$$12.29. \sum_{n=0}^{\infty} \frac{\cos(\pi n)}{(n^3 + 1)^2}, \quad \alpha = 0,001.$$

$$12.30. \sum_{n=0}^{\infty} \frac{(-1)^n}{1 + n^2}, \quad \alpha = 0,01.$$

$$12.31. \sum_{n=0}^{\infty} \frac{(-1)^n \cdot n}{(1 + n^3)^2}, \quad \alpha = 0,001.$$

**Задача 13. Доказать справедливость равенства. (Ответом служит число, получаемое при применении признака Даламбера или признака Коши)**

$$13.1. \lim_{n \rightarrow \infty} \frac{n!}{n^n} = 0.$$

$$13.2. \lim_{n \rightarrow \infty} \frac{n^n}{(2n)!} = 0.$$

$$13.3. \lim_{n \rightarrow \infty} \frac{2n!!}{n^n} = 0.$$

$$13.4. \lim_{n \rightarrow \infty} \frac{(2n)^n}{(2n-1)!} = 0.$$

$$13.5. \lim_{n \rightarrow \infty} \frac{(2n)!}{2n^2!} = 0.$$

$$13.6. \lim_{n \rightarrow \infty} \frac{n^n}{(n!)^2} = 0.$$

$$13.7. \lim_{n \rightarrow \infty} \frac{(2n)!!}{5^{n^2}} = 0.$$

$$13.8. \lim_{n \rightarrow \infty} \frac{n^2}{n!} = 0.$$

$$13.9. \lim_{n \rightarrow \infty} \frac{(n+1)!}{n^n} = 0.$$

$$13.10. \lim_{n \rightarrow \infty} \frac{n^n}{(2n+1)!} = 0.$$

$$13.11. \lim_{n \rightarrow \infty} \frac{(2n-1)!!}{n^n} = 0.$$

$$13.12. \lim_{n \rightarrow \infty} \frac{(3n)^n}{(2n-1)!} = 0.$$

$$13.13. \lim_{n \rightarrow \infty} \frac{(3n)!}{2^{n^2}} = 0.$$

$$13.14. \lim_{n \rightarrow \infty} \frac{n^n}{(n!)^3} = 0.$$

$$13.15. \lim_{n \rightarrow \infty} \frac{n^5}{(2n)!} = 0.$$

$$13.16. \lim_{n \rightarrow \infty} \frac{2^{3n}}{n!} = 0.$$

$$13.17. \lim_{n \rightarrow \infty} \frac{(n+2)!}{n^n} = 0.$$

$$13.18. \lim_{n \rightarrow \infty} \frac{n^n}{(2n-1)!} = 0.$$

$$13.19. \lim_{n \rightarrow \infty} \frac{(2n+1)!!}{n^n} = 0.$$

$$13.20. \lim_{n \rightarrow \infty} \frac{(2n)^n}{(2n+1)!} = 0.$$

$$13.21. \lim_{n \rightarrow \infty} \frac{(4n)!}{2^{n^2}} = 0.$$

$$13.22. \lim_{n \rightarrow \infty} \frac{n^n}{[(n+1)!]^2} = 0.$$

$$13.23. \lim_{n \rightarrow \infty} \frac{n^3}{4^{n^2}} = 0.$$

$$13.24. \lim_{n \rightarrow \infty} \frac{n!}{2^{n^2}} = 0.$$

$$13.25. \lim_{n \rightarrow \infty} \frac{(n+3)!}{n^n} = 0.$$

$$13.26. \lim_{n \rightarrow \infty} \frac{n^n}{(2n+3)!} = 0.$$

$$13.27. \lim_{n \rightarrow \infty} \frac{(2n+3)!!}{n^n} = 0.$$

$$13.28. \lim_{n \rightarrow \infty} \frac{(5n)^n}{(2n+1)!} = 0.$$

$$13.29. \lim_{n \rightarrow \infty} \frac{(5n)!}{2^{n^2}} = 0.$$

$$13.30. \lim_{n \rightarrow \infty} \frac{n^n}{[(n+2)!]^2} = 0.$$

$$13.31. \lim_{n \rightarrow \infty} \frac{n^2 + 1}{(2n)!!} = 0.$$

**Задача 14. Найти область сходимости ряда**

$$14.1. \sum_{n=1}^{\infty} \frac{2^n x^n}{n^2 + 1}$$

$$14.5. \sum_{n=1}^{\infty} \frac{x^n}{n}$$

$$14.2. \sum_{n=1}^{\infty} \frac{nx^{n-1}}{2^{n-1} \cdot 3^n}$$

$$14.6. \sum_{n=1}^{\infty} \frac{x^{2n+1}}{2n+1}$$

$$14.3. \sum_{n=1}^{\infty} \frac{x^{3n}}{8^n}$$

$$14.7. \sum_{n=1}^{\infty} \frac{2^n x^n}{2n-1}$$

$$14.4. \sum_{n=1}^{\infty} \frac{x^n}{n \cdot 2^n}$$

$$14.8. \sum_{n=1}^{\infty} (\ln x)^n$$

$$14.9. \sum_{n=1}^{\infty} \frac{x^n}{n(n+1)}$$

$$14.21. \sum_{n=1}^{\infty} \frac{x^n}{\sqrt{n}}$$

$$14.10. \sum_{n=1}^{\infty} \frac{x^{3n}}{8^n(n^2+1)}$$

$$14.22. \sum_{n=1}^{\infty} \frac{2^n x^n}{\sqrt{n}}$$

$$14.11. \sum_{n=1}^{\infty} n(n+1)x^n$$

$$14.23. \sum_{n=1}^{\infty} \frac{(-x)^{n+1}}{n^3}$$

$$14.12. \sum_{n=1}^{\infty} x^n \operatorname{tg} \frac{x}{2^n}$$

$$14.24. \sum_{n=1}^{\infty} \frac{3^n x^n}{\sqrt[3]{n}}$$

$$14.13. \sum_{n=1}^{\infty} \frac{10^n x^n}{\sqrt{n}}$$

$$14.25. \sum_{n=1}^{\infty} \frac{x^n}{2^n \sqrt{3n-1}}$$

$$14.14. \sum_{n=1}^{\infty} \frac{n! x^n}{n^n}$$

$$14.26. \sum_{n=1}^{\infty} \frac{2^n x^n}{\sqrt{2n-1}}$$

$$14.15. \sum_{n=1}^{\infty} \frac{x^{n+1}}{5^{n+1} n}$$

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

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

$$14.28. \sum_{n=1}^{\infty} \frac{5^n x^n}{6^n \sqrt[3]{n}}$$

$$14.17. \sum_{n=1}^{\infty} \frac{(0,1)^n x^{2n}}{n}$$

$$14.29. \sum_{n=1}^{\infty} x^n \operatorname{tg} \frac{1}{n}$$

$$14.18. \sum_{n=1}^{\infty} (\lg x)^n$$

$$14.30. \sum_{n=1}^{\infty} \left( \frac{n}{n+1} \right)^{n^2} \frac{x^n}{5^n}$$

$$14.19. \sum_{n=1}^{\infty} \frac{x^n}{5^n}$$

$$14.31. \sum_{n=1}^{\infty} \frac{x^n}{\sqrt{n^3}}$$

$$14.20. \sum_{n=1}^{\infty} \frac{5^n x^n}{(2n+1)^2 \sqrt{3^n}}$$

**Задача 15. Найти область сходимости ряда**

15.1.  $\sum_{n=1}^{\infty} \frac{\sqrt{n} x^n}{n!}$

15.2.  $\sum_{n=1}^{\infty} \frac{n^{n/2} x^n}{(n+1)!}$

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

15.4.  $\sum_{n=1}^{\infty} (nx)^n$

15.5.  $\sum_{n=1}^{\infty} \frac{(x-3)^n}{n!}$

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

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

15.8.  $\sum_{n=1}^{\infty} \sin \frac{x}{2^n}$

15.9.  $\sum_{n=1}^{\infty} e^{-n^2 x}$

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

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

15.12.  $\sum_{n=1}^{\infty} \frac{n^3}{x^n}$

15.13.  $\sum_{n=1}^{\infty} \frac{1}{\sqrt[3]{nx^n}}$

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

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

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

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

15.18.  $\sum_{n=1}^{\infty} \frac{1}{(nx)^n}$

15.19.  $\sum_{n=1}^{\infty} \frac{1}{n^x}$

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

15.21.  $\sum_{n=0}^{\infty} 2^n \sin \frac{x}{3^n}$

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

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

15.24.  $\sum_{n=1}^{\infty} n! x^n$

$$15.25. \sum_{n=1}^{\infty} \frac{x^n}{n^n}$$

$$15.29. \sum_{n=1}^{\infty} \frac{1}{x^n}$$

$$15.26. \sum_{n=1}^{\infty} \frac{\sin nx}{n^2}$$

$$15.30. \sum_{n=1}^{\infty} \frac{\cos nx}{n^2}$$

$$15.27. \sum_{n=1}^{\infty} e^{-n^3 x}$$

$$15.31. \sum_{n=1}^{\infty} e^{-n^2 x^2}$$

$$15.28. \sum_{n=1}^{\infty} \frac{nx}{e^{nx}}$$

**Задача 16. Найти область сходимости ряда**

$$16.1. \sum_{n=1}^{\infty} \frac{(x-4)^{2n-1}}{2n-1}$$

$$16.8. \sum_{n=1}^{\infty} \frac{(x+5)^n}{\sqrt[3]{n+1}\sqrt{n^2+1}}$$

$$16.2. \sum_{n=1}^{\infty} \frac{(x-2)^n}{n^n \ln(1+1/n)}$$

$$16.9. \sum_{n=0}^{\infty} 2^{n^2} (x+2)^{n^2}$$

$$16.3. \sum_{n=1}^{\infty} \frac{(x-2)^n}{2^n}$$

$$16.10. \sum_{n=1}^{\infty} \frac{(x-1)^n}{2^n \ln(n+1)}$$

$$16.4. \sum_{n=1}^{\infty} \frac{(x-1)^n}{n^2}$$

$$16.11. \sum_{n=1}^{\infty} \frac{n!(x+10)^n}{n^n}$$

$$16.5. \sum_{n=1}^{\infty} \frac{(x+8)^n}{n^2}$$

$$16.12. \sum_{n=0}^{\infty} \frac{(x+5)^{n^2}}{(n+1)^n}$$

$$16.6. \sum_{n=1}^{\infty} (2+x)^n$$

$$16.13. \sum_{n=0}^{\infty} \frac{\sqrt{\ln^3(n+1)}}{n+1} (x+1)^n$$

$$16.7. \sum_{n=1}^{\infty} \frac{(x-1)^n}{2^n (n+3)}$$

$$16.14. \sum_{n=0}^{\infty} (2-x)^n \sin \frac{\pi}{2^n}$$

$$16.15. \sum_{n=1}^{\infty} \frac{(3-2x)^n}{n - \ln^2 n}$$

$$16.24. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-2)^{2n}}{2n}$$

$$16.16. \sum_{n=0}^{\infty} \frac{(3n-2)(x-3)^n}{(n+1)^2 \cdot 2^{n+1}}$$

$$16.25. \sum_{n=1}^{\infty} \frac{(x-1)^{2n}}{n \cdot 9^n}$$

$$16.17. \sum_{n=1}^{\infty} \frac{(x-2)^n}{n^2}$$

$$16.26. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{(x-2)^n}{(n+1) \ln(n+1)}$$

$$16.18. \sum_{n=1}^{\infty} \frac{(x-2)^n}{(2n-1) \cdot 2^n}$$

$$16.27. \sum_{n=1}^{\infty} \frac{(x-3)^n}{n \cdot 5^n}$$

$$16.19. \sum_{n=0}^{\infty} (-1)^n \frac{\sqrt[3]{n+2}}{n+1} (x-2)^n$$

$$16.28. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{(2n-1)^{2n} (x-1)^n}{(3n-2)^{2n}}$$

$$16.20. \sum_{n=1}^{\infty} \frac{(x+5)^{2n-1}}{2n \cdot 4^n}$$

$$16.29. \sum_{n=1}^{\infty} \frac{(x-3)^{2n}}{(n+1) \ln(n+1)}$$

$$16.21. \sum_{n=1}^{\infty} \frac{(2n-1)^n (x+1)^n}{2^{n-1} n^n}$$

$$16.30. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-5)^n}{n \cdot 3^n}$$

$$16.22. \sum_{n=1}^{\infty} \frac{(x+3)^n}{n^2}$$

$$16.31. \sum_{n=1}^{\infty} \frac{(x+2)^n}{n^3}$$

$$16.23. \sum_{n=1}^{\infty} \frac{(x+2)^{n^2}}{n^n}$$

**Задача 17. Найти область сходимости функционального ряда**

$$17.1. \sum_{n=1}^{\infty} \frac{(-1)^n}{(x+n)^{-1/5}}.$$

$$17.2. \sum_{n=1}^{\infty} \frac{(-1)^n}{2n-1} \left( \frac{1-x}{1+x} \right)^n.$$

$$17.3. \sum_{n=1}^{\infty} \frac{n}{n+1} \frac{1}{(3x^2 + 4x + 2)^n}.$$

$$17.4. \sum_{n=1}^{\infty} \frac{n+1}{3^n} (x^2 - 4x + 6)^n.$$



$$17.5. \sum_{n=1}^{\infty} \frac{x^n}{1-x^n}.$$

$$17.6. \sum_{n=1}^{\infty} \frac{n+3}{n+1} \frac{1}{(27x^2+12x+2)^n}.$$

$$17.7. \sum_{n=1}^{\infty} \frac{x^n}{1+x^{2n}}.$$

$$17.8. \sum_{n=1}^{\infty} \frac{n2^n}{n+1} \frac{1}{(3x^2+8x+6)^n}.$$

$$17.9. \sum_{n=1}^{\infty} \frac{1}{n+3} \left( \frac{1+x}{1-x} \right)^n.$$

$$17.10. \sum_{n=1}^{\infty} \frac{(x^2-6x+12)^n}{4^n(n^2+1)}.$$

$$17.11. \sum_{n=1}^{\infty} \frac{1}{\left( \sqrt[3]{n^2} + \sqrt{n} + 1 \right)^{2x+1}}.$$

$$17.12. \sum_{n=1}^{\infty} \frac{(-1)^n}{(x+n)^3}.$$

$$17.13. \sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt[3]{x+n}}.$$

$$17.14. \sum_{n=1}^{\infty} \frac{(x^2-5x+11)^n}{5^n(n^2+5)}.$$

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

$$17.16. \sum_{n=1}^{\infty} \frac{1}{n(n+x)}.$$

$$17.17. \sum_{n=1}^{\infty} \frac{(-1)^n}{(x+n)^2}.$$

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

$$17.19. \sum_{n=1}^{\infty} \frac{n+1}{xn^x}.$$

$$17.20. \sum_{n=1}^{\infty} \frac{\sqrt{n}}{n^{x^2-1}}.$$

$$17.21. \sum_{n=1}^{\infty} \frac{n^2}{2^n(n^2+1)} (25x^2+1)^n.$$

$$17.22. \sum_{n=1}^{\infty} \frac{\sqrt[3]{n}}{x^2+n^2}.$$

$$17.23. \sum_{n=1}^{\infty} \frac{2n^3}{n^3+2} \frac{1}{(3x^2+10x+9)^n}.$$

$$17.24. \sum_{n=1}^{\infty} \frac{(-1)^n}{x+2^n}.$$

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

$$17.26. \sum_{n=1}^{\infty} \frac{|x|^n + |x|^{-n}}{2}.$$

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

$$17.28. \sum_{n=1}^{\infty} \frac{(-1)^n n}{(n-e^x)(n^2+1)}.$$

$$17.29. \sum_{n=1}^{\infty} \frac{(-1)^n}{(n-x)^{1/3}}.$$

$$17.30. \sum_{n=1}^{\infty} \frac{\sqrt{x}}{3^{nx} + 2}.$$

$$17.31. \sum_{n=1}^{\infty} \frac{x}{n+x^2}.$$

**Задача 18. Найти область сходимости функционального ряда**

$$18.1. \sum_{n=1}^{\infty} \frac{9^n}{n} x^{2n} \sin(x + \pi n).$$

$$18.2. \sum_{n=1}^{\infty} \frac{4^n}{n} x^{4n} \sin(2x - \pi n).$$

$$18.3. \sum_{n=1}^{\infty} \frac{3^n}{n} x^{4n} \cos(x + \pi n).$$

$$18.4. \sum_{n=1}^{\infty} \left(\frac{5}{3}\right)^n \frac{1}{\sqrt{n}} x^{2n} \cos(x - \pi n).$$

$$18.5. \sum_{n=1}^{\infty} \frac{2^{3n}}{\sqrt[3]{n}} x^{4n} \sin(3x + \pi n).$$

$$18.6. \sum_{n=1}^{\infty} \frac{6^n}{n} x^{2n} \sin(5x - \pi n).$$

$$18.7. \sum_{n=1}^{\infty} \frac{5^n}{\sqrt[4]{3n}} x^{2n} \cos(x + \pi n).$$

$$18.8. \sum_{n=1}^{\infty} \frac{9^n}{2n} x^{2n} \sin(3x - \pi n).$$

$$18.9. \sum_{n=1}^{\infty} 2^n x^{3n} \sin \frac{x}{n}.$$

$$18.10. \sum_{n=1}^{\infty} 3^{2n} x^n \sin \frac{x}{2n}.$$

$$18.11. \sum_{n=1}^{\infty} 2^{3n} x^n \sin \frac{2x}{n}.$$

$$18.12. \sum_{n=1}^{\infty} 3^n x^{3n} \sin \frac{3x}{\sqrt{n}}.$$

$$18.13. \sum_{n=1}^{\infty} 3^n x^n \operatorname{tg} \frac{3x}{n}.$$

$$18.14. \sum_{n=1}^{\infty} 8^n x^{3n} \operatorname{tg} \frac{x}{4\sqrt{n}}.$$

$$18.15. \sum_{n=1}^{\infty} x^{3n} \operatorname{tg} \frac{2x}{3n}.$$

$$18.16. \sum_{n=1}^{\infty} 2^n x^{3n} \arcsin \frac{x}{3n}.$$

$$18.17. \sum_{n=1}^{\infty} 16^n x^{3n} \arcsin \frac{x}{\sqrt[3]{n}}.$$

$$18.18. \sum_{n=1}^{\infty} 32^n x^{5n} \arcsin \frac{x}{\sqrt{n}}.$$

$$18.19. \sum_{n=1}^{\infty} 2^n x^n \operatorname{arctg} \frac{2x}{n+1}.$$

$$18.20. \sum_{n=1}^{\infty} 2^n x^{3n} \operatorname{arctg} \frac{x}{2(n+3)}$$

$$18.21. \sum_{n=1}^{\infty} 27^n x^{3n} \operatorname{arctg} \frac{3x}{2n+3}.$$

$$18.22. \sum_{n=1}^{\infty} \frac{8^n}{n^2} \sin^{3n} x.$$

$$18.23. \sum_{n=1}^{\infty} 8^n n^2 \sin^{3n} x.$$

$$18.24. \sum_{n=1}^{\infty} \frac{2^n}{\sqrt{n}} \sin^{2n}(2x).$$

$$18.25. \sum_{n=1}^{\infty} \frac{3^n}{n} \operatorname{tg}^{2n} x$$

$$18.26. \sum_{n=1}^{\infty} \frac{2^n}{n^4} \sin^n(3x).$$

$$18.27. \sum_{n=1}^{\infty} \frac{4^n}{n^2} \sin^{2n} x.$$

$$18.28. \sum_{n=1}^{\infty} \frac{1}{n^3} \operatorname{tg}^n(2x)$$

$$18.29. \sum_{n=1}^{\infty} \frac{1}{n^2} \operatorname{tg}^n x.$$

$$18.30. \sum_{n=1}^{\infty} \frac{1}{n \cdot 3^{n/2}} \operatorname{tg}^n x.$$

$$18.31. \sum_{n=1}^{\infty} \frac{4 \cdot 3^{n/2}}{\sqrt{n}} \operatorname{tg}^n(2x)$$

**Задача 19. Найти область сходимости функционального ряда**

$$19.1. \sum_{n=1}^{\infty} \frac{(n-2)^3 (x+3)^{2n}}{2n+3}.$$

$$19.2. \sum_{n=1}^{\infty} \frac{(-1)^n (x-3)^n}{(n+1)5^n}.$$

$$19.3. \sum_{n=1}^{\infty} \frac{(x-1)^{2n}}{n9^n}.$$

$$19.4. \sum_{n=1}^{\infty} \frac{2n+3}{(n+1)^5 x^{2n}}.$$

$$19.5. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-2)^{2n}}{2n}.$$

$$19.6. \sum_{n=1}^{\infty} \frac{(x-5)^{2n+1}}{3n+8}.$$

$$19.7. \sum_{n=1}^{\infty} \frac{n^3+1}{3^n(x-2)^n}.$$

$$19.8. \sum_{n=1}^{\infty} \frac{n!}{x^n}.$$

$$19.9. \sum_{n=1}^{\infty} \frac{(x+5)^{2n-1}}{4^n(2n-1)}.$$

$$19.10. \sum_{n=1}^{\infty} \frac{(x-7)^{2n-1}}{(2n^2-5n)4^n}.$$

$$19.11. \sum_{n=1}^{\infty} \frac{(x-2)^n}{(3n+1)2^n}.$$

$$19.12. \sum_{n=2}^{\infty} \frac{3n(x-2)^{3n}}{(5n-8)^3}.$$

$$19.13. \sum_{n=1}^{\infty} (x+5)^n \operatorname{tg} \frac{1}{3^n}.$$

$$19.14. \sum_{n=1}^{\infty} \sin \frac{\sqrt{n}}{n^2+1} (x-2)^n.$$

$$19.15. \sum_{n=1}^{\infty} \frac{1}{n \cdot 9^n (x-1)^{2n}}.$$

$$19.16. \sum_{n=1}^{\infty} 3^{n^2} x^{n^2}.$$

$$19.17. \sum_{n=1}^{\infty} \frac{(x+2)^{n^2}}{n^n}.$$

$$19.18. \sum_{n=1}^{\infty} \frac{n^5}{(n+1)!} (x+5)^{2n+1}.$$

$$19.19. \sum_{n=1}^{\infty} \frac{(3n-2)(x-3)^n}{(n+1)^2 2^{n+1}}.$$

$$19.20. \sum_{n=1}^{\infty} \frac{(x-5)^n}{(n+4) \ln(n+4)}.$$

$$19.21. \sum_{n=2}^{\infty} \frac{1}{(n+2) \ln(n+2) (x-3)^{2n}}.$$

$$19.22. \sum_{n=5}^{\infty} \frac{1}{2^n n^2 (x+2)^n}.$$

$$19.23. \sum_{n=1}^{\infty} \frac{(x-4)^{n^2}}{n^{n+1}}.$$

$$19.24. \sum_{n=1}^{\infty} \frac{n^5}{x^n}.$$

$$19.25. \sum_{n=5}^{\infty} \frac{\sqrt{n+1}}{3^n (x+3)^n}.$$

$$19.26. \sum_{n=1}^{\infty} \frac{4^n (x+1)^{2n}}{n}.$$

$$19.27. \sum_{n=1}^{\infty} \frac{3n+5}{(2n+9)^5 (x+2)^{2n}}.$$

$$19.28. \sum_{n=5}^{\infty} \frac{n^2+1}{5^n (x+4)^n}.$$

$$19.29. \sum_{n=1}^{\infty} \frac{(x+2)^n}{(2n+1)3^n}.$$

$$19.30. \sum_{n=1}^{\infty} \frac{n^2 (x-3)^n}{(n^4+1)^2}.$$

$$19.31. \sum_{n=1}^{\infty} \frac{(n+1)^5 x^{2n}}{2n+1}.$$

**Задача 20.** Доказать, исходя из определения, равномерную сходимость функционального ряда на отрезке  $[0,1]$ . При каких  $n$  абсолютная величина остаточного члена ряда не превосходит  $0.1 \quad \forall x \in [0,1]$ ?

$$20.1. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{7n-11}.$$

$$20.2. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{5n-6}.$$

$$20.3. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{4n-6}.$$

$$20.4. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-5}}.$$

$$20.5. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{4n-5}.$$

$$20.6. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{5n-9}.$$

$$20.7. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{3n-4}.$$

$$20.8. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-2}}.$$

$$20.9. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{6n-11}.$$

$$20.10. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-7}}.$$

$$20.11. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{7n-10}.$$

$$20.12. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{6n-8}.$$

$$20.13. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-4}}.$$

$$20.14. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{2n-3}.$$

$$20.15. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{8n-12}.$$

$$20.16. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{6n-7}.$$

$$20.17. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{5n-8}.$$

$$20.18. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{6n-10}.$$

$$20.19. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{4n-7}.$$

$$20.20. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{5n-7}.$$

$$20.21. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{7n-13}.$$

$$20.22. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{8n^3-21}}.$$

$$20.23. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{3n-5}.$$

$$20.24. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{8n^3-19}}.$$

$$20.25. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{8n-11}.$$

$$20.26. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{8n^3-11}}.$$

$$20.27. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{8n^3-12}}.$$

$$20.28. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-3}}.$$

$$20.29. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{9n-15}.$$

$$20.30. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{10n-12}.$$

$$20.31. \sum_{n=1}^{\infty} (-1)^n \frac{x^n}{\sqrt[3]{n^3-6}}.$$

**Задача 21.** Для данного функционального ряда построить мажорирующий ряд и доказать равномерную сходимость на указанном отрезке.

$$21.1. \sum_{n=0}^{\infty} \frac{\sqrt{x+1} \cos nx}{\sqrt[3]{n^5+1}}, [0, 2].$$

$$21.2. \sum_{n=1}^{\infty} \frac{x^n}{n2^n}, \left[-\frac{3}{2}, \frac{3}{2}\right].$$

$$21.3. \sum_{n=1}^{\infty} \frac{x^n}{n^n}, [-2, 2].$$

$$21.4. \sum_{n=1}^{\infty} \frac{n}{n+1} \left(\frac{x}{2}\right)^n, \left[-\frac{3}{2}, \frac{3}{2}\right].$$

$$21.5. \sum_{n=1}^{\infty} x^{n!}, \left[-\frac{1}{2}, \frac{1}{2}\right].$$

$$21.6. \sum_{n=1}^{\infty} \frac{(x-3)^n}{n5^n}, [-1, 6].$$

$$21.7. \sum_{n=0}^{\infty} \frac{(-1)^n (x-3)^n}{(2n+1)\sqrt{n+1}}, [2, 4].$$

$$21.8. \sum_{n=0}^{\infty} \frac{(\pi-x) \cos^2 nx}{\sqrt[4]{n^7+1}}, [0, \pi].$$

$$21.9. \sum_{n=1}^{\infty} \frac{(x-1)^{2n}}{n9^n}, [-1, 3].$$

$$21.10. \sum_{n=1}^{\infty} \frac{n!(x+3)^n}{n^n}, [-5, -1].$$

$$21.11. \sum_{n=1}^{\infty} (-1)^n \frac{(x-2)^{2n}}{(n+1)^2 \ln(n+1)}, [1, 3].$$

$$21.12. \sum_{n=1}^{\infty} \frac{x^n}{n!}, [-3, 3].$$

$$21.13. \sum_{n=1}^{\infty} \frac{2^{n-1} x^{2n-1}}{(4n-3)^2}, \left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right].$$

$$21.14. \sum_{n=1}^{\infty} \frac{x^{n-1}}{n3^n \ln n}, [-2, 2].$$

$$21.15. \sum_{n=1}^{\infty} \frac{(x+5)^{2n-1}}{n^2 4^n}, [-7, -3].$$

$$21.16. \sum_{n=1}^{\infty} \frac{(x+2)^{n^2}}{n^n}, [-3, -1].$$

$$21.17. \sum_{n=1}^{\infty} \frac{(-1)^{n-1} x^n}{n}, \left[-\frac{1}{2}, \frac{1}{2}\right].$$

$$21.18. \sum_{n=0}^{\infty} \frac{(n+1)^4 x^{2n}}{2n+1}, \left[-\frac{1}{2}, \frac{1}{2}\right].$$

$$21.19. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-2)^{2n}}{n}, \left[ \frac{3}{2}, \frac{5}{2} \right].$$

$$21.20. \sum_{n=1}^{\infty} \frac{(x+5)^n}{n^2}, [-6, -4].$$

$$21.21. \sum_{n=1}^{\infty} \frac{(x-2)^n}{(2n-1)2^n}, [1, 3].$$

$$21.22. \sum_{n=1}^{\infty} \frac{(x+1)\sin^2 nx}{n\sqrt{n+1}}, [-3, 0].$$

$$21.23. \sum_{n=1}^{\infty} \frac{x^n}{n(n+2)}, [-1, 1].$$

$$21.24. \sum_{n=0}^{\infty} \frac{(x+5)^n}{\sqrt[3]{n+1}\sqrt{n^2+1}}, [-6, -4].$$

$$21.25. \sum_{n=0}^{\infty} \frac{x^{n^2}}{3^{n^2}}, [-2, 2].$$

$$21.26. \sum_{n=0}^{\infty} \left( \sin \frac{\pi}{2^n} \right) (x-2)^n, [1, 3].$$

$$21.27. \sum_{n=0}^{\infty} \frac{(x-1)^n}{2^n(n+3)}, [0, 2].$$

$$21.28. \sum_{n=1}^{\infty} \frac{(x+1)^{2n}}{n4^n}, [-1, 0].$$

$$21.29. \sum_{n=0}^{\infty} \frac{(-1)^{n-1} n(x+2)^n}{(n+1)\sqrt[3]{n+2}}, [-3, -1].$$

$$21.30. \sum_{n=0}^{\infty} \frac{(x-3)^{2n}}{n\sqrt{n+1}}, [2, 4].$$

$$21.31. \sum_{n=1}^{\infty} \frac{(x+1)^n}{(n+1)\ln^2(n+1)}, [-2, 0].$$

**Задача 22. Найти сумму ряда**

$$22.1. \sum_{n=1}^{\infty} (-1)^{n-1} \left( 1 + \frac{1}{n} \right) x^{n-1}.$$

$$22.2. \sum_{n=2}^{\infty} \frac{x^{2n}}{(2n-3)(2n-2)}.$$

$$22.3. \sum_{n=1}^{\infty} (-1)^{n+1} \left( \frac{1}{n} - \frac{1}{n+2} \right) x^{n+2}.$$

$$22.4. \sum_{n=1}^{\infty} \frac{(-1)^{n-1} x^{2n-1}}{4^n(2n-1)}.$$

$$22.5. \sum_{n=0}^{\infty} \frac{1+(-1)^n}{2n+1} x^{2n+1}.$$

$$22.6. \sum_{n=1}^{\infty} (-1)^{n-1} \left( 1 - \frac{1}{n} \right) \frac{1}{x^n}.$$



$$22.7. \sum_{n=2}^{\infty} \frac{(-1)^{n-1} x^n}{n(n-1)}.$$

$$22.8. \sum_{n=0}^{\infty} \frac{1+(-1)^{n-1}}{2n+1} x^{2n+1}.$$

$$22.9. \sum_{n=1}^{\infty} \frac{x^n}{n(n+1)}.$$

$$22.10. \sum_{n=0}^{\infty} \frac{(-1)^{n-1} x^{2n+2}}{16^n (2n+1)}.$$

$$22.11. \sum_{n=0}^{\infty} \frac{x^{2n+2}}{(2n+1)(2n+2)}.$$

$$22.12. \sum_{n=1}^{\infty} (-1)^{n-1} \left( \frac{1}{n} + \frac{1}{n+1} \right) x^n.$$

$$22.13. \sum_{n=1}^{\infty} (-1)^{n-1} \frac{x^{n+1}}{n(n+1)}.$$

$$22.14. \sum_{n=1}^{\infty} \frac{e^{-nx}}{n}.$$

$$22.15. \sum_{n=1}^{\infty} \frac{x^{2n-1}}{2n(2n-1)}.$$

$$22.16. \sum_{n=1}^{\infty} \left[ (-1)^n + \frac{1}{n} \right] x^{2n}.$$

$$22.17. \sum_{n=1}^{\infty} \left[ 1 + \frac{(-1)^{n+1}}{n} \right] x^{n-1}.$$

$$22.18. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n(n+1)x^{n+1}}.$$

$$22.19. \sum_{n=0}^{\infty} \frac{(-1)^n x^{n+1}}{(n+1)(n+2)}.$$

$$22.20. \sum_{n=2}^{\infty} \frac{\sin^n x}{n(n-1)}.$$

$$22.21. \sum_{n=1}^{\infty} \frac{x^{2n+1}}{2n(2n+1)}.$$

$$22.22. \sum_{n=1}^{\infty} \left( \frac{1}{n} + \frac{1}{n+1} \right) x^n.$$

$$22.23. \sum_{n=0}^{\infty} \frac{x^{n+2}}{(n+1)(n+2)}.$$

$$22.24. \sum_{n=1}^{\infty} \left[ 2^n + \frac{(-1)^n}{n} \right] x^n.$$

$$22.25. \sum_{n=2}^{\infty} \frac{x^{2n}}{(2n-2)(2n-1)}.$$

$$22.26. \sum_{n=2}^{\infty} \frac{x^n}{n(n-1)}.$$

$$22.27. \sum_{n=1}^{\infty} \frac{(-1)^{n+1} \cos^{n+1} x}{n(n+1)}.$$

$$22.28. \sum_{n=1}^{\infty} \frac{(-1)^{n+1} \operatorname{tg}^n x}{n(n+1)}.$$

$$22.29. \sum_{n=0}^{\infty} \frac{3^n}{(n+1)x^{n+1}}.$$

$$22.30. \sum_{n=2}^{\infty} \frac{n+(-1)^n}{n(n-1)} x^n.$$

$$22.31. \sum_{n=0}^{\infty} \frac{x^{2n+2}}{(2n+2)(2n+3)}.$$

**Задача 23. Найти сумму ряда**

$$23.1. \sum_{n=0}^{\infty} (4n^2 + 9n + 5)x^{n+1}.$$

$$23.2. \sum_{n=0}^{\infty} (3n^2 + 7n + 4)x^n.$$

$$23.3. \sum_{n=0}^{\infty} (n^2 + n + 1)x^{n+3}.$$

$$23.4. \sum_{n=0}^{\infty} (2n^2 + 4n + 3)x^{n+2}.$$

$$23.5. \sum_{n=0}^{\infty} (n^2 + 5n + 3)x^n.$$

$$23.6. \sum_{n=0}^{\infty} (2n^2 + 5n + 3)x^{n+1}.$$

$$23.7. \sum_{n=0}^{\infty} (3n^2 + 8n + 5)x^{n+2}.$$

$$23.8. \sum_{n=0}^{\infty} (2n^2 + 8n + 5)x^n.$$

$$23.9. \sum_{n=0}^{\infty} (2n^2 + 7n + 5)x^{n+1}.$$

$$23.10. \sum_{n=0}^{\infty} (3n^2 + 7n + 5)x^n.$$

$$23.11. \sum_{n=0}^{\infty} n(2n-1)x^{n+2}.$$

$$23.12. \sum_{n=0}^{\infty} (n^2 - n + 1)x^n.$$

$$23.13. \sum_{n=0}^{\infty} (2n^2 - n - 1)x^n.$$

$$23.14. \sum_{n=0}^{\infty} (3n^2 + 5n + 4)x^{n+1}.$$

$$23.15. \sum_{n=0}^{\infty} (n^2 + 7n + 4)x^n.$$

$$23.16. \sum_{n=0}^{\infty} (2n^2 - n - 2)x^{n+1}.$$

$$23.17. \sum_{n=0}^{\infty} (2n^2 + 2n + 1)x^n.$$

$$23.18. \sum_{n=0}^{\infty} (n^2 + 2n - 1)x^{n+1}.$$

$$23.19. \sum_{n=0}^{\infty} (n^2 + 2n + 2) x^{n+2}.$$

$$23.20. \sum_{n=0}^{\infty} (n^2 + 4n + 3) x^{n+1}.$$

$$23.21. \sum_{n=0}^{\infty} (n^2 + 5n + 4) x^{n+2}.$$

$$23.22. \sum_{n=0}^{\infty} (2n^2 - 2n + 1) x^n.$$

$$23.23. \sum_{n=0}^{\infty} (n^2 - 2n - 1) x^{n+1}.$$

$$23.24. \sum_{n=0}^{\infty} (n^2 - 2n + 2) x^n.$$

$$23.25. \sum_{n=0}^{\infty} (n^2 - 2n - 2) x^{n+1}.$$

$$23.26. \sum_{n=0}^{\infty} (4n^2 + 6n + 5) x^n.$$

$$23.27. \sum_{n=0}^{\infty} (n^2 + 6n + 5) x^{n+1}.$$

$$23.28. \sum_{n=0}^{\infty} n(2n + 1) x^{n+2}.$$

$$23.29. \sum_{n=0}^{\infty} (2n^2 + n + 1) x^{n+1}.$$

$$23.30. \sum_{n=0}^{\infty} (2n^2 + n - 1) x^n.$$

$$23.31. \sum_{n=0}^{\infty} (n^2 + 9n + 5) x^{n+1}.$$

**Задача 24. Разложить функцию в ряд Тейлора по степеням  $x$**

$$24.1. \frac{9}{20 - x - x^2}.$$

$$24.2. \frac{x^2}{\sqrt{4 - 5x}}.$$

$$24.3. \ln(1 - x - 6x^2).$$

$$24.4. 2x \cos^2(x/2) - x.$$

$$24.5. \frac{\operatorname{sh} 2x}{x} - 2.$$

$$24.6. \frac{7}{12 + x - x^2}.$$

$$24.7. \frac{x}{\sqrt[3]{27 - 2x}}.$$

$$24.8. \ln(1 + x - 6x^2).$$

$$24.9. (x-1)\sin 5x.$$

$$24.10. \frac{\operatorname{ch} 3x - 1}{x^2}.$$

$$24.11. \frac{6}{8+2x-x^2}.$$

$$24.12. \frac{1}{\sqrt[4]{16-3x}}.$$

$$24.13. \ln(1-x-12x^2).$$

$$24.14. (3+e^{-x})^2.$$

$$24.15. \frac{\arcsin x}{x} - 1. \quad 24.16. \frac{\operatorname{arctg} x}{x}.$$

$$24.17. \frac{7}{12-x-x^2}.$$

$$24.18. x^2 \sqrt{4-3x}.$$

$$24.19. \ln(1+2x-8x^2).$$

$$24.20. 2x \sin^2(x/2) - x.$$

$$24.21. (x-1)\operatorname{sh} x.$$

$$24.22. \frac{5}{6+x-x^2}. \quad 24.23. \frac{5}{6-x-x^2}.$$

$$24.24. x\sqrt[3]{27-2x}.$$

$$24.25. \ln(1+x-12x^2).$$

$$24.26. \frac{\sin 3x}{x} - \cos 3x.$$

$$24.27. \sqrt[4]{16-5x}.$$

$$24.28. \ln(1-x-20x^2).$$

$$24.29. (2-e^x)^2. \quad 24.30. (x-1)\operatorname{ch} x.$$

$$24.31. \frac{3}{2-x-x^2}.$$

**Задача 25.** Разложить в ряд Маклорена функцию  $f(x)$  и указать область сходимости полученного ряда к этой функции (задачи 25.1–25.16).

$$25.1. f(x) = \cos 5x$$

$$25.3. f(x) = \sin x^2$$

$$25.2. f(x) = x^3 \operatorname{arctg} x$$

$$25.4. f(x) = \frac{x^2}{1+x}$$

$$25.5. f(x) = \cos \frac{2x^3}{3}$$

$$25.11. f(x) = \operatorname{sh} x$$

$$25.6. f(x) = \frac{2}{1-3x^2}$$

$$25.12. f(x) = e^{-x^4}$$

$$25.7. f(x) = e^{3x}$$

$$25.13. f(x) = 2^{-x^2}$$

$$25.8. f(x) = \frac{1}{1+x}$$

$$25.14. f(x) = 5^x$$

$$25.9. f(x) = \operatorname{ch}(2x^3)$$

$$25.15. f(x) = x \cos \sqrt{x}$$

$$25.10. f(x) = \frac{1}{\sqrt{e^x}}$$

$$25.16. f(x) = \frac{\sin 3x}{x}$$

**Разложить функцию  $f(x)$  в ряд Тейлора в окрестности указанной точки  $x_0$  и найти область сходимости полученного ряда к этой функции (задачи 25.17–25.31)**

$$25.17. f(x) = \frac{1}{x}, x_0 = -2$$

$$25.23. f(x) = \ln(5x+3), x_0 = -2/5$$

$$25.18. f(x) = \frac{1}{x+3}, x_0 = -2$$

$$25.24. f(x) = \ln \frac{1}{x^2 - 2x + 2}, x_0 = 1$$

$$25.19. f(x) = e^x, x_0 = 1$$

$$25.25. f(x) = \frac{1}{\sqrt{4+x}}, x_0 = -3$$

$$25.20. f(x) = \frac{1}{2x+5}, x_0 = 3$$

$$25.26. f(x) = \cos x, x_0 = \pi/4$$

$$25.21. f(x) = \frac{1}{(x-3)^2}, x_0 = 1$$

$$25.27. f(x) = \frac{1}{\sqrt{x-1}}, x_0 = 2$$

$$25.22. f(x) = \sin \frac{\pi x}{4}, x_0 = 2$$

$$25.28. f(x) = \frac{1}{x^2 - 4x + 3}, x_0 = -2$$

$$25.29. f(x) = \sin x, x_0 = a$$

$$25.30. f(x) = \ln(5x + 3), x_0 = 1$$

$$25.31. f(x) = \frac{1}{\sqrt{x}}, x_0 = 1$$

**Задача 26.** Вычислить указанную величину приближенно с заданной степенью точности  $\alpha$ , воспользовавшись разложением в степенной ряд соответствующим образом подобранной функции

$$26.1. e, \alpha = 0,0001$$

$$26.16. \sqrt[3]{e}, \alpha = 0,00001$$

$$26.2. \sqrt[5]{250}, \alpha = 0,01$$

$$26.17. \sin 1^\circ, \alpha = 0,0001$$

$$26.3. \sin 1, \alpha = 0,00001$$

$$26.18. \sqrt[3]{8,36}, \alpha = 0,001$$

$$26.4. \sqrt{1,3}, \alpha = 0,001$$

$$26.19. \ln 10, \alpha = 0,0001$$

$$26.5. \operatorname{arctg} \frac{\pi}{10}, \alpha = 0,001$$

$$26.20. \arcsin \frac{1}{3}, \alpha = 0,001$$

$$26.6. \ln 3, \alpha = 0,0001$$

$$26.21. \lg 7, \alpha = 0,001$$

$$26.7. \operatorname{ch} 2, \alpha = 0,0001$$

$$26.22. \sqrt{e}, \alpha = 0,0001$$

$$26.8. \lg e, \alpha = 0,0001$$

$$26.23. \cos 10^\circ, \alpha = 0,0001$$

$$26.9. \pi, \alpha = 0,00001$$

$$26.24. \frac{1}{\sqrt[3]{30}}, \alpha = 0,001$$

$$26.10. e^2, \alpha = 0,001$$

$$26.25. \sqrt[10]{1080}, \alpha = 0,001$$

$$26.11. \cos 2^\circ, \alpha = 0,001$$

$$26.26. \frac{1}{e}, \alpha = 0,0001$$

$$26.12. \sqrt[3]{80}, \alpha = 0,001$$

$$26.27. \sin \frac{\pi}{100}, \alpha = 0,0001$$

$$26.13. \ln 5, \alpha = 0,001$$

$$26.28. \sqrt[4]{90}, \alpha = 0,001$$

$$26.14. \operatorname{arctg} \frac{1}{2}, \alpha = 0,001$$

$$26.29. \frac{1}{\sqrt[7]{136}}, \alpha = 0,001$$

$$26.15. \sqrt[6]{738}, \alpha = 0,001$$

$$26.30. \frac{1}{\sqrt[3]{e}}, \alpha = 0,001$$

$$26.31. \pi, \alpha = 0,001$$

**Задача 27. Вычислить интеграл с точностью до 0,001**

$$27.1. \int_0^{0,1} e^{-6x^2} dx.$$

$$27.2. \int_0^{0,1} \sin(100x^2) dx.$$

$$27.3. \int_0^1 \cos x^2 dx.$$

$$27.4. \int_0^{0,5} \frac{dx}{\sqrt[4]{1+x^4}}.$$

$$27.5. \int_0^{0,1} \frac{1-e^{-2x}}{x} dx.$$

$$27.6. \int_0^1 \frac{\ln(1+x/5)}{x} dx.$$

$$27.7. \int_0^{1,5} \frac{dx}{\sqrt[3]{27+x^3}}.$$

$$27.8. \int_0^{0,2} e^{-3x^2} dx.$$

$$27.9. \int_0^{0,2} \sin(25x^2) dx.$$

$$27.10. \int_0^{0,5} \cos(4x^2) dx.$$

$$27.11. \int_0^1 \frac{dx}{\sqrt[4]{16+x^4}}.$$

$$27.12. \int_0^{0,2} \frac{1-e^{-x}}{x} dx.$$

$$27.13. \int_0^{0,4} \frac{\ln(1+x/2)}{x} dx.$$

$$27.14. \int_0^2 \frac{dx}{\sqrt[3]{64+x^3}}.$$

$$27.15. \int_0^{0,3} e^{-2x^2} dx.$$

$$27.16. \int_0^{0,4} \sin(5x/2)^2 dx.$$

$$27.17. \int_0^{0.2} \cos(25x^2) dx.$$

$$27.18. \int_0^{1.5} \frac{dx}{\sqrt[4]{81+x^4}}.$$

$$27.19. \int_0^{0.4} \frac{1-e^{-x/2}}{x} dx.$$

$$27.20. \int_0^{0.1} \frac{\ln(1+2x)}{x} dx.$$

$$27.21. \int_0^{2.5} \frac{dx}{\sqrt[3]{125+x^3}}.$$

$$27.22. \int_0^{0.4} e^{-3x^2/4} dx.$$

$$27.23. \int_0^{0.5} \sin(4x^2) dx.$$

$$27.24. \int_0^{0.4} \cos(5x/2)^2 dx.$$

$$27.25. \int_0^2 \frac{dx}{\sqrt[4]{256+x^4}}.$$

$$27.26. \int_0^{0.5} \frac{dx}{\sqrt[3]{1+x^3}}.$$

$$27.27. \int_0^{2.5} \frac{dx}{\sqrt[4]{625+x^4}}.$$

$$27.28. \int_0^1 \frac{dx}{\sqrt[3]{8+x^3}}.$$

$$27.29. \int_0^{0.5} e^{-3x^2/25} dx.$$

$$27.30. \int_0^1 \sin x^2 dx.$$

$$27.31. \int_0^{0.1} \cos(100x^2) dx.$$

**Задача 28.** Разложить в ряд Фурье периодическую (с периодом  $\omega = 2\pi$ ) функцию  $f(x)$ , заданную на отрезке  $[-\pi, \pi]$

$$28.1. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ x-1, & 0 \leq x \leq \pi. \end{cases}$$

$$28.3. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ x+2, & 0 \leq x \leq \pi. \end{cases}$$

$$28.2. f(x) = \begin{cases} 2x-1, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.4. f(x) = \begin{cases} -x+1/2, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$



$$28.5. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ x/2 + 1, & 0 \leq x \leq \pi. \end{cases}$$

$$28.6. f(x) = \begin{cases} 2x + 3, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.7. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 3 - x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.8. f(x) = \begin{cases} x - 2, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.9. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 4x - 3, & 0 \leq x \leq \pi. \end{cases}$$

$$28.10. f(x) = \begin{cases} 5 - x, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.11. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 3x - 1, & 0 \leq x \leq \pi. \end{cases}$$

$$28.12. f(x) = \begin{cases} 3 - 2x, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.13. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ (\pi - x)/2, & 0 \leq x \leq \pi. \end{cases}$$

$$28.14. f(x) = \begin{cases} 5x + 1, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.15. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 1 - 4x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.16. f(x) = \begin{cases} 3x + 2, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.17. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 4 - 2x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.18. f(x) = \begin{cases} x + \pi/2, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.19. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 6x - 5, & 0 \leq x \leq \pi. \end{cases}$$

$$28.20. f(x) = \begin{cases} 7 - 3x, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.21. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ \pi/4 - x/2, & 0 \leq x \leq \pi. \end{cases}$$

$$28.22. f(x) = \begin{cases} 6x - 2, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.23. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 4 - 9x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.24. f(x) = \begin{cases} x/3 - 3, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.25. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 10x - 3, & 0 \leq x \leq \pi. \end{cases}$$

$$28.26. f(x) = \begin{cases} 1 - x/4, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.27. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ x/5 - 2, & 0 \leq x \leq \pi. \end{cases}$$

$$28.28. f(x) = \begin{cases} 2x - 11, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

$$28.29. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 3-8x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.31. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 1-x, & 0 \leq x \leq \pi. \end{cases}$$

$$28.30. f(x) = \begin{cases} 7x-1, & -\pi \leq x \leq 0, \\ 0, & 0 < x \leq \pi. \end{cases}$$

**Задача 29.** Разложить в ряд Фурье функцию  $f(x)$ , заданную в интервале на отрезке  $(0, \pi)$ , продолжив (доопределив) ее четным и нечетным образом; построить графики для каждого продолжения

$$29.1. f(x) = e^x$$

$$29.13. f(x) = e^{4x}$$

$$29.2. f(x) = x^2$$

$$29.14. f(x) = (x+1)^2$$

$$29.3. f(x) = 2^x$$

$$29.15. f(x) = 5^{-x}$$

$$29.4. f(x) = \operatorname{ch} x$$

$$29.16. f(x) = \operatorname{sh} 3x$$

$$29.5. f(x) = e^{-x}$$

$$29.17. f(x) = e^{-x/4}$$

$$29.6. f(x) = (x-1)^2$$

$$29.18. f(x) = (2x-1)^2$$

$$29.7. f(x) = 3^{-x/2}$$

$$29.19. f(x) = 6^{x/4}$$

$$29.8. f(x) = \operatorname{sh} 2x$$

$$29.20. f(x) = \operatorname{ch} 4x$$

$$29.9. f(x) = e^{2x}$$

$$29.21. f(x) = e^{-3x}$$

$$29.10. f(x) = (x-2)^2$$

$$29.22. f(x) = x^2 + 1$$

$$29.11. f(x) = 4^{x/3}$$

$$29.23. f(x) = 7^{-x/7}$$

$$29.12. f(x) = \operatorname{ch}(x/2)$$

$$29.24. f(x) = \operatorname{sh}(x/5)$$

$$29.25. f(x) = e^{-2x/3}$$

$$29.29. f(x) = e^{4x/3}$$

$$29.26. f(x) = (x - \pi)^2$$

$$29.30. f(x) = (x - 5)^2$$

$$29.27. f(x) = 10^{-x}$$

$$29.31. f(x) = e^{3x/5}$$

$$29.28. f(x) = \operatorname{ch} \frac{x}{\pi}$$

**Задача 30.** Воспользовавшись разложением функции  $f(x)$  в ряд Фурье в указанном интервале, найти сумму данного числового ряда

$$30.1. f(x) = |x|, (-\pi, \pi), \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.2. f(x) = |\sin x|, (-\pi, \pi), \sum_{n=1}^{\infty} \frac{1}{4n^2 - 1}.$$

$$30.3. f(x) = x^2, [-\pi, \pi], \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}.$$

$$30.4. f(x) = x, [0, \pi], \text{ по косинусам, } \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.5. f(x) = \begin{cases} -x, & -\pi \leq x \leq 0, \\ x^2 / \pi, & 0 < x \leq \pi, \end{cases} \sum_{n=1}^{\infty} \frac{3 - (-1)^n}{n^2}.$$

$$30.6. f(x) = \begin{cases} -1, & -\pi < x < 0, \\ 1, & 0 < x < \pi, \\ 0, & x = -\pi, x = 0, x = \pi, \end{cases} \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2n-1}.$$

$$30.7. f(x) = \frac{\pi}{4}, (0, \pi), \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1}.$$

$$\mathbf{30.8.} \quad f(x) = \cos x, [0, \pi/2], \sum_{k=1}^{\infty} \frac{(-1)^k}{(2k-1)(2k+1)}.$$

$$\mathbf{30.9.} \quad f(x) = x, (0, \pi), \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$\mathbf{30.10.} \quad f(x) = x^2, (-\pi, \pi), \sum_{n=1}^{\infty} \frac{1}{n^2}.$$

$$\mathbf{30.11.} \quad f(x) = x(\pi - x), (0, \pi), \text{ по синусам, } \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(2n-1)^3}.$$

$$\mathbf{30.12.} \quad f(x) = |\sin x|, (-\pi, \pi), \sum_{n=1}^{\infty} \frac{(-1)^n}{4n^2 - 1}.$$

$$\mathbf{30.13.} \quad f(x) = \begin{cases} 0, & -3 < x \leq 0, \\ x, & 0 < x < 3, \end{cases} \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$\mathbf{30.14.} \quad f(x) = \begin{cases} 1, & -1 \leq x < 0, \\ x, & 0 \leq x \leq 1, \end{cases} \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$\mathbf{30.15.} \quad f(x) = |x|, (-1, 1), \sum_{n=0}^{\infty} \frac{1}{(2n+1)^2}.$$

$$\mathbf{30.16.} \quad f(x) = x^2, (-\pi, \pi), \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$\mathbf{30.17.} \quad f(x) = \begin{cases} 1, & -1 \leq x < 0, \\ 1/2, & x = 0, \\ x, & 0 < x \leq 1, \end{cases} \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$\mathbf{30.18.} \quad f(x) = \begin{cases} 1, & 0 < x < 1, \\ -1, & 1 < x < 2, \end{cases} \sum_{n=1}^{\infty} \frac{(-1)^n}{2n+1}.$$

$$30.19. f(x) = \begin{cases} -x, & -4 < x < 0, \\ 1, & x = 0, \\ 2, & 0 < x < 4, \end{cases} \quad \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.20. f(x) = \begin{cases} 1, & 0 \leq x < 3/2, \\ -1, & 3/2 < x < 3, \end{cases} \quad \sum_{n=1}^{\infty} \frac{(-1)^n}{2n+1}.$$

$$30.21. f(x) = \begin{cases} -1, & -2 < x < 0, \\ -1/2, & x = 0, \\ x/2, & 0 < x < 2, \end{cases} \quad \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.22. f(x) = \begin{cases} -2x, & -2 < x < 0, \\ 2, & x = 0, \\ 4, & 0 < x < 2, \end{cases} \quad \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.23. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ x-1, & 0 \leq x \leq \pi, \end{cases} \quad \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}.$$

$$30.24. f(x) = \begin{cases} -2x, & -\pi \leq x \leq 0, \\ 3x, & 0 < x \leq \pi, \end{cases} \quad \sum_{n=1}^{\infty} \frac{1 - (-1)^n}{n^2}.$$

$$30.25. f(x) = \pi^2 - x^2, (-\pi, \pi), \quad \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}.$$

$$30.26. f(x) = x \sin x, [-\pi, \pi], \quad \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2 - 1}.$$

$$30.27. f(x) = \begin{cases} 0, & -\pi \leq x < 0, \\ 1, & 0 \leq x \leq \pi, \end{cases} \quad \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2n-1}.$$

$$30.28. f(x) = \begin{cases} -a, & -\pi \leq x < 0, \\ a, & 0 \leq x \leq \pi, \end{cases} \quad \sum_{n=0}^{\infty} \frac{(-1)^{n+1}}{2n+1}.$$

$$\mathbf{30.29.} \quad f(x) = |\cos x|, [-\pi, \pi], \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{4n^2 - 1}.$$

$$\mathbf{30.30.} \quad f(x) = \left| \cos \frac{x}{2} \right|, [-\pi, \pi], \sum_{n=1}^{\infty} \frac{(-1)^n}{1 - 4n^2}.$$

$$\mathbf{30.31.} \quad f(x) = \begin{cases} -\pi, & -\pi \leq x < 0, \\ \pi, & 0 \leq x \leq \pi, \end{cases} \quad \sum_{n=0}^{\infty} \frac{(-1)^{n+1}}{2n+1}.$$