

## ИДЗ 2 Числовые ряды

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

$$1.1. \sum_{n=1}^{\infty} \frac{\sin^2 n\sqrt{n}}{n\sqrt{n}}.$$

$$1.3. \sum_{n=1}^{\infty} \frac{\cos^2(n\pi/2)}{n(n+1)(n+2)}.$$

$$1.5. \sum_{n=1}^{\infty} \frac{2+(-1)^n}{n-\ln n}.$$

$$1.7. \sum_{n=1}^{\infty} \frac{n(2+\cos n\pi)}{2n^2-1}.$$

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

$$1.11. \sum_{n=2}^{\infty} \frac{\arccos \frac{(-1)^n n}{n+1}}{n^2+2}.$$

$$1.13. \sum_{n=2}^{\infty} \frac{n \ln n}{n^2-3}.$$

$$1.15. \sum_{n=2}^{\infty} \frac{1}{\sqrt[4]{n^3}} \sin \frac{2+(-1)^n}{6} \pi.$$

$$1.17. \sum_{n=1}^{\infty} \frac{1+\sin \frac{\pi n}{2}}{n^2}.$$

$$1.19. \sum_{n=1}^{\infty} \frac{(2+\cos \frac{n\pi}{2})\sqrt{n}}{\sqrt[4]{n^7}+5}.$$

$$1.21. \sum_{n=1}^{\infty} \frac{\sin^2 2^n}{n^2}.$$

$$1.23. \sum_{n=3}^{\infty} \frac{1}{n^2 \ln n + \sqrt[3]{\ln^2 n}}.$$

$$1.2. \sum_{n=1}^{\infty} n \sin \frac{2+(-1)^n}{n^3}.$$

$$1.4. \sum_{n=1}^{\infty} \frac{\ln n}{\sqrt[3]{n^7}}.$$

$$1.6. \sum_{n=1}^{\infty} \frac{\operatorname{arctg} \frac{1+(-1)^n}{2} n}{n^3+2}.$$

$$1.8. \sum_{n=2}^{\infty} \frac{\arcsin \frac{n-1}{n}}{\sqrt[3]{n^3-3n}}.$$

$$1.10. \sum_{n=2}^{\infty} \frac{\ln \sqrt{n^2+3n}}{\sqrt{n^2-n}}.$$

$$1.12. \sum_{n=1}^{\infty} \frac{n \cos^2 n}{n^3+5}.$$

$$1.14. \sum_{n=1}^{\infty} \frac{n^2+3}{n^3(2+\sin(n\pi/2))}.$$

$$1.16. \sum_{n=1}^{\infty} \frac{\ln n}{n^3+n+1}.$$

$$1.18. \sum_{n=1}^{\infty} \frac{\cos^2 \frac{\pi n}{2}}{3^n+2}.$$

$$1.20. \sum_{n=1}^{\infty} \frac{2+\sin \frac{n\pi}{2}}{n^2} \operatorname{ctg} \frac{1}{\sqrt{n}}.$$

$$1.22. \sum_{n=1}^{\infty} \frac{\ln n}{\sqrt{n^5+n}}.$$

$$1.24. \sum_{n=1}^{\infty} \frac{\frac{3}{\pi} \operatorname{arctg} \sqrt{n^2-1}}{\sqrt{n^2-n}}.$$

$$1.25. \sum_{n=1}^{\infty} \frac{\sin \frac{\pi}{2n+1}}{n \left( 3 + \sin \frac{\pi n}{4} \right)}.$$

$$1.26. \sum_{n=2}^{\infty} \frac{2 \cos \frac{2\pi}{3n}}{\sqrt[4]{n^4 - 1}}.$$

$$1.27. \sum_{n=1}^{\infty} \frac{3 + (-1)^n}{2^{n+2}}.$$

$$1.28. \sum_{n=1}^{\infty} \frac{\operatorname{arctg} \left[ 2 + (-1)^n \right]}{\ln(1+n)}.$$

$$1.29. \sum_{n=1}^{\infty} \frac{\operatorname{arcctg}(-1)^n}{\sqrt{n(2+n^2)}}.$$

$$1.30. \sum_{n=1}^{\infty} \frac{\arcsin \frac{3 + (-1)^n}{4}}{2^n + n}.$$

$$1.31. \sum_{n=1}^{\infty} \frac{\sqrt{n^3 + 2}}{n^2 \sin^2 n}.$$

**Задача 2.** Исследовать на сходимость ряд.

$$2.1. \sum_{n=1}^{\infty} \frac{2}{5^{n-1} + n - 1}.$$

$$2.2. \sum_{n=1}^{\infty} \frac{1}{n} \cdot \operatorname{tg} \frac{1}{\sqrt{n}}.$$

$$2.3. \sum_{n=1}^{\infty} \ln \frac{n^2 + 5}{n^2 + 4}.$$

$$2.4. \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} \sin \frac{1}{n}.$$

$$2.5. \sum_{n=2}^{\infty} \frac{1}{n-1} \operatorname{arctg} \frac{1}{\sqrt[3]{n-1}}.$$

$$2.6. \sum_{n=1}^{\infty} \frac{(n^2 + 3)^2}{n^5 + \ln^4 n}.$$

$$2.7. \sum_{n=1}^{\infty} \frac{n^3 + 2}{n^5 + \sin 2^n}.$$

$$2.8. \sum_{n=1}^{\infty} \frac{2^n + \cos n}{3^n + \sin n}.$$

$$2.9. \sum_{n=1}^{\infty} \frac{1}{n - \cos^2 6n}.$$

$$2.10. \sum_{n=1}^{\infty} \frac{1}{\sqrt[5]{n+1}} \sin \frac{1}{\sqrt{n}}.$$

$$2.11. \sum_{n=1}^{\infty} \frac{1}{\sqrt[3]{n}} \operatorname{arctg} \frac{\pi}{4\sqrt{n}}.$$

$$2.12. \sum_{n=1}^{\infty} \frac{1}{n^2 - \ln n}.$$

$$2.13. \sum_{n=2}^{\infty} \frac{1}{\sqrt[3]{n+5}} \sin \frac{1}{n-1}.$$

$$2.14. \sum_{n=1}^{\infty} \frac{1}{\sqrt[3]{n+2}} \operatorname{arctg} \frac{n+3}{n^2+5}.$$

$$2.15. \sum_{n=1}^{\infty} \frac{1}{\sqrt{n+3}} \left( e^{1/\sqrt{n}} - 1 \right).$$

$$2.16. \sum_{n=1}^{\infty} \ln \frac{n^2 + 1}{n^2 + n + 2}.$$

$$2.17. \sum_{n=1}^{\infty} \sqrt[3]{n} \operatorname{arctg} \frac{1}{n^3}.$$

$$2.18. \sum_{n=1}^{\infty} \ln \frac{n^3}{n^3 + 1}.$$

$$2.19. \sum_{n=3}^{\infty} n^3 \operatorname{tg}^5 \frac{\pi}{n}.$$

$$2.20. \sum_{n=2}^{\infty} \frac{n+1}{\left( \sqrt[3]{n} - 1 \right) \left( n \sqrt[4]{n^3} - 1 \right)}.$$

$$2.21. \sum_{n=1}^{\infty} \left( 1 - \cos \frac{\pi}{n} \right).$$

$$2.23. \sum_{n=2}^{\infty} \left( e^{\sqrt{n}/(n^3-1)} - 1 \right).$$

$$2.25. \sum_{n=1}^{\infty} \frac{\sin \frac{2\pi}{2n+1}}{\sqrt{n}}.$$

$$2.27. \sum_{n=1}^{\infty} n(e^{1/n} - 1)^2.$$

$$2.29. \sum_{n=1}^{\infty} \operatorname{arctg} \frac{1}{(n-1)\sqrt[5]{n^2+1}}.$$

$$2.31. \sum_{n=1}^{\infty} \arcsin \frac{n}{(n^2+3)^{5/2}}.$$

$$2.22. \sum_{n=1}^{\infty} \sin \frac{\sqrt[3]{n}}{\sqrt{n^5+2}}.$$

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

$$2.26. \sum_{n=1}^{\infty} \frac{3+7n}{5^n+n}.$$

$$2.28. \sum_{n=1}^{\infty} n \sin \frac{1}{\sqrt[3]{n^4}}.$$

$$2.30. \sum_{n=1}^{\infty} \sin \frac{n}{n^2 \sqrt[3]{n+5}}.$$

**Задача 3.** Исследовать на сходимость ряд.

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

$$3.3. \sum_{n=1}^{\infty} \frac{2^{n+1}(n^3+1)}{(n+1)!}.$$

$$3.5. \sum_{n=1}^{\infty} \frac{(2n+2)!}{3n+5} \cdot \frac{1}{2^n}.$$

$$3.7. \sum_{n=1}^{\infty} \frac{\operatorname{arctg} \frac{5}{n}}{n!}.$$

$$3.9. \sum_{n=1}^{\infty} \frac{n}{(2n)!} \operatorname{tg} \frac{1}{5^n}.$$

$$3.11. \sum_{n=1}^{\infty} \frac{n^2}{(n+2)!}.$$

$$3.13. \sum_{n=1}^{\infty} \frac{7^{2n}}{(2n-1)!}.$$

$$3.15. \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \dots (2n-1)}{3^n(n+1)!}.$$

$$3.2. \sum_{n=1}^{\infty} \frac{(n!)^2}{2^{n^2}}.$$

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

$$3.6. \sum_{n=1}^{\infty} \frac{n+5}{n!} \sin \frac{2}{3^n}.$$

$$3.8. \sum_{n=1}^{\infty} \frac{n^n}{3^n n!}.$$

$$3.10. \sum_{n=1}^{\infty} \frac{6^n(n^2-1)}{n!}.$$

$$3.12. \sum_{n=1}^{\infty} \frac{n^n}{(n!)^2}.$$

$$3.14. \sum_{n=1}^{\infty} \frac{n!}{(3n)!}.$$

$$3.16. \sum_{n=1}^{\infty} \frac{n!}{n^{n-1}}.$$

$$3.17. \sum_{n=1}^{\infty} \frac{(n!)^2}{(3^n + 1)(2n)!}.$$

$$3.19. \sum_{n=1}^{\infty} \frac{(n+1)!}{n^n}.$$

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

$$3.23. \sum_{n=1}^{\infty} \frac{3^n}{(n+2)!4^n}.$$

$$3.25. \sum_{n=1}^{\infty} \frac{1 \cdot 4 \cdot 7 \dots (3n-2)}{7 \cdot 9 \cdot 11 \dots (2n+5)}.$$

$$3.27. \sum_{n=1}^{\infty} \frac{(3n+2)!}{10^n n^2}.$$

$$3.29. \sum_{n=1}^{\infty} \frac{n! \sqrt[3]{n}}{3^n + 2}.$$

$$3.31. \sum_{n=1}^{\infty} \frac{1 \cdot 4 \cdot 7 \dots (3n-2)}{2^{n+1} n!}.$$

$$3.18. \sum_{n=1}^{\infty} n! \sin \frac{\pi}{2^n}.$$

$$3.20. \sum_{n=1}^{\infty} \frac{5^n \sqrt[3]{n^2}}{(n+1)!}.$$

$$3.22. \sum_{n=1}^{\infty} \frac{5^n (n+1)!}{(2n)!}.$$

$$3.24. \sum_{n=1}^{\infty} \frac{3 \cdot 5 \cdot 7 \dots (2n+1)}{2 \cdot 5 \cdot 8 \dots (3n-1)}.$$

$$3.26. \sum_{n=1}^{\infty} \frac{2n!}{\sqrt{2^n + 3}}.$$

$$3.28. \sum_{n=2}^{\infty} \frac{4^{n-1} \sqrt{n^2 + 5}}{(n-1)!}.$$

$$3.30. \sum_{n=1}^{\infty} \frac{n!(2n+1)!}{(3n)!}.$$

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

$$4.1. \sum_{n=1}^{\infty} \frac{1}{3^n} \left( \frac{n}{n+1} \right)^{-n^2}.$$

$$4.3. \sum_{n=1}^{\infty} \left( \frac{2n^2 + 1}{n^2 + 1} \right)^{n^2}.$$

$$4.5. \sum_{n=1}^{\infty} \left( \frac{2n+1}{3n-2} \right)^{n^2}.$$

$$4.7. \sum_{n=1}^{\infty} \left( \frac{4n-3}{5n+1} \right)^{n^3}.$$

$$4.9. \sum_{n=1}^{\infty} n \arcsin^n \frac{\pi}{4n}.$$

$$4.11. \sum_{n=1}^{\infty} \left( \frac{n-1}{n} \right)^n \frac{n}{5^n}.$$

$$4.2. \sum_{n=1}^{\infty} \frac{1}{4^n} \left( 1 + \frac{1}{n} \right)^{n^2}.$$

$$4.4. \sum_{n=1}^{\infty} n^4 \left( \frac{2n}{3n+5} \right)^n.$$

$$4.6. \sum_{n=1}^{\infty} \left( \frac{2n+2}{3n+1} \right)^n (n+1)^3.$$

$$4.8. \sum_{n=1}^{\infty} \left( \frac{n}{10n+5} \right)^{n^2}.$$

$$4.10. \sum_{n=1}^{\infty} \left( \frac{n+2}{3n-1} \right)^{n^2}.$$

$$4.12. \sum_{n=1}^{\infty} \left( \frac{2n+3}{n+1} \right)^{n^2}.$$

$$4.13. \sum_{n=1}^{\infty} \left( \frac{3n+2}{4n-1} \right)^n (n-1)^2.$$

$$4.15. \sum_{n=1}^{\infty} \left( \frac{n}{3n+1} \right)^{2n+1}.$$

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

$$4.19. \sum_{n=2}^{\infty} \frac{n^3}{(\ln n)^n}.$$

$$4.21. \sum_{n=1}^{\infty} n^3 \operatorname{arctg}^n \frac{\pi}{3n}.$$

$$4.23. \sum_{n=1}^{\infty} 2^{n-1} e^{-n}.$$

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

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

$$4.29. \sum_{n=1}^{\infty} \frac{n \cdot 3^{n+2}}{5^n}.$$

$$4.31. \sum_{n=1}^{\infty} n^4 \operatorname{arctg}^{2n} \frac{\pi}{4n}.$$

$$4.14. \sum_{n=2}^{\infty} \left( \frac{n+1}{2n-3} \right)^{n^2}.$$

$$4.16. \sum_{n=1}^{\infty} \left( \frac{2n-1}{3n+1} \right)^{n/2}.$$

$$4.18. \sum_{n=1}^{\infty} n^2 \sin^n \frac{\pi}{2n}.$$

$$4.20. \sum_{n=1}^{\infty} \left( \frac{n}{3n-1} \right)^{n^3}.$$

$$4.22. \sum_{n=1}^{\infty} \frac{n^5 3^n}{(2n+1)^n}.$$

$$4.24. \sum_{n=1}^{\infty} n \left( \frac{3n-1}{4n+2} \right)^{2n}.$$

$$4.26. \sum_{n=1}^{\infty} \frac{n^{n+2}}{(2n^2+1)^{n/2}}.$$

$$4.28. \sum_{n=1}^{\infty} \left( \frac{n+1}{n} \right)^{n^2} \frac{1}{2^n}.$$

$$4.30. \sum_{n=2}^{\infty} \sqrt[3]{n} \left( \frac{n-2}{2n+1} \right)^{3n}.$$

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

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

$$5.3. \sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{\ln(n+1)}.$$

$$5.5. \sum_{n=1}^{\infty} \frac{(-1)^n 2n^2}{n^4 - n^2 + 1}.$$

$$5.7. \sum_{n=3}^{\infty} \frac{(-1)^n}{n \ln(n+1)}.$$

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

$$5.4. \sum_{n=3}^{\infty} \frac{(-1)^n}{n(\ln \ln n) \ln n}.$$

$$5.6. \sum_{n=3}^{\infty} \frac{(-1)^n}{(n+1) \ln n}.$$

$$5.8. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n \sqrt[4]{2n+3}}.$$

$$5.9. \sum_{n=1}^{\infty} \frac{(-1)^n \sin \frac{\pi}{2\sqrt{n}}}{\sqrt{3n+1}}.$$

$$5.11. \sum_{n=1}^{\infty} \frac{\sin n}{n!}.$$

$$5.13. \sum_{n=1}^{\infty} (-1)^n \operatorname{tg} \frac{1}{n}.$$

$$5.15. \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(n+1)2^{2n}}.$$

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

$$5.19. \sum_{n=1}^{\infty} \frac{(-1)^n (n+3)}{\ln(n+4)}.$$

$$5.21. \sum_{n=1}^{\infty} \frac{(-1)^n \operatorname{tg} \frac{\pi}{4\sqrt{n}}}{\sqrt{5n-1}}.$$

$$5.23. \sum_{n=1}^{\infty} (-1)^n \frac{\sin(n\sqrt{n})}{n\sqrt{n}}.$$

$$5.25. \sum_{n=1}^{\infty} (-1)^n \sin \frac{\pi}{2^n}.$$

$$5.27. \sum_{n=1}^{\infty} (-1)^n \frac{\sin 3^n}{3^n}.$$

$$5.29. \sum_{n=1}^{\infty} (-1)^n \sin \frac{1}{n} \cdot \operatorname{tg} \frac{1}{n}.$$

$$5.31. \sum_{n=1}^{\infty} (-1)^n \frac{n^3}{(n+1)!}.$$

$$5.10. \sum_{n=1}^{\infty} (-1)^n \cos \frac{\pi}{6n}.$$

$$5.12. \sum_{n=3}^{\infty} \frac{(-1)^n}{n \ln(2n)}.$$

$$5.14. \sum_{n=1}^{\infty} \frac{\cos n}{n^2}.$$

$$5.16. \sum_{n=1}^{\infty} \frac{(-1)^n}{\cos \frac{\pi}{3\sqrt{n}} \sqrt[3]{3n + \ln n}}.$$

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

$$5.20. \sum_{n=1}^{\infty} (-1)^n \frac{n+1}{\sqrt{n^3}}.$$

$$5.22. \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)2^{2n+1}}.$$

$$5.24. \sum_{n=1}^{\infty} \frac{(-1)^n}{n + \cos(2/\sqrt{n+4})}.$$

$$5.26. \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2 + \sin^2 n}.$$

$$5.28. \sum_{n=1}^{\infty} (-1)^n \ln \left( 1 + \frac{1}{n^2} \right).$$

$$5.30. \sum_{n=1}^{\infty} (-1)^n \left( 1 - \cos \frac{1}{\sqrt{n}} \right).$$

**Задача 6.** Вычислить сумму ряда с точностью  $\alpha$ .

$$6.1. \sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{3n^2}, \quad \alpha = 0,01.$$

$$6.2. \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n!}, \quad \alpha = 0,01.$$

- 6.3.  $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{(2n)^3}, \alpha = 0,001.$
- 6.4.  $\sum_{n=0}^{\infty} (-1)^n \frac{1}{n!(2n+1)}, \alpha = 0,001.$
- 6.5.  $\sum_{n=1}^{\infty} (-1)^n \frac{2n+1}{n^3(n+1)}, \alpha = 0,01.$
- 6.6.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!}, \alpha = 0,0001.$
- 6.7.  $\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{2^n}, \alpha = 0,1.$
- 6.8.  $\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n^2}{3^n}, \alpha = 0,1.$
- 6.9.  $\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{(2n-1)^2(2n+1)^2}, \alpha = 0,001.$
- 6.10.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n+1)!!}, \alpha = 0,0001.$
- 6.11.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!!}, \alpha = 0,001.$
- 6.12.  $\sum_{n=0}^{\infty} \left(-\frac{2}{5}\right)^n, \alpha = 0,01.$
- 6.13.  $\sum_{n=1}^{\infty} \frac{(-1)^n \cdot n}{7^n}, \alpha = 0,0001.$
- 6.14.  $\sum_{n=0}^{\infty} \left(-\frac{2}{3}\right)^n, \alpha = 0,1.$
- 6.15.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!}, \alpha = 0,001.$
- 6.16.  $\sum_{n=0}^{\infty} \frac{(-1)^n}{3n!}, \alpha = 0,01.$
- 6.17.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!2n}, \alpha = 0,00001.$
- 6.18.  $\sum_{n=1}^{\infty} \frac{(-1)^n \cdot (2n+1)}{(2n)!n!}, \alpha = 0,001.$
- 6.19.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{2^n \cdot n!}, \alpha = 0,001.$
- 6.20.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{3^n \cdot n!}, \alpha = 0,001.$
- 6.21.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{(2n)!n!}, \alpha = 0,00001.$
- 6.22.  $\sum_{n=0}^{\infty} \frac{\cos \pi n}{3^n(n+1)}, \alpha = 0,001.$
- 6.23.  $\sum_{n=0}^{\infty} \frac{(-1)^n}{4^n(2n+1)}, \alpha = 0,001.$
- 6.24.  $\sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3}, \alpha = 0,01.$
- 6.25.  $\sum_{n=0}^{\infty} \frac{(-1)^n \cdot 2^n}{(n+1)^n}, \alpha = 0,001.$
- 6.26.  $\sum_{n=0}^{\infty} \frac{(-1)^n}{(n+1)^n}, \alpha = 0,001.$
- 6.27.  $\sum_{n=1}^{\infty} \frac{\sin(\pi/2 + \pi n)}{n^3 + 1}, \alpha = 0,01.$
- 6.28.  $\sum_{n=1}^{\infty} \frac{(-1)^n}{n^3(n+3)}, \alpha = 0,01.$
- 6.29.  $\sum_{n=0}^{\infty} \frac{\cos(\pi n)}{(n^3 + 1)^2}, \alpha = 0,001.$
- 6.30.  $\sum_{n=0}^{\infty} \frac{(-1)^n}{1+n^2}, \alpha = 0,01.$
- 6.31.  $\sum_{n=0}^{\infty} \frac{(-1)^n \cdot n}{(1+n^3)^2}, \alpha = 0,001.$