

1. Провести полное исследование указанных функций и построить их графики.

1.1. $y = \frac{x^2 - 2x + 2}{x - 1}$

1.2. $y = e^{\frac{1}{5+x}}$

1.3. $y = \frac{4x - x^2 - 4}{x}$

1.4. $y = \frac{\ln x}{\sqrt{x}}$

1.5. $y = x - \ln(1 + x^2)$

1.6. $y = x^2 - 2 \ln x$

1.7. $y = \frac{x^2 - x - 1}{x^2 - 2x}$

1.8. $y = -\ln \frac{1+x}{1-x}$

1.9. $y = \frac{x+1}{(x-1)^2}$

1.10. $y = \frac{x}{9-x}$

1.11. $y = \frac{x^2}{4x^2 - 1}$

1.12. $y = x + \frac{\ln x}{x}$

1.13. $y = \frac{x^3}{x^2 - x + 1}$

1.14. $y = x^3 e^{-\frac{x^2}{2}}$

1.15. $y = \frac{(x-2)^2}{x+1}$

1.16. $y = \ln(x^2 + 1)$

1.17. $y = \frac{x^2 + 6}{x^2 + 1}$

1.18. $y = x \ln x$

1.19. $y = (x-1)e^{3x+1}$

1.20. $y = \frac{x^2 - 3x + 2}{x+1}$

1.21. $y = \frac{2x-1}{(x-1)^2}$

1.22. $y = \frac{x^5}{x^4 - 1}$

1.23. $y = \frac{x^3 + 4}{x^2}$

1.24. $y = \frac{1}{3} \sqrt[3]{x^2} (x-5)$

1.25. $y = \frac{x^3}{x^4 - 1}$

1.26. $y = \frac{e^{2x} + 1}{e^x}$

1.27. $y = x^2 + \frac{1}{x^2}$

1.28. $y = \frac{5x^4 + 3}{x}$

1.29. $y = \frac{4-2x}{1-x^2}$

1.30. $y = \frac{5x}{4-x^2}$

2. Провести полное исследование указанных функций и построить их графики.

2.1. $y = e^{2x-x^2}$

2.2. $y = x + \ln(x^2 - 4)$

2.3. $y = \frac{2(x+1)^2}{x-2}$

2.4. $y = x \ln^2 x$

2.5. $y = \frac{4e^{x^2} - 1}{e^{x^2}}$

2.6. $y = x^2 e^{-x^2/2}$

2.7. $y = x e^{1/x}$

2.8. $y = \frac{2+x}{(x+1)^2}$

2.9. $y = \frac{(1-x)^3}{(x-2)^2}$

2.10. $y = x e^x$

2.11. $y = x^2 e^{1/x}$

2.12. $y = \frac{x^2}{(x+1)^2}$

2.13. $y = (x+2)e^{1-x}$

$$2.14. \quad y = \frac{\ln x}{x}$$

$$2.15. \quad y = \left(\frac{x-2}{x+1} \right)^2$$

$$2.16. \quad y = \frac{x^3}{9-x^3}$$

$$2.17. \quad y = (x+1)e^{2x}$$

$$2.18. \quad y = \frac{4x}{4+x^2}$$

$$2.19. \quad y = \frac{x^4}{x^3-1}$$

$$2.20. \quad y = \ln(x^2 - 2x + 6)$$

$$2.21. \quad y = \ln\left(1 - \frac{1}{x^2}\right)$$

$$2.22. \quad y = x^3 e^{x+1}$$

$$2.23. \quad y = x - \ln(1+x^2)$$

$$2.24. \quad y = 1 - \ln^3 x$$

$$2.25. \quad y = (x-1)e^{4x+2}$$

$$2.26. \quad y = \frac{2x^2 + 2 + 4x}{2-x}$$

$$2.27. \quad y = -x \ln^2 x$$

$$2.28. \quad y = x^2 - 2 \ln x$$

$$2.29. \quad y = e^{\frac{1}{2-x}}$$

$$2.30. \quad y = \ln(4-x^2)$$

3. Найти наименьшее и наибольшее значения функции $y=f(x)$ на отрезке $[a; b]$

$$3.1. \quad y = \ln(x^2 - 2x + 2), [0; 3]$$

$$3.2. \quad y = \frac{3x}{x^2 + 1}, [0; 5]$$

$$3.3. \quad y = \frac{3}{x^2 - 1}, [-0, 5; 0]$$

$$3.4. \quad y = (x+2)e^{1-x}, [-2; 2]$$

$$3.5. \quad y = \ln(x^2 - 2x + 4), [-1; 1, 5]$$

$$3.6. \quad y = \frac{x^3}{x^2 - x + 1}, [-1; 1]$$

$$3.7. \quad y = \left(\frac{x+1}{x} \right)^3, [1; 2]$$

$$3.8. \quad y = \sqrt{x-x^3}, [-2; 2]$$

$$3.9. \quad y = 4 - e^{-x^2}, [0; 1]$$

$$3.10. \quad y = \frac{x^3 + 4}{x^2}, [1; 2]$$

$$3.11. \quad y = xe^x, [-2; 0]$$

$$3.12. \quad y = (x-2)e^x, [-2; 1]$$

$$3.13. \quad y = (x-1)e^{-x}, [0; 3]$$

$$3.14. \quad y = \frac{x}{9-x^2}, [-2; 2]$$

$$3.15. \quad y = \frac{1 + \ln x}{x}, [1/e; e]$$

$$3.16. \quad y = e^{4x-x^2}, [1; 3]$$

$$3.17. \quad y = \frac{x^5 - 8}{x^4}, [-3; -1]$$

$$3.18. \quad y = \frac{e^{2x} + 1}{e^x}, [-1; 2]$$

$$3.19. \quad y = x \ln x, [1/e^2; 1]$$

$$3.20. \quad y = x^3 e^{x+1}, [-4; 0]$$

$$3.21. \quad y = x^2 - 2x + \frac{2}{x-1}, [-1; 3]$$

$$3.22. \quad y = (x+1)\sqrt[3]{x^2}, [-4/5; 3]$$

$$3.23. \quad y = e^{6x-x^2}, [-3; 3]$$

$$3.24. \quad y = \frac{\ln x}{x}, [1; 4]$$

$$3.25. \quad y = 3x^4 - 16x^3 + 2, [-3; 1]$$

$$3.26. y = x^5 - 5x^4 + 5x^3 + 1, [-1; 2]$$

$$3.27. y = (3 - x)e^{-x}, [0; 5]$$

$$3.28. y = \frac{\sqrt{3}}{2} + \cos x, [0; \Pi/2]$$

$$3.29. y = 108x - x^4, [-1; 4]$$

$$3.30. y = \frac{x^4}{4} - 6x^3 + 7, [16; 20]$$

4. Найти указанные пределы, используя правило Лопиталя

$$4.1. \lim_{x \rightarrow \infty} \frac{\ln(x+5)}{\sqrt[4]{x+3}}$$

$$4.2. \lim_{x \rightarrow \infty} \frac{e^x}{x^5}$$

$$4.3. \lim_{x \rightarrow 0} \frac{\ln \cos x}{x}$$

$$4.4. \lim_{x \rightarrow \infty} \frac{x^2}{e^{0,01x}}$$

$$4.5. \lim_{x \rightarrow 0} \frac{\Pi/x}{\operatorname{ctg}(5x/2)}$$

$$4.6. \lim_{x \rightarrow 0} \frac{e^{x^2} - 1}{\operatorname{tg} x - x}$$

$$4.7. \lim_{x \rightarrow \infty} \frac{\ln(x+7)}{\sqrt[7]{x-3}}$$

$$4.8. \lim_{x \rightarrow \frac{\Pi}{2}} \frac{\operatorname{tg} 3x}{\operatorname{tg} 5x}$$

$$4.9. \lim_{x \rightarrow 0} \frac{x \cos x - \sin x}{x^3}$$

$$4.10. \lim_{x \rightarrow 0} \frac{\operatorname{tg} x - \sin x}{4x - \sin x}$$

$$4.11. \lim_{x \rightarrow \frac{\Pi}{4}} \frac{\sqrt{\operatorname{tg} x} - 1}{2 \sin^2 x - 1}$$

$$4.12. \lim_{x \rightarrow 0} \frac{\arcsin x}{\operatorname{ctg} x}$$

$$4.13. \lim_{x \rightarrow \infty} \frac{x^3}{e^{-x}}$$

$$4.14. \lim_{x \rightarrow 0} \frac{1 - \cos 2x}{\operatorname{tg} 4x}$$

$$4.15. \lim_{x \rightarrow -1} \frac{\sqrt[3]{1+2x} + 1}{\sqrt{2+x} + x}$$

$$4.16. \lim_{x \rightarrow 0} \frac{1 - \cos 8x}{\operatorname{tg}^2 2x}$$

$$4.17. \lim_{x \rightarrow 0} \frac{e^{2x} - e^{5x}}{\sin x}$$

$$4.18. \lim_{x \rightarrow 1} \frac{\ln x}{1 - x^3}$$

$$4.19. \lim_{x \rightarrow 0} \frac{1 - \cos 8x}{1 - \cos 4x}$$

$$4.20. \lim_{x \rightarrow \frac{\Pi}{2}} \frac{\operatorname{tg} x}{\operatorname{tg} 5x}$$

$$4.21. \lim_{x \rightarrow 1} \frac{1 - x}{1 - \sin(\Pi x/2)}$$

$$4.22. \lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt[3]{x}}$$

$$4.23. \lim_{x \rightarrow 1} \frac{1 - x}{\operatorname{ctg}(\Pi x/2)}$$

$$4.24. \lim_{x \rightarrow \frac{\Pi}{6}} \frac{1 - 2 \sin x}{\cos 3x}$$

$$4.25. \lim_{x \rightarrow 0} \frac{\ln x}{\operatorname{ctg} x}$$

$$4.26. \lim_{x \rightarrow 0} \frac{1 - e^{2x}}{\operatorname{tg} x}$$

$$4.27. \lim_{x \rightarrow 0} \frac{\ln(1 + x^2)}{\cos 3x - e^{-x}}$$

$$4.28. \lim_{x \rightarrow \infty} \frac{\ln(x^2 + 1)}{\sqrt[5]{3x - 1}}$$

$$4.29. \quad \lim_{x \rightarrow \frac{\pi}{2}} \frac{1 - \sin x}{\operatorname{tg}^2 5x}$$

$$4.30. \quad \lim_{x \rightarrow 0} \frac{\operatorname{arctg} 4x}{e^{5x} - 1}$$

5. С помощью дифференциала приближенно вычислить данные величины и оценить допущенную относительную погрешность (с точностью до двух знаков после запятой).

$$5.1. \quad \sqrt[5]{34}, \arcsin 0,6$$

$$5.2. \quad \sqrt[4]{16,64}, \cos 61^0$$

$$5.3. \quad \sqrt[4]{16,64}, e^{0,25}$$

$$5.4. \quad \sqrt{8,76}, \operatorname{arctg} 0,96$$

$$5.5. \quad \sqrt[5]{31}, e^{2,01}$$

$$5.6. \quad \sqrt[3]{70}, \operatorname{tg} 44^0$$

$$5.7. \quad (2,01)^3 + (2,01)^2, e^2$$

$$5.8. \quad \sqrt[3]{65}, \lg 101$$

$$5.9. \quad \frac{2,9}{\sqrt{(2,9)^2 + 16}}, \sin 29^0$$

$$5.10. \quad \sqrt{\frac{4 - 3,02}{1 + 3,02}}, e^{0,2}$$

$$5.11. \quad \sqrt[4]{15,8}, \operatorname{arctg} 1,03$$

$$5.12. \quad \sqrt[3]{10}, \arcsin 0,54$$

$$5.13. \quad \sqrt[5]{200}, \operatorname{ctg} 29^0$$

$$5.14. \quad (3,03)^5, 4^{1,2}$$

$$5.15. \quad \sqrt{\frac{(2,037)^2 - 3}{(2,037)^2 + 5}}, \lg 11$$

$$5.16. \quad \sqrt[7]{130}, \sin 93^0$$

$$5.17. \quad \sqrt[3]{27,5}, \log_2 1,9$$

$$5.18. \quad \sqrt{17}, \cos 59^0$$

$$5.19. \quad \sqrt{640}, 2^{2,1}$$

$$5.20. \quad \sqrt{1,2}, \operatorname{arctg} 1,01$$

$$5.21. \quad \sqrt[10]{1025}, \operatorname{arctg} 1,05$$

$$5.22. \quad (3,02)^4 + (3,02)^3, \lg 9,5$$

$$5.23. \quad (5,07)^3, \operatorname{arctg} \sqrt{3,1}$$

$$5.24. \quad (4,01)^{1,5}, \sin 29^0$$

$$5.25. \quad \sqrt{15}, \sin 92^0$$

$$5.26. \quad \sqrt[3]{1,02}, \cos 151^0$$

$$5.27. \quad \sqrt[3]{84}, \operatorname{tg} 44^0$$

$$5.28. \quad \sqrt{3,2}, \cos 61^0$$

$$5.29. \quad \sqrt{18}, \sin 31^0$$

$$5.30. \quad \sqrt[3]{67}, \operatorname{arctg} \sqrt{1,02}$$