

Задача 2. Складіть рівняння нормалі (у варіантах 1–12) або рівняння дотичної (у варіантах 13–30) до даної кривої в точці з абсцисою x_0 :

1. $y = (4x - x^2)/4, \quad x_0 = 2.$

2. $y = 2x^2 + 3x - 1, \quad x_0 = -2.$

3. $y = x - x^3, \quad x_0 = -1.$

4. $y = x^2 + 8\sqrt{x} - 32, \quad x_0 = 4.$

5. $y = x + \sqrt{x^3}, \quad x_0 = 1.$

6. $y = \sqrt[3]{x^2} - 20, \quad x_0 = -8.$

7. $y = \frac{1 + \sqrt{x}}{1 - \sqrt{x}}, \quad x_0 = 4.$

8. $y = 8\sqrt[4]{x} - 70, \quad x_0 = 16.$

9. $y = 2x^2 - 3x + 1, \quad x_0 = 1.$

10. $y = (x^2 - 3x + 6)/x^2, \quad x_0 = 3.$

11. $y = \sqrt{x} - 3\sqrt[3]{x}, \quad x_0 = 64.$

12. $y = (x^3 + 2)/(x^3 - 2), \quad x_0 = 2.$

13. $y = 2x^2 + 3, \quad x_0 = -1.$

14. $y = \frac{x^{29} + 6}{x^4 + 1}, \quad x_0 = 1.$

15. $y = 2x + \frac{1}{x}, \quad x_0 = 1.$

16. $y = -2(x^8 + 2)/(3(x^4 + 1)), \quad x_0 = 1.$

17. $y = \frac{x^5 + 1}{x^4 + 1}, \quad x_0 = 1.$

18. $y = \frac{x^{16} + 9}{1 - 5x^2}, \quad x_0 = 1.$

19. $y = 3(\sqrt[3]{x} - 2\sqrt{x}), \quad x_0 = 1.$

20. $y = 1/(3x + 2), \quad x_0 = 2.$

21. $y = x/(x^2 + 1), \quad x_0 = -2.$

22. $y = (x^2 - 3x + 3)/3, \quad x_0 = 3.$

23. $y = 2x/(x^2 + 1), \quad x_0 = 1.$

24. $y = -2(\sqrt[3]{x} + 3\sqrt{x}), \quad x_0 = 1.$

25. $y = \frac{1 + 3x^2}{3 + x^2}, \quad x_0 = 1.$

26. $y = 14\sqrt{x} - 15\sqrt[3]{x} + 2, \quad x_0 = 1.$

27. $y = 3\sqrt[4]{x} - \sqrt{x}, \quad x_0 = 1.$

28. $y = (3x - 2x^3)/3, \quad x_0 = 1.$

29. $y = x^2/10 + 3, \quad x_0 = 2.$

30. $y = (x^2 - 2x - 3)/4, \quad x_0 = 4.$

Задача 3. Знайдіть диференціал dy функцій:

1. $y = x \arcsin(1/x) + \ln|x + \sqrt{x^2 - 1}|, \quad x > 0.$

2. $y = \operatorname{tg}(2 \arccos \sqrt{1 - 2x^2}), \quad x > 0.$

3. $y = \sqrt{1 + 2x} - \ln|x + \sqrt{1 + 2x}|.$

4. $y = x^2 \operatorname{arctg} \sqrt{x^2 - 1} - \sqrt{x^2 - 1}.$

5. $y = \arccos(1/\sqrt{1 + 2x^2}), \quad x > 0.$

6. $y = x \ln|x + \sqrt{x^2 + 3}| - \sqrt{x^2 + 3}.$

7. $y = \operatorname{arctg}(\operatorname{sh} x) + (\operatorname{sh} x) \operatorname{lnch} x.$

8. $y = \arccos((x^2 - 1)/(x^2 \sqrt{2})).$

9. $y = \ln(\cos^2 x + \sqrt{1 + \cos^4 x}).$

10. $y = \ln(x + \sqrt{1 + x^2}) - \sqrt{1 + x^2} \operatorname{arctg} x.$

$$11. y = \frac{\ln|x|}{1+x^2} - \frac{1}{2} \ln \frac{x^2}{1+x^2}$$

$$13. y = x\sqrt{4-x^2} + a \arcsin(x/2).$$

$$15. y = 2x + \ln|\sin x + 2\cos x|.$$

$$17. y = \ln \left| \frac{x + \sqrt{x^2 + 1}}{2x} \right|.$$

$$19. y = \operatorname{arctg} \frac{x^2 - 1}{x}.$$

$$21. y = \operatorname{arctg} \left(\operatorname{tg} \frac{x}{2} + 1 \right).$$

$$23. y = \ln|\cos \sqrt{x}| + \sqrt{x} \operatorname{tg} \sqrt{x}.$$

$$25. y = x(\sin \ln x - \cos \ln x).$$

$$27. y = \cos x \cdot \operatorname{Intg} x - \operatorname{Intg} \frac{x}{2}.$$

$$29. y = \sqrt{x} - (1+x) \operatorname{arctg} \sqrt{x}.$$

$$12. y = \ln(e^x + \sqrt{e^{2x} - 1}) + \operatorname{arcsine}^x.$$

$$14. y = \operatorname{Intg}(x/2) - x/\sin x.$$

$$16. y = \sqrt{\operatorname{ctg} x} - \sqrt{\operatorname{tg}^3 x/3}.$$

$$18. y = \sqrt[3]{\frac{x+2}{x-2}}.$$

$$20. y = \ln|x^2 - 1| - \frac{1}{x^2 - 1}.$$

$$22. y = \ln|2x + 2\sqrt{x^2 + x} + 1|.$$

$$24. y = e^x (\cos 2x + 2\sin 2x).$$

$$26. y = \left(\sqrt{x-1} - \frac{1}{2} \right) e^{2\sqrt{x-1}}.$$

$$28. y = \sqrt{3+x^2} - x \ln|x + \sqrt{3+x^2}|.$$

$$30. y = x \operatorname{arctg} x - \ln \sqrt{1+x^2}.$$

Задача 4. Обчисліть наближено за допомогою диференціала:

$$1. y = \sqrt[3]{x}, \quad x = 7,76.$$

$$2. y = \sqrt[3]{x^3 + 7x}, \quad x = 1,012.$$

$$3. y = \left(x + \sqrt{5-x^2} \right) / 2, \quad x = 0,98.$$

$$4. y = \sqrt[3]{x}, \quad x = 27,54.$$

$$5. y = \arcsin x, \quad x = 0,08.$$

$$6. y = \sqrt[3]{x^2 + 2x + 5}, \quad x = 0,97.$$

$$7. y = \sqrt[3]{x}, \quad x = 26,46.$$

$$8. y = \sqrt{x^2 + x + 3}, \quad x = 1,97.$$

$$9. y = x^{11}, \quad x = 1,021.$$

$$10. y = \sqrt[3]{x}, \quad x = 1,21.$$

$$11. y = x^{21}, \quad x = 0,998.$$

$$12. y = \sqrt[3]{x^2}, \quad x = 1,03.$$

$$13. y = x^6, \quad x = 2,01.$$

$$14. y = \sqrt[3]{x}, \quad x = 8,24.$$

$$15. y = x^7, \quad x = 1,996.$$

$$16. y = \sqrt[3]{x}, \quad x = 7,64.$$

$$17. y = \sqrt{4x-1}, \quad x = 2,56.$$

$$18. y = 1/\sqrt{2x^2 + x + 1}, \quad x = 1,016.$$

$$19. y = \sqrt[3]{x}, \quad x = 8,36.$$

$$20. y = 1/\sqrt{x}, \quad x = 4,16.$$

$$21. y = x^7, \quad x = 2,002.$$

$$22. y = \sqrt{4x-3}, \quad x = 1,78.$$

$$23. y = \sqrt{x^3}, \quad x = 0,98.$$

$$24. y = x^5, \quad x = 2,997.$$

$$25. y = \sqrt[5]{x^2}, \quad x = 1,03.$$

$$26. y = x^4, \quad x = 3,998.$$

$$27. y = \sqrt{1+x+\sin x}, \quad x = 0,01.$$

$$28. y = \sqrt[3]{3x+\cos x}, \quad x = 0,01.$$

$$29. y = \sqrt[4]{2x - \sin(\pi x/2)}, \quad x = 1,02. \quad 30. y = \sqrt{x^2 + 5}, \quad x = 1,97.$$

Задача 5. Знайти похідні функцій, застосовуючи попереднє логарифмування: (Додаткова)

$$1. y = \frac{2(3x^3 + 4x^2 - x - 2)}{15\sqrt{1+x}}.$$

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

$$3. y = \frac{x^4 - 8x^2}{2(x^2 - 4)}.$$

$$4. y = \frac{2x^2 - x - 1}{3\sqrt{2+4x}}.$$

$$5. y = \frac{(1+x^8)\sqrt{1+x^8}}{12x^{12}}.$$

$$6. y = \frac{x^2}{2\sqrt{1-3x^4}}.$$

$$7. y = \frac{(x^2 - 6)\sqrt{(4+x^2)^3}}{120x^5}.$$

$$8. y = \frac{(x^2 - 8)\sqrt{x^2 - 8}}{6x^3}.$$

$$9. y = \frac{4 + 3x^3}{x^3\sqrt{(2+x^3)^2}}.$$

$$10. y = \sqrt[3]{\frac{(1+x^{3/4})^2}{x^{3/2}}}.$$

$$11. y = \frac{x^6 + x^3 - 2}{\sqrt{1-x^3}}.$$

$$12. y = \frac{(x^2 - 2)\sqrt{4+x^2}}{24x^3}.$$

$$13. y = \frac{1+x^2}{2\sqrt{1+2x^2}}.$$

$$14. y = \frac{\sqrt{x-1}(3x+2)}{4x^2}.$$

$$15. y = \frac{\sqrt{(1+x^2)^3}}{3x^3}.$$

$$16. y = \frac{x^6 + 8x^3 - 128}{\sqrt{8-x^3}}.$$

$$17. y = \frac{\sqrt{2x+3}(x-2)}{x^2}.$$

$$18. y = (1-x^2)\sqrt[5]{x^3 + \frac{1}{x}}.$$

$$19. y = \frac{(2x^2 + 3)\sqrt{x^2 - 3}}{9x^3}.$$

$$20. y = \frac{x-1}{(x^2+5)\sqrt{x^2+5}}.$$

$$21. y = \frac{(2x+1)\sqrt{x^2-x}}{x^2}.$$

$$22. y = 2\sqrt{\frac{1-\sqrt{x}}{1+\sqrt{x}}}.$$

$$23. y = \frac{1}{(x+2)\sqrt{x^2+4x+5}}.$$

$$24. y = 3\frac{\sqrt[3]{x^2+x+1}}{x+1}.$$

$$25. y = 3 \cdot \sqrt[3]{\frac{(x+1)}{(x-1)^2}}.$$

$$26. y = \frac{x+7}{6\sqrt{x^2+2x+7}}.$$

$$27. y = \frac{x\sqrt{x+1}}{x^2+x+1}.$$

$$28. y = \frac{x^2+2}{2\sqrt{1-x^4}}.$$

$$29. y = \frac{(x+3)\sqrt{2x-1}}{2x+7}.$$

$$30. y = \frac{3x+\sqrt{x}}{\sqrt{x^2+2}}.$$

Задача 6. Знайдіть похідну:

$$1. y = x - \ln(2 + e^x + 2\sqrt{e^{2x} + e^x + 1}). \quad 2. y = e^{2x}(2 - \sin 2x - \cos 2x)/8.$$

$$3. y = \frac{1}{2} \operatorname{arctg} \frac{e^x - 3}{2}.$$

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

$$5. y = 2\sqrt{e^x+1} + \ln \frac{\sqrt{e^x+1}-1}{\sqrt{e^x+1}+1}.$$

$$6. y = \frac{2}{3} \sqrt{(\operatorname{arctg} e^x)^3}.$$

$$7. y = \frac{1}{2} \ln(e^{2x} + 1) - 2 \operatorname{arctg} e^x.$$

$$8. y = \ln(e^x + 1) + \frac{18e^{2x} + 27e^x + 11}{6(e^x + 1)^3}.$$

$$9. y = \frac{2(\sqrt{2^x-1} - \operatorname{arctg} \sqrt{2^x-1})}{\ln 2}.$$

$$10. y = 2(x-2)\sqrt{1+e^x} - 2 \ln \frac{\sqrt{1+e^x}-1}{\sqrt{1+e^x}+1}.$$

$$11. y = \frac{e^{\alpha x}(\alpha \sin \beta x - \beta \cos \beta x)}{\alpha^2 + \beta^2}.$$

$$12. y = \frac{e^{\alpha x}(\beta \sin \beta x - \alpha \cos \beta x)}{\alpha^2 + \beta^2}.$$

$$13. y = e^{ax} \left[\frac{1}{2a} + \frac{a \cos 2bx + 2b \sin 2bx}{2(a^2 + 4b^2)} \right].$$

$$14. y = x + \frac{1}{1+e^x} - \ln(1+e^x).$$

$$15. y = x - 3 \ln \left[(1 + e^{x/6}) \sqrt{1 + e^{x/3}} \right] - 3 \operatorname{arctg} e^{x/6}.$$

$$16. y = x + \frac{8}{1+e^{x/4}}.$$

$$17. y = \ln(e^x + \sqrt{e^{2x}-1}) + \arcsin e^{-x}.$$

$$18. y = x - e^{-x} \arcsin e^x - \ln(1 + \sqrt{1 - e^{2x}}).$$

$$19. y = x - \ln(1 + e^x) - 2e^{-x/2} \operatorname{arctg} e^{x/2} - (\operatorname{arctg} e^{x/2})^2.$$

$$20. y = \frac{e^{-x^3}}{1+x^3}.$$

$$21. y = \frac{1}{m\sqrt{ab}} \operatorname{arctg} \left(e^{mx} \cdot \sqrt{\frac{a}{b}} \right).$$

$$22. y = 3e^{\sqrt[3]{x}} \left(\sqrt[3]{x^2} - 2\sqrt[3]{x} + 2 \right).$$

$$23. y = \ln \frac{\sqrt{1+e^x+e^{2x}} - e^x - 1}{\sqrt{1+e^x+e^{2x}} - e^x + 1}.$$

$$24. y = e^{\sin x} \left(x - \frac{1}{\cos x} \right).$$

$$25. y = \frac{e^x}{2} \left[(x^2 - 1) \cos x + (x - 1)^2 \sin x \right].$$

$$26. y = \operatorname{arctg}(e^x - e^{-x}).$$

$$27. y = 3e^{\sqrt[3]{x}} \left(\sqrt[3]{x^5} - 5\sqrt[3]{x^4} + 20x - 60\sqrt[3]{x^2} + 120\sqrt[3]{x} - 120 \right).$$

$$28. y = -\frac{e^{3x}}{3\operatorname{sh}^3 x}.$$

$$29. y = \arcsin e^{-x} - \sqrt{1 - e^{2x}}.$$

$$30. y = -\frac{1}{2} e^{-x^2} (x^4 + 2x^2 + 2).$$

Задача 7. Знайдіть похідну: (Додаткова)

$$1. y = \sqrt{x} \ln(\sqrt{x} + \sqrt{x+a}) - \sqrt{x+a}. \quad 2. y = \ln(x + \sqrt{a^2 + x^2}).$$

$$3. y = 2\sqrt{x} - 4\ln(2 + \sqrt{x}).$$

$$4. y = \ln \frac{x^2}{\sqrt{1 - ax^4}}.$$

$$5. y = \ln(\sqrt{x} + \sqrt{x+1}).$$

$$6. y = \ln \frac{a^2 + x^2}{a^2 - x^2}.$$

$$7. y = \ln^2(x + \cos x).$$

$$8. y = \ln^3(1 + \cos x).$$

$$9. y = \ln \frac{x^2}{1 - x^2}.$$

$$10. y = \operatorname{Intg} \left(\frac{\pi}{4} + \frac{x}{2} \right).$$

$$11. y = \ln^4 \sqrt{\frac{1+2x}{1-2x}}.$$

$$12. y = x + \frac{1}{\sqrt{2}} \ln \frac{x - \sqrt{2}}{x + \sqrt{2}} + a^{\pi\sqrt{2}}.$$

$$13. y = \ln \sin \frac{2x+4}{x+1}.$$

$$14. y = \log_{16} \log_5 \operatorname{tg} x.$$

$$15. y = \log_4 \log_2 \operatorname{tg} x.$$

$$16. y = x(\cos \ln x + \sin \ln x)/2.$$

$$17. y = \ln \cos \frac{2x+3}{x+1}.$$

$$18. y = \lg \ln(\operatorname{ctg} x).$$

$$19. y = \log_a \frac{1}{\sqrt{1-x^4}}.$$

$$20. y = \frac{1}{\sqrt{2}} \ln(\sqrt{2} \operatorname{tg} x + \sqrt{1+2\operatorname{tg}^2 x}).$$

$$21. y = \ln \arcsin \sqrt{1 - e^{2x}}.$$

$$22. y = \ln \arccos \sqrt{1 - e^{4x}}.$$

$$23. y = \ln(bx + \sqrt{a^2 + b^2 x^2}).$$

$$24. y = \ln \frac{\sqrt{x^2+1} + x\sqrt{2}}{\sqrt{x^2+1} - x\sqrt{2}}.$$

$$25. y = \ln \left(\arccos \frac{1}{\sqrt{x}} \right).$$

$$26. y = \ln(e^x + \sqrt{1 + e^{2x}}).$$

$$27. y = \ln \frac{\sqrt{5} + \operatorname{tg}(x/2)}{\sqrt{5} - \operatorname{tg}(x/2)}.$$

$$28. y = \ln \frac{\ln x}{\sin(1/x)}.$$

$$29. y = \ln \ln \sin(1 + 1/x).$$

$$30. y = \ln \ln^3 \ln^2 x.$$

Задача 9. Знайдіть похідну: (Додаткова)

$$1. y = \operatorname{arctg} \frac{\operatorname{tg} x - \operatorname{ctg} x}{\sqrt{2}}.$$

$$2. y = \arcsin \frac{\sqrt{x} - 2}{\sqrt{5x}}.$$

$$3. y = \frac{2x-1}{4} \sqrt{2+x-x^2} + \frac{9}{8} \arcsin \frac{2x-1}{3}. \quad 4. y = \operatorname{arctg} \frac{\sqrt{1+x^2} - 1}{x}.$$

$$5. y = \arccos \frac{x^2 - 4}{\sqrt{x^4 + 16}}.$$

$$6. y = \sqrt{\frac{2}{3}} \operatorname{arctg} \frac{3x-1}{\sqrt{6x}}.$$

$$7. y = \frac{1}{4} \ln \frac{x-1}{x+1} - \frac{1}{2} \operatorname{arctg} x. \quad 8. y = \frac{1}{2} (x-4) \sqrt{8x-x^2-7} - 9 \arccos \sqrt{\frac{x-1}{6}}.$$

$$9. y = \frac{(1+x) \operatorname{arctg} \sqrt{x}}{x^2} + \frac{1}{3x\sqrt{x}}.$$

$$10. y = \frac{x^3}{3} \arccos x - \frac{2+x^2}{9} \sqrt{1-x^2}.$$

$$11. y = \frac{1}{2\sqrt{x}} + \frac{1+x}{2x} \operatorname{arctg} \sqrt{x}.$$

$$12. y = \frac{3+x}{2} \sqrt{x(2-x)} + 3 \arccos \sqrt{\frac{x}{2}}.$$

$$13. y = \frac{4+x^4}{x^3} \operatorname{arctg} \frac{x^2}{2} + \frac{4}{x}.$$

$$14. y = \arcsin \sqrt{\frac{x}{x+1}} + \operatorname{arctg} \sqrt{x}.$$

$$15. y = \frac{1}{2} \sqrt{\frac{1}{x^2} - 1} - \frac{\arccos x}{2x^2}.$$

$$16. y = 6 \arcsin \frac{\sqrt{x}}{2} - \frac{6+x}{2} \sqrt{x(4-x)}.$$

$$17. y = \frac{x-3}{2} \sqrt{6x-x^2-8} + \arcsin \sqrt{\frac{x}{2}-1}. \quad 18. y = \frac{(1+x) \operatorname{arctg} \sqrt{x} - \sqrt{x}}{x}.$$

$$19. y = \frac{2\sqrt{1-x} \arcsin \sqrt{x}}{x} + \frac{2}{\sqrt{x}}.$$

$$20. y = \frac{2x-5}{4} \sqrt{5x-4-x^2} + \frac{9}{4} \arcsin \sqrt{\frac{x-1}{3}}.$$

$$21. y = \operatorname{arctg} x + \frac{5}{6} \ln \frac{x^2+1}{x^2+4}.$$

$$22. y = \arcsin \frac{x-2}{(x-1)\sqrt{2}}.$$

$$23. y = \sqrt{1-x^2} - x \arcsin \sqrt{1-x^2}.$$

$$24. y = \sqrt{x} + \frac{1}{3} \operatorname{arctg} \sqrt{x} + \frac{8}{3} \operatorname{arctg} \frac{\sqrt{x}}{2}.$$

$$25. y = \operatorname{arctg} \frac{\sqrt{1-x}}{1-\sqrt{x}}.$$

$$26. y = (2x^2 + 6x + 5) \operatorname{arctg} \frac{x+1}{x+2} - x.$$

$$27. y = \frac{x}{2\sqrt{1-4x^2}} \arcsin 2x + \frac{1}{8} \ln(1-4x^2).$$

$$28. y = \left(2x^2 - x + \frac{1}{2}\right) \operatorname{arctg} \frac{x^2 - 1}{x\sqrt{3}} - \frac{x^3}{2\sqrt{3}} - \frac{\sqrt{3}}{2} x.$$

$$29. y = (x + 2\sqrt{x} + 2) \operatorname{arctg} \frac{\sqrt{x}}{\sqrt{x} + 2} - \sqrt{x}.$$

$$30. y = \sqrt{1+2x-x^2} \arcsin \frac{x\sqrt{2}}{1+x} - \sqrt{2} \ln(1+x).$$

Задача 11. Знайдіть похідну:

$$1. y = (\operatorname{arctg} x)^{(1/2)\ln(\operatorname{arctg} x)}.$$

$$2. y = (\sin \sqrt{x})^{\ln(\sin \sqrt{x})}.$$

$$3. y = (\sin x)^{5e^x}.$$

$$4. y = (\arcsin x)^{e^x}.$$

$$5. y = (\ln x)^{3^x}.$$

$$6. y = x^{\arcsin x}.$$

$$7. y = (\operatorname{ctg} 3x)^{2e^x}.$$

$$8. y = x^{e^{\operatorname{tg} x}}.$$

$$9. y = (\operatorname{tg} x)^{4e^x}.$$

$$10. y = (\cos 5x)^{e^x}.$$

$$11. y = (x \sin x)^{8\ln(x \sin x)}.$$

$$12. y = (x-5)^{\operatorname{ch} x}.$$

$$13. y = (x^3 + 4)^{\operatorname{tg} x}.$$

$$14. y = x^{\sin x^3}.$$

$$15. y = (x^2 - 1)^{\operatorname{sh} x}.$$

$$16. y = (x^4 + 5)^{\operatorname{ctg} x}.$$

$$17. y = (\sin x)^{5x/2}.$$

$$18. y = (x^2 + 1)^{\cos x}.$$

$$19. y = 19^{x^{19}} x^{19}.$$

$$20. y = x^{3^x} \cdot 2^x.$$

$$21. y = (\sin \sqrt{x})^{e^{1/x}}.$$

$$22. y = x^{e^{\operatorname{ctg} x}}.$$

$$23. y = x^{e^{\cos x}}.$$

$$24. y = x^{2^x} \cdot 5^x.$$

$$25. y = x^{e^{\sin x}}.$$

$$26. y = (\operatorname{tg} x)^{\ln(\operatorname{tg} x)/4}.$$

$$27. y = x^{e^{\operatorname{arctg} x}}.$$

$$28. y = (x^8 + 1)^{\operatorname{th} x}.$$

$$29. y = x^{29^x} \cdot 29^x.$$

$$30. y = (\cos 2x)^{\ln(\cos 2x)/4}.$$

Задача 12. Знайдіть похідну: (Додаткова)

$$1. y = \frac{1}{24} (x^2 + 8) \sqrt{x^2 - 4} + \frac{x^2}{16} \arcsin \frac{2}{x}, \quad x > 0.$$

2. $y = \frac{4x+1}{16x^2+8x+3} + \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{4x+1}{\sqrt{2}}.$
3. $y = 2x - \ln(1 + \sqrt{1 - e^{4x}}) - e^{-2x} \arcsin(e^{2x}).$
4. $y = \sqrt{9x^2 - 12x + 5} \operatorname{arctg}(3x - 2) - \ln(3x - 2 + \sqrt{9x^2 - 12x + 5}).$
5. $y = \frac{2}{x-1} \sqrt{2x - x^2} + \ln \frac{1 + \sqrt{2x - x^2}}{x-1}.$
6. $y = \frac{x^2}{81} \arcsin \frac{3}{x} + \frac{1}{81} (x^2 + 18) \sqrt{x^2 - 9}, \quad x > 0.$
7. $y = \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{3x-1}{\sqrt{2}} + \frac{1}{3} \cdot \frac{3x-1}{3x^2 - 2x + 1}.$
8. $y = 3x - \ln(1 + \sqrt{1 - e^{6x}}) - e^{-3x} \arcsin(e^{3x}).$
9. $y = \ln(4x - 1 + \sqrt{16x^2 - 8x + 2}) - \sqrt{16x^2 - 8x + 2} \operatorname{arctg}(4x - 1).$
10. $y = \ln \frac{1 + 2\sqrt{-x - x^2}}{2x+1} + \frac{4}{2x+1} \sqrt{-x - x^2}.$
11. $y = (2x+3)^4 \cdot \arcsin \frac{1}{2x+3} + \frac{2}{3} (4x^2 + 12x + 11) \sqrt{x^2 + 3x + 2}, \quad 2x+3 > 0.$
12. $y = \frac{x+2}{x^2+4x+6} + \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{x+2}{\sqrt{2}}.$
13. $y = 5x - \ln(1 + \sqrt{1 - e^{10x}}) - e^{-5x} \arcsin(e^{5x}).$
14. $y = \sqrt{x^2 - 8x + 17} \operatorname{arctg}(x - 4) - \ln(x - 4 + \sqrt{x^2 - 8x + 17}).$
15. $y = \ln \frac{1 + \sqrt{-3 + 4x - x^2}}{2-x} + \frac{2}{2-x} \sqrt{-3 + 4x - x^2}.$
16. $y = (3x^2 - 4x + 2) \sqrt{9x^2 - 12x + 3} + (3x - 2)^4 \arcsin \frac{1}{3x-2}, \quad 3x - 2 > 0.$
17. $y = \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{x-1}{\sqrt{2}} + \frac{x-1}{x^2 - 2x + 3}.$
18. $y = \ln(e^{5x} + \sqrt{e^{10x} - 1}) + \arcsin(e^{-5x}).$
19. $y = \ln(2x - 3 + \sqrt{4x^2 - 12x + 10}) - \sqrt{4x^2 - 12x + 10} \operatorname{arctg}(2x - 3).$
20. $y = \ln \frac{1 + \sqrt{-3 - 4x - x^2}}{-x-2} - \frac{2}{x+2} \sqrt{-3 - 4x - x^2}.$

$$21. y = \frac{2}{3}(4x^2 - 4x + 3)\sqrt{x^2 - x} + (2x - 1)^4 \arcsin \frac{1}{2x - 1}, \quad 2x - 1 > 0.$$

$$22. y = \frac{2x - 1}{4x^2 - 4x + 3} + \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{2x - 1}{\sqrt{2}}.$$

$$23. y = \arcsin(e^{-4x}) + \ln(e^{4x} + \sqrt{e^{8x} - 1}).$$

$$24. y = \ln(5x + \sqrt{25x^2 + 1}) - \sqrt{25x^2 + 1} \operatorname{arctg} 5x.$$

$$25. y = \frac{2}{3x - 2} \sqrt{-3 + 12x - 9x^2} + \ln \frac{1 + \sqrt{-3 + 12x - 9x^2}}{3x - 2}.$$

$$26. y = (3x + 1)^4 \arcsin \frac{1}{3x + 1} + (3x^2 + 2x + 1)\sqrt{9x^2 + 6x}, \quad 3x + 1 > 0.$$

$$27. y = \frac{1}{\sqrt{2}} \operatorname{arctg} \frac{2x + 1}{\sqrt{2}} + \frac{2x + 1}{4x^2 + 4x + 3}.$$

$$28. y = \ln(e^{3x} + \sqrt{e^{6x} - 1}) + \arcsin(e^{-3x}).$$

$$29. y = \sqrt{49x^2 + 1} \operatorname{arctg} 7x - \ln(7x + \sqrt{49x^2 + 1}).$$

$$30. y = \frac{1}{x} \sqrt{1 - 4x^2} + \ln \frac{1 + \sqrt{1 + 4x^2}}{2x}.$$

Задача 13. Знайдіть похідну: (Додаткова)

$$1. y = \frac{x \arcsin x}{\sqrt{1 - x^2}} + \ln \sqrt{1 - x^2}. \quad 2. y = 4 \ln \frac{x}{1 + \sqrt{1 - 4x^2}} - \frac{\sqrt{1 - 4x^2}}{x^2}.$$

$$3. y = x(2x^2 + 5)\sqrt{x^2 + 1} + 3 \ln(x + \sqrt{x^2 + 1}).$$

$$4. y = x^3 \arcsin x + \frac{x^2 + 2}{3} \sqrt{1 - x^2}.$$

$$5. y = 3 \arcsin \frac{3}{4x + 1} + 2\sqrt{4x^2 + 2x - 2}, \quad 4x + 1 > 0.$$

$$6. y = \sqrt{1 + x^2} \operatorname{arctg} x - \ln(x + \sqrt{1 + x^2}).$$

$$7. y = 2 \arcsin \frac{2}{3x + 4} + \sqrt{9x^2 + 24x + 12}, \quad 3x + 4 > 0.$$

$$8. y = x(2x^2 + 1)\sqrt{x^2 + 1} - \ln(x + \sqrt{x^2 + 1}).$$

$$9. y = \ln(x + \sqrt{x^2 + 1}) - \frac{\sqrt{1 + x^2}}{x}. \quad 10. y = \sqrt{1 - 3x - 2x^2} + \frac{3}{2\sqrt{2}} \arcsin \frac{4x + 3}{\sqrt{17}}.$$

$$11. y = \sqrt{(4+x)(1+x)} + 3\ln(\sqrt{4+x} + \sqrt{1+x}).$$

$$12. y = \ln \frac{\sqrt{x^2 - x + 1}}{x} + \sqrt{3} \operatorname{arctg} \frac{2x-1}{\sqrt{3}}.$$

$$13. y = \frac{1}{12} \ln \frac{x^4 - x^2 + 1}{(x^2 + 1)^2} - \frac{1}{2\sqrt{3}} \operatorname{arctg} \frac{\sqrt{3}}{2x^2 - 1}.$$

$$14. y = 4 \arcsin \frac{4}{2x+3} + \sqrt{4x^2 + 12x - 7}, \quad 2x+3 > 0.$$

$$15. y = 2 \arcsin \frac{2}{3x+1} + \sqrt{9x^2 + 6x - 3}, \quad 3x+1 > 0.$$

$$16. y = (2+3x)\sqrt{x-1} - \frac{3}{2} \operatorname{arctg} \sqrt{x-1}.$$

$$17. y = \frac{1}{3}(x-2)\sqrt{x+1} + \ln(\sqrt{x+1} + 1).$$

$$18. y = \sqrt{x^2 + 1} - \frac{1}{2} \ln \frac{\sqrt{x^2 + 1} - x}{\sqrt{x^2 + 1} + 1}. \quad 19. y = \ln \sqrt[3]{\frac{x-1}{x+1}} - \frac{1}{2} \left(\frac{1}{2} + \frac{1}{x^2 - 1} \right) \operatorname{arctg} x.$$

$$20. y = x \ln(\sqrt{1-x} + \sqrt{1+x}) + \frac{1}{2}(\arcsin x - x).$$

$$21. y = \operatorname{arctg} \sqrt{x^2 - 1} - \frac{\ln x}{\sqrt{x^2 - 1}}. \quad 22. y = 3 \arcsin \frac{3}{x+2} + \sqrt{x^2 + 4x - 5}.$$

$$23. y = \sqrt{(3-x)(2+x)} + 5 \arcsin \sqrt{\frac{x+2}{5}}.$$

$$24. y = x(\arcsin x)^2 + 2\sqrt{1-x^2} \arcsin x - 2x.$$

$$25. y = \frac{\sqrt{1-x^2}}{x} + \arcsin x. \quad 26. y = x^2 \arccos x - \frac{x^2 + 2}{3} \sqrt{1-x^2}.$$

$$27. y = \frac{\sqrt{x^2 + 2}}{x^2} - \frac{1}{\sqrt{2}} \ln \frac{\sqrt{2} + \sqrt{x^2 + 2}}{x}.$$

$$28. y = \frac{x}{4}(10-x^2)\sqrt{4-x^2} + 6 \arcsin \frac{x}{2}.$$

$$29. y = \arcsin \frac{1}{2x+3} + 2\sqrt{x^2 + 3x + 2}, \quad 2x+3 > 0.$$

$$30. y = x \arcsin \sqrt{\frac{x}{x+1}} - \sqrt{x} + \operatorname{arctg} \sqrt{x}.$$

Задача 15. Знайдіть похідну y'_x :

$$1. \begin{cases} x = \frac{3t^2 + 1}{3t^3}, \\ y = \sin\left(\frac{t^3}{3} + t\right). \end{cases}$$

$$2. \begin{cases} x = \sqrt{1-t^2}, \\ y = \operatorname{tg} \sqrt{1+t}. \end{cases}$$

$$3. \begin{cases} x = \sqrt{2t-t^2}, \\ y = \frac{1}{\sqrt[3]{(1-t)^2}}. \end{cases}$$

$$4. \begin{cases} x = \arcsin(\sin t), \\ y = \arccos(\cos t). \end{cases}$$

$$5. \begin{cases} x = \ln(t + \sqrt{t^2 + 1}), \\ y = t\sqrt{t^2 + 1}. \end{cases}$$

$$6. \begin{cases} x = \sqrt{2t-t^2}, \\ y = \arcsin(t-1). \end{cases}$$

$$7. \begin{cases} x = \operatorname{ctg}(2e^t), \\ y = \ln(\operatorname{tge}^t). \end{cases}$$

$$8. \begin{cases} x = \ln(\operatorname{ctg} t), \\ y = \frac{1}{\cos^2 t}. \end{cases}$$

$$9. \begin{cases} x = \operatorname{arctge}^{t/2}, \\ y = \sqrt{e^t + 1}. \end{cases}$$

$$10. \begin{cases} x = \ln \sqrt{\frac{1-t}{1+t}}, \\ y = \sqrt{1-t^2}. \end{cases}$$

$$11. \begin{cases} x = \ln \frac{1}{\sqrt{1-t^4}}, \\ y = \arcsin \frac{1-t^2}{1+t^2}. \end{cases}$$

$$12. \begin{cases} x = \sqrt{1-t^2}, \\ y = \frac{t}{\sqrt{1-t^2}}. \end{cases}$$

$$13. \begin{cases} x = \arcsin(\sqrt{1-t^2}), \\ y = (\arccos t)^2. \end{cases}$$

$$14. \begin{cases} x = \frac{t}{\sqrt{1-t^2}}, \\ y = \ln \frac{1 + \sqrt{1-t^2}}{t}. \end{cases}$$

$$15. \begin{cases} x = (1 + \cos^2 t)^2, \\ y = \frac{\cos t}{\sin^2 t}. \end{cases}$$

$$16. \begin{cases} x = \ln \frac{1-t}{1+t}, \\ y = \sqrt{1-t^2}. \end{cases}$$

$$17. \begin{cases} x = \arccos \frac{1}{t}, \\ y = \sqrt{t^2 - 1} + \arcsin \frac{1}{t}. \end{cases}$$

$$18. \begin{cases} x = \frac{1}{\ln t}, \\ y = \ln \frac{1 + \sqrt{1 - t^2}}{t}. \end{cases}$$

$$19. \begin{cases} x = \arcsin \sqrt{t}, \\ y = \sqrt{1 + \sqrt{t}}. \end{cases}$$

$$20. \begin{cases} x = (\arcsin t)^2, \\ y = \frac{t}{\sqrt{1 - t^2}}. \end{cases}$$

$$21. \begin{cases} x = t\sqrt{t^2 + 1}, \\ y = \ln \frac{1 + \sqrt{1 + t^2}}{t}. \end{cases}$$

$$22. \begin{cases} x = \operatorname{arctg} t, \\ y = \ln \frac{\sqrt{1 + t^2}}{t + 1}. \end{cases}$$

$$23. \begin{cases} x = \ln(1 - t^2), \\ y = \arcsin \sqrt{1 - t^2}. \end{cases}$$

$$24. \begin{cases} x = \operatorname{arctg} \frac{t + 1}{t - 1}, \\ y = \arcsin \sqrt{1 - t^2}. \end{cases}$$

$$25. \begin{cases} x = \ln \sqrt{\frac{1 - \sin t}{1 + \sin t}}, \\ y = \frac{1}{2} \operatorname{tg}^2 t + \ln \cos t. \end{cases}$$

$$26. \begin{cases} x = \sqrt{t - t^2} - \operatorname{arctg} \sqrt{\frac{1 - t}{t}}, \\ y = \sqrt{t} - \sqrt{1 - t} \arcsin \sqrt{t}. \end{cases}$$

$$27. \begin{cases} x = \ln \operatorname{tg} t, \\ y = \frac{1}{\sin^2 t}. \end{cases}$$

$$28. \begin{cases} x = \frac{t^2 \ln t}{1 - t^2} + \ln \sqrt{1 - t^2}, \\ y = \frac{t}{\sqrt{1 - t^2}} \arcsin t + \ln \sqrt{1 - t^2}. \end{cases}$$

$$29. \begin{cases} x = e^{\sec^2 t}, \\ y = \operatorname{tg} t \cdot \ln \cos t + \operatorname{tg} t - t. \end{cases}$$

$$30. \begin{cases} x = \frac{t}{\sqrt{1 - t^2}} \arcsin t + \ln \sqrt{1 - t^2}, \\ y = \frac{t}{\sqrt{1 - t^2}}. \end{cases}$$

Задача 18. Знайдіть похідну вказаного порядку: (Додаткова)

$$1. y = (2x^2 - 7) \ln(x - 1), \quad y^V = ?$$

$$2. y = (3 - x^2) \ln^2 x, \quad y^{III} = ?$$

$$3. y = x \cos x^2, \quad y^{III} = ?$$

$$4. y = \frac{\ln(x - 1)}{\sqrt{x - 1}}, \quad y^{III} = ?$$

$$5. y = \frac{\log_2 x}{x^3}, \quad y^{III} = ?$$

$$6. y = (4x^3 + 5) e^{2x+1}, \quad y^V = ?$$

7. $y = x^2 \sin(5x - 3)$, $y''' = ?$
8. $y = \frac{\ln x}{x^2}$, $y^{IV} = ?$
9. $y = (2x + 3) \ln^2 x$, $y''' = ?$
10. $y = (1 + x^2) \operatorname{arctg} x$, $y''' = ?$
11. $y = \frac{\ln x}{x^3}$, $y^{IV} = ?$
12. $y = (4x + 3) \cdot 2^{-x}$, $y^V = ?$
13. $y = e^{1-2x} \cdot \sin(2 + 3x)$, $y^{IV} = ?$
14. $y = \frac{\ln(3 + x)}{3 + x}$, $y''' = ?$
15. $y = (2x^3 + 1) \cos x$, $y^V = ?$
16. $y = (x^2 + 3) \ln(x - 3)$, $y^{IV} = ?$
17. $y = (1 - x - x^2) e^{(x-1)/2}$, $y^{IV} = ?$
18. $y = \frac{1}{x} \sin 2x$, $y''' = ?$
19. $y = (x + 7) \ln(x + 4)$, $y^V = ?$
20. $y = (3x - 7) \cdot 3^{-x}$, $y^{IV} = ?$
21. $y = \frac{\ln(2x + 5)}{2x + 5}$, $y''' = ?$
22. $y = e^{x/2} \cdot \sin 2x$, $y^{IV} = ?$
23. $y = \frac{\ln x}{x^5}$, $y''' = ?$
24. $y = x \ln(1 - 3x)$, $y^{IV} = ?$
25. $y = (x^2 + 3x + 1) e^{3x+2}$, $y^V = ?$
26. $y = (5x - 8) \cdot 2^{-x}$, $y^{IV} = ?$
27. $y = \frac{\ln(x - 2)}{x - 2}$, $y^V = ?$
28. $y = e^{-x} \cdot (\cos 2x - 3 \sin 2x)$, $y^{IV} = ?$
29. $y = (5x - 1) \ln^2 x$, $y''' = ?$
30. $y = \frac{\log_3 x}{x^2}$, $y^{IV} = ?$

Задача 19. Знайдіть похідну другого порядку y''_{xx} : (Додаткова)

1. $\begin{cases} x = \cos 2t, \\ y = 2 \sec^2 t. \end{cases}$
2. $\begin{cases} x = \sqrt{1 - t^2}, \\ y = 1/t. \end{cases}$
3. $\begin{cases} x = e^t \cos t, \\ y = e^t \sin t. \end{cases}$
4. $\begin{cases} x = \operatorname{sh}^2 t, \\ y = 1/\operatorname{ch}^2 t. \end{cases}$
5. $\begin{cases} x = t + \sin t, \\ y = 2 - \cos t. \end{cases}$
6. $\begin{cases} x = 1/t, \\ y = 1/(1 + t^2). \end{cases}$
7. $\begin{cases} x = \sqrt{t}, \\ y = 1/\sqrt{1 - t}. \end{cases}$
8. $\begin{cases} x = \sin t, \\ y = \sec t. \end{cases}$
9. $\begin{cases} x = \operatorname{tg} t, \\ y = 1/\sin 2t. \end{cases}$
10. $\begin{cases} x = \sqrt{t - 1}, \\ y = t/\sqrt{1 - t}. \end{cases}$

$$11. \begin{cases} x = \sqrt{t}, \\ y = \sqrt[3]{t-1}. \end{cases}$$

$$12. \begin{cases} x = \cos t / (1 + 2 \cos t), \\ y = \sin t / (1 + 2 \cos t). \end{cases}$$

$$13. \begin{cases} x = \sqrt{t^3 - 1}, \\ y = \ln t. \end{cases}$$

$$14. \begin{cases} x = \operatorname{sh} t, \\ y = \operatorname{th}^2 t. \end{cases}$$

$$15. \begin{cases} x = \sqrt{t-1}, \\ y = 1/\sqrt{t}. \end{cases}$$

$$16. \begin{cases} x = \cos^2 t, \\ y = \operatorname{tg}^2 t. \end{cases}$$

$$17. \begin{cases} x = \sqrt{t-3}, \\ y = \ln(t-2). \end{cases}$$

$$18. \begin{cases} x = \sin t, \\ y = \ln \cos t. \end{cases}$$

$$19. \begin{cases} x = t + \sin t, \\ y = 2 + \cos t. \end{cases}$$

$$20. \begin{cases} x = t - \sin t, \\ y = 2 - \cos t. \end{cases}$$

$$21. \begin{cases} x = \cos t, \\ y = \ln \sin t. \end{cases}$$

$$22. \begin{cases} x = \cos t + t \sin t, \\ y = \sin t - t \cos t. \end{cases}$$

$$23. \begin{cases} x = e^t, \\ y = \arcsin t. \end{cases}$$

$$24. \begin{cases} x = \cos t, \\ y = \sin^4(t/2). \end{cases}$$

$$25. \begin{cases} x = \operatorname{ch} t, \\ y = \sqrt[3]{\operatorname{sh}^2 t}. \end{cases}$$

$$26. \begin{cases} x = \operatorname{arctg} t, \\ y = t^2/2. \end{cases}$$

$$27. \begin{cases} x = 2(t - \sin t), \\ y = 4(2 + \cos t). \end{cases}$$

$$28. \begin{cases} x = \sin t - t \cos t, \\ y = \cos t + t \sin t. \end{cases}$$

$$29. \begin{cases} x = 1/t^2, \\ y = 1/(t^2 + 1). \end{cases}$$

$$30. \begin{cases} x = \cos t + \sin t, \\ y = \sin 2t. \end{cases}$$

Задача 24. Знайдіть найбільше та найменше значення функції на заданих відрізках:

$$1. y = x^2 + \frac{16}{x} - 16, \quad [1, 4].$$

$$2. y = 4 - x - \frac{4}{x^2}, \quad [1, 4].$$

$$3. y = \sqrt[3]{2(x-2)^2(8-x)} - 1, \quad [0, 6].$$

$$4. y = \frac{2(x^2 + 3)}{x^2 - 2x + 5}, \quad [-3, 3].$$

$$5. y = 2\sqrt{x} - x, \quad [0, 4].$$

$$6. y = 1 + \sqrt[3]{2(x-1)^2(x-7)}, \quad [-1, 5].$$

$$7. y = x - 4\sqrt{x} + 5, \quad [1, 9].$$

$$8. y = \frac{10x}{1+x^2}, \quad [0, 3].$$

$$9. y = \sqrt[3]{2(x+1)^2(5-x)} - 2, \quad [-3, 3].$$

$$10. y = 2x^2 + \frac{108}{x} - 59, \quad [2, 4].$$

$$\begin{array}{ll}
11. y = 3 - x - \frac{4}{(x+2)^2}, & [-1, 2]. \\
12. y = \sqrt[3]{2x^2(x-3)}, & [-1, 6]. \\
13. y = \frac{2(-x^2+7x-7)}{x^2-2x+2}, & [1, 4]. \\
14. y = x - 4\sqrt{x+2} + 8, & [-1, 7]. \\
15. y = \sqrt[3]{2(x-2)^2(5-x)}, & [1, 5]. \\
16. y = \frac{4x}{4+x^2}, & [-4, 2]. \\
17. y = -\frac{x^2}{2} + \frac{8}{x} + 8, & [-4, -1]. \\
18. y = \sqrt[3]{2x^2(x-6)}, & [-2, 4]. \\
19. y = \frac{-2x(2x+3)}{x^2+4x+5}, & [1, 4]. \\
20. y = -\frac{2(x^2+3)}{x^2+2x+5}, & [-5, 1]. \\
21. y = \sqrt[3]{2(x-1)^2(x-4)}, & [0, 4]. \\
22. y = x^2 - 2x + \frac{16}{x-1} - 13, & [2, 5]. \\
23. y = 2\sqrt{x-1} - x + 2, & [1, 5]. \\
24. y = \sqrt[3]{2(x+2)^2(1-x)}, & [-3, 4]. \\
25. y = -\frac{x^2}{2} + 2x + \frac{8}{x-2} + 5, & [-2, 1]. \\
26. y = 8x + \frac{4}{x^2} - 15, & \left[\frac{1}{2}, 2\right]. \\
27. y = \sqrt[3]{2(x+2)^2(x-4)} + 3, & [-4, 2]. \\
28. y = x^2 + 4x + \frac{16}{x+2} - 9, & [-1, 2]. \\
29. y = \frac{4}{x^2} - 8x - 15, & \left[-2, -\frac{1}{2}\right]. \\
30. y = \sqrt[3]{2(x+1)^2(x-2)}, & [-2, 5].
\end{array}$$

Задача 28. Проведіть повне дослідження функції та побудуйте її графік:

$$\begin{array}{ll}
1. y = (x^3 + 4)/x^2. & 2. y = (x^2 - x + 1)/(x - 1). \\
3. y = 2/(x^2 + 2x). & 4. y = 4x^2/(3 + x^2). \\
5. y = 12x/(9 + x^2). & 6. y = (x^2 - 3x + 3)/(x - 1). \\
7. y = (4 - x^3)/x^2. & 8. y = (x^2 - 4x + 1)/(x - 4). \\
9. y = (2x^3 + 1)/x^2. & 10. y = (x - 1)^2/x^2. \\
11. y = x^2/(x - 1)^2. & 12. y = (1 + 1/x)^2. \\
13. y = (12 - 3x^2)/(x^2 + 12). & 14. y = (9 + 6x - 3x^2)/(x^2 - 2x + 13). \\
15. y = -8x/(x^2 + 4). & 16. y = ((x - 1)/(x + 1))^2. \\
17. y = (3x^4 + 1)/x^3. & 18. y = 4x/(x + 1)^2. \\
19. y = 8(x - 1)/(x + 1)^2. & 20. y = (1 - 2x^3)/x^2.
\end{array}$$

$$21. y = 4/(x^2 + 2x - 3).$$

$$23. y = (x^2 + 2x - 7)/(x^2 + 2x - 3).$$

$$25. y = -(x/(x+2))^2.$$

$$27. y = 4(x+1)^2/(x^2 + 2x + 4).$$

$$29. y = (x^2 - 6x + 9)/(x-1)^2.$$

$$22. y = 4/(3 + 2x - x^2).$$

$$24. y = 1/(x^4 - 1).$$

$$26. y = (x^3 - 32)/x^2.$$

$$28. y = (3x - 2)/x^3.$$

$$30. y = (x^3 - 27x + 54)/x^3.$$