

**Контрольное домашнее задание.**  
**Часть 2. Математический анализ.**

Срок сдачи – до начала сессии

**Задание 1.** Найти пределы.

1.1. а)  $\lim_{x \rightarrow \infty} \frac{x + 3x^2}{4 - 2x^2}$

б)  $\lim_{x \rightarrow 1} \frac{x - 1}{x^2 + 4x - 5}$

1.2. а)  $\lim_{x \rightarrow \infty} \frac{1 - 6x + 7x^2}{3 - x^2}$

б)  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{2x^2 - x - 1}$

1.3. а)  $\lim_{x \rightarrow \infty} \frac{6x^4 + 2x^2 - 3}{1 - 2x^4}$

б)  $\lim_{x \rightarrow 1} \frac{x^2 - 6x + 5}{2x^2 - x - 1}$

1.4. а)  $\lim_{x \rightarrow \infty} \frac{2x^3 + 3x^2 + 4x}{1 + 15x - x^3}$

б)  $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 - 3x + 2}$

1.5. а)  $\lim_{x \rightarrow \infty} \frac{5x^2 + 4x + 1}{3 + x - 2x^2}$

б)  $\lim_{x \rightarrow 5} \frac{x^2 - 25}{x^2 - 4x - 5}$

1.6. а)  $\lim_{x \rightarrow \infty} \frac{7x^4 - 3x^3 + 2x^2}{5 - 2x^4}$

б)  $\lim_{x \rightarrow 4} \frac{x^2 - 4x}{x^2 - 3x - 4}$

1.7. а)  $\lim_{x \rightarrow \infty} \frac{1 + 2x + 3x^2}{5 - 6x - 2x^2}$

б)  $\lim_{x \rightarrow -2} \frac{x^2 + 4x + 4}{x^2 + 7x + 10}$

1.8. а)  $\lim_{x \rightarrow \infty} \frac{2x^5 + 3x^3 + x}{1 + x^2 - 3x^5}$

б)  $\lim_{x \rightarrow -1} \frac{x^2 + 3x + 2}{x^2 - x - 2}$

1.9. а)  $\lim_{x \rightarrow \infty} \frac{x - 3x^2 + 2x^3}{5x^3 - 6x^2 + 3x + 2}$

б)  $\lim_{x \rightarrow -3} \frac{x^2 + 2x - 3}{x^2 + 4x + 3}$

1.10. а)  $\lim_{x \rightarrow \infty} \frac{2x^4 + 3x^2 + 4}{6x^4 - x^3 + x^2}$

б)  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 4x + 3}$

1.11. а)  $\lim_{x \rightarrow \infty} \frac{2x - 3x^2}{4x + 5x^2}$

б)  $\lim_{x \rightarrow -5} \frac{x + 5}{x^2 + 4x - 5}$

1.12. а)  $\lim_{x \rightarrow \infty} \frac{7 - 3x + 5x^2}{2x - 1 + 4x^2}$

б)  $\lim_{x \rightarrow -1} \frac{1 - x^2}{2x^2 + x - 1}$

1.13. а)  $\lim_{x \rightarrow \infty} \frac{3x^3 + 7x^2 - 2}{3 - 2x + x^3}$

б)  $\lim_{x \rightarrow -1} \frac{x^2 + 6x + 5}{2x^2 + x - 1}$

1.14. а)  $\lim_{x \rightarrow \infty} \frac{2x^4 - 5x^2 + 4}{3x^2 - 5x - 4x^4}$

б)  $\lim_{x \rightarrow -2} \frac{4 - x^2}{x^2 + 3x + 2}$

1.15. а)  $\lim_{x \rightarrow \infty} \frac{4x^2 - 2x + 3}{2 - 3x - 7x^2}$

б)  $\lim_{x \rightarrow 5} \frac{25 - x^2}{x^2 - 3x - 10}$

1.16. а)  $\lim_{x \rightarrow \infty} \frac{3x^4 + 5x^3 + x^2}{4 + 2x^3 - 3x^4}$

б)  $\lim_{x \rightarrow -4} \frac{x^2 + 4x}{x^2 + 3x - 4}$

1.17.	a) $\lim_{x \rightarrow \infty} \frac{3 + 4x - 2x^2}{4 - 5x + 6x^2}$	б) $\lim_{x \rightarrow 2} \frac{x^2 - 4x + 4}{x^2 - 6x + 8}$
1.18.	a) $\lim_{x \rightarrow \infty} \frac{3x^4 - 5x^3 + 2x}{2 - x^2 - 7x^4}$	б) $\lim_{x \rightarrow -1} \frac{x^2 - 4x - 5}{x^2 + 3x + 2}$
1.19.	a) $\lim_{x \rightarrow \infty} \frac{6x - 2x^2 + 6x^3}{4x^3 - 5x^2 - 2x + 1}$	б) $\lim_{x \rightarrow 3} \frac{x^2 - 2x - 3}{x^2 - 4x + 3}$
1.20.	a) $\lim_{x \rightarrow \infty} \frac{x^5 - 3x^2 - 8}{2x^5 + 3x^3 - 2x^2}$	б) $\lim_{x \rightarrow -1} \frac{1 - x^2}{x^2 + 5x + 4}$
1.21.	a) $\lim_{x \rightarrow \infty} \frac{4x - 2x^2 - 7}{3x + 1 - 5x^2}$	б) $\lim_{x \rightarrow -1} \frac{x + 1}{x^2 - 4x - 5}$
1.22.	a) $\lim_{x \rightarrow \infty} \frac{2 + 6x + 5x^2}{4 - 5x + x^2}$	б) $\lim_{x \rightarrow -1} \frac{x^2 - 1}{2x^2 - x - 3}$
1.23.	a) $\lim_{x \rightarrow \infty} \frac{3x^4 + 4x^2 - 2x}{3 + 2x^2 - 3x^4}$	б) $\lim_{x \rightarrow -1} \frac{x^2 - 3x - 4}{2x^2 - x - 3}$
1.24.	a) $\lim_{x \rightarrow \infty} \frac{4x^3 + 5x^2 - 2x}{2 - 5x - 2x^3}$	б) $\lim_{x \rightarrow 2} \frac{x^2 - 2x}{x^2 - 5x + 6}$
1.25.	a) $\lim_{x \rightarrow \infty} \frac{6x^2 - 4x + 2}{3 - 2x - 4x^2}$	б) $\lim_{x \rightarrow 5} \frac{x^2 - 5x}{x^2 - 6x + 5}$
1.26.	a) $\lim_{x \rightarrow \infty} \frac{2x^4 + 5x^3 - x^2}{4 - 4x^4}$	б) $\lim_{x \rightarrow -4} \frac{x^2 - 16}{x^2 + 2x - 8}$
1.27.	a) $\lim_{x \rightarrow \infty} \frac{4 - 3x + 2x^2}{3 + 5x - 3x^2}$	б) $\lim_{x \rightarrow -2} \frac{x^2 + 2x}{x^2 + x - 2}$
1.28.	a) $\lim_{x \rightarrow \infty} \frac{7x^5 - 3x^3 + 8x}{5 - 2x^2 - x^5}$	б) $\lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x^2 - 1}$
1.29.	a) $\lim_{x \rightarrow \infty} \frac{1 - 2x^2 + 5x^3}{3x^3 - 2x^2 - 4x + 1}$	б) $\lim_{x \rightarrow 3} \frac{x^2 + x - 12}{x^2 - 5x + 6}$
1.30.	a) $\lim_{x \rightarrow \infty} \frac{3x^4 - 4x^2 + 6}{6x^4 + 2x^3 - 5x^2}$	б) $\lim_{x \rightarrow 1} \frac{x^2 - x}{x^2 + 3x - 4}$

**Задание 2.** Найти производные.

2.1. а)  $y = e^x \cdot \arccos x$

б)  $y = \frac{1 - \cos x}{2^x + 3}$

в)  $y = \operatorname{arctg}(\ln x)$

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

д)  $y = \frac{\sin 3x}{\cos^2 x}$

2.2. а)  $y = \sqrt{x^5} \cdot \ln x$

б)  $y = \frac{x^3 - 3}{\operatorname{arctg} x}$

в)  $y = \cos^3 x \cdot 2^{\arcsin x}$

г)  $y = \sqrt{\frac{1 + x^2}{1 - x}}$

д)  $y = \frac{1}{\operatorname{tg}^5 5x}$

2.3. а)  $y = \log_3 x \cdot \arcsin x$

б)  $y = \frac{\sin x}{1 + \cos x}$

в)  $y = \sqrt{x^3} \cdot \ln x + \frac{1}{x}$

г)  $y = (e^{\cos x} + 3)^4$

д)  $y = 5^{x + \operatorname{arctg} x}$

2.4. а)  $y = \sqrt[3]{x^2} \cdot \cos x$

б)  $y = \frac{x + e^x}{x - e^x}$

в)  $y = \frac{\sqrt{1 - x^2}}{x}$

г)  $y = 3 \operatorname{arctg} \frac{x}{3} + e^{\arcsin x}$

д)  $y = 3^{\sin \frac{1}{x}}$

2.5. а)  $y = x^{10} \cdot \log_2 x$

б)  $y = \frac{2^x}{\cos x + 5}$

в)  $y = \frac{\sin^4 x}{\operatorname{ctg} x}$

г)  $y = \ln(x + \sqrt{x^2 + 1})$

д)  $y = e^{-3x} \cdot \arcsin 2x$

2.6. а)  $y = 3^x \cdot \operatorname{tg} x$

б)  $y = \frac{2 - x}{x^2 + \sqrt{x}}$

в)  $y = (3 + 2x^2)^5$

г)  $y = \sqrt[3]{\operatorname{ctg} \frac{1}{x}}$

д)  $y = e^{\operatorname{arctg} \sqrt{x}}$

2.7. а)  $y = \sqrt[7]{x^3} \cdot \sin x$

б)  $y = \frac{4 + x^3}{x - \operatorname{ctg} x}$

в)  $y = \operatorname{tg}^2 x + \frac{1}{\cos x}$

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

д)  $y = e^{2x} \cdot \ln(1 + x^2)$

2.8. а)  $y = \log_5 x \cdot \arccos x$

б)  $y = \frac{e^x}{1 - x^2}$

в)  $y = \left(x^5 + 3x + \frac{1}{x}\right)^{10}$

г)  $y = 3 \sin 2x \cdot \cos^2 x$

д)  $y = \sqrt{\ln(x^2 + 1)}$

2.9. а)  $y = \sqrt[5]{x} \cdot 3^x$

б)  $y = \frac{x^2 + 5x - 6}{\ln x}$

в)  $y = \frac{1}{2 \sin^2 x} + \ln(\operatorname{tg} x)$

г)  $y = e^{1/\cos x}$

д)  $y = \frac{2}{3} \sqrt{\frac{x-1}{x+1}}$

2.10. а)  $y = (x^3 + 3x^4) \cdot \log_3 x$

б)  $y = \frac{1 + \cos x}{1 - \cos x}$

в)  $y = \operatorname{ctg}^3 x - \frac{1}{\sin x}$

г)  $y = \frac{\ln(x^2 + 2x)}{3x}$

д)  $y = x \cdot 5^{\frac{1}{x}}$

2.11. а)  $y = \frac{2}{3x^2} - \frac{x\sqrt[3]{x}}{2}$   
 б)  $y = \frac{1 + \cos x}{\arccos x}$   
 в)  $y = \ln^3(1 + e^{3x})$   
 г)  $y = \operatorname{arctg} \frac{1}{x}$   
 д)  $y = \ln(e^x + \sqrt{1 + e^{2x}})$

2.13. а)  $y = 3\sqrt[3]{x} \arccos x$   
 б)  $y = \frac{1}{6(1 - x^2)}$   
 в)  $y = \sin^6 x + \cos^6 x$

г)  $y = \ln \frac{\sqrt{2} + \operatorname{tg} x}{\sqrt{2} - \operatorname{tg} x}$   
 д)  $y = \frac{4}{3} \sqrt[4]{\frac{x-1}{x+2}}$

2.15. а)  $y = \frac{1 + x^2}{2} \operatorname{arctg} x$   
 б)  $y = \frac{1 + \sqrt{x}}{1 - \sqrt{x}}$   
 в)  $y = \frac{2}{3} \sqrt{(1 + \ln x)^3}$   
 г)  $y = \cos^2 x - 2 \ln \cos x$   
 д)  $y = \ln \sin \frac{2x + 4}{x + 1}$

2.17. а)  $y = 3\sqrt[3]{x} - 2\sqrt{x^3} + 4$   
 б)  $y = \frac{x}{4} (\operatorname{tg} x - \operatorname{ctg} x)$   
 в)  $y = \frac{2}{3} \sqrt{(1 + \ln x)^3}$   
 г)  $y = 5e^{-x^2} + \frac{1}{\operatorname{arctg} x}$   
 д)  $y = \log_4 \log_2 \operatorname{tg} x$

2.12. а)  $y = \frac{2^x}{1 + 2^x}$   
 б)  $y = (1 + \sqrt[4]{x^3}) \arcsin x$   
 в)  $y = 3^{\arcsin^2 x}$   
 г)  $y = \ln \arcsin \sqrt{1 - e^{2x}}$   
 д)  $y = \frac{\cos x}{\sin^2 x} + \ln(\sin x)$

2.14. а)  $y = \frac{4}{x^3} + 5\sqrt[5]{x^4} + 2$   
 б)  $y = \frac{\operatorname{arctg} x}{1 + x^2}$   
 в)  $y = e^{\sqrt{1 + \ln x}}$

г)  $y = \operatorname{arctg} \frac{1}{x} + \frac{\sqrt{x^2 - 1}}{x}$   
 д)  $y = x + \ln \sqrt{\frac{1+x}{1-x}}$

2.16. а)  $y = x^2 \sqrt{x} + \frac{1}{4x^2} - 6x$   
 б)  $y = \frac{\ln x}{\sin x} + x 2^x$   
 в)  $y = \frac{1}{3} \operatorname{arctg} \frac{x}{3} + e^{\sin x}$   
 г)  $y = (1 + \ln \sin 2x)^2$   
 д)  $y = \ln \operatorname{tg} \frac{x}{2} - \frac{x}{\sin x}$

2.18. а)  $y = \frac{\sqrt{x}}{1 + \sqrt{x}}$   
 б)  $y = \left(x^2 + \frac{1}{x}\right) \log_3 x$   
 в)  $y = \frac{x}{2} (\cos \ln x + \sin \ln x)$   
 г)  $y = \arccos \frac{1}{x^2}$   
 д)  $y = \sqrt{\operatorname{ctg} x} + \frac{1}{3} \sqrt{\operatorname{tg}^3 x}$

2.19. а)  $y = \frac{1}{2} \operatorname{tg} x \operatorname{arctg} x$

б)  $y = \frac{3e^x}{\sqrt{x}}$

в)  $y = \ln \cos \frac{2x+3}{2x+1}$

г)  $y = 3^{\operatorname{ctg}^2 x}$

д)  $y = \frac{3}{2} \sin^2 x + \ln(\operatorname{tg} x)$

2.21. а)  $y = \frac{\ln x}{2x+1}$

б)  $y = (1-2x^2) \operatorname{arctg} x$

в)  $y = \sqrt[3]{\operatorname{tg} 3x}$

г)  $y = \ln^2 x - \ln \ln x$

д)  $y = \arcsin e^x - \sqrt{1-e^{2x}}$

2.23. а)  $y = \frac{2}{x^3} + \frac{6}{\sqrt{x}} + \frac{3x^4}{4}$

б)  $y = \frac{\cos x}{1+\sin x}$

в)  $y = \cos^3 x 5^{\operatorname{tg} x}$

г)  $y = 2^{\operatorname{ctg} \frac{1}{x}}$

д)  $y = x \operatorname{arctg} x + \ln \sqrt{1+x^2}$

2.25. а)  $y = \operatorname{arctg} x \log_3 x$

б)  $y = \frac{1+e^x}{1-e^x}$

в)  $y = \sqrt{\frac{2x+1}{x}}$

г)  $y = \operatorname{arctg}(\ln x) + \ln(\operatorname{arctg} x)$

д)  $y = -\frac{1}{2 \sin^2 x} + \ln(\arcsin x)$

2.20. а)  $y = \frac{2}{x^2-4x+5}$

б)  $y = x\sqrt{x} \operatorname{arctg} x$

в)  $y = e^{\operatorname{tg} 2x} \ln(1-x^3)$

г)  $y = \sqrt[3]{\sin^2 x} + \frac{1}{\cos x}$

д)  $y = \ln \operatorname{arctg} \sqrt{e^{4x}-1}$

2.22. а)  $y = 5^x (\operatorname{tg} x + \operatorname{ctg} x)$

б)  $y = \frac{2x+1}{4-x^2}$

в)  $y = \sqrt[3]{\operatorname{arctg}^2 x}$

г)  $y = e^{5x} - \frac{1}{2} \operatorname{tg} 4x + \frac{1}{4} x^4$

д)  $y = \ln \sqrt[5]{e^{5x} - e^{-5x}}$

2.24. а)  $y = 2x \arcsin x$

б)  $y = \frac{1-10^x}{1+10^x}$

в)  $y = \lg \ln \operatorname{ctg} x$

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

д)  $y = \frac{\operatorname{arctg} \sqrt{x} - \sqrt{x}}{x}$

2.26. а)  $y = 5^x \operatorname{arctg} x$

б)  $y = \frac{\cos x}{2-\sin x}$

в)  $y = \ln^3 x^2$

г)  $y = \frac{\cos^2 x}{\operatorname{tg} x}$

д)  $y = \ln(e^x - \sqrt{1-e^{3x}})$

2.27. а)  $y = x^3 e^x$

б)  $y = \frac{2 + x^5}{x + \operatorname{tg} x}$

в)  $y = \cos^5 2x$

г)  $y = \frac{\ln(x^2 - 7x)}{2x}$

д)  $y = (3x - 2)^2 \arccos \frac{1}{3x - 2}$

2.29. а)  $y = \frac{1 - x^2}{2} \operatorname{arctg} x$

б)  $y = \frac{\sqrt{x}}{2e^x}$

в)  $y = \sqrt[5]{1 - x^3}$

г)  $y = \ln \operatorname{arctg} \sqrt{e^{3x} + 2}$

д)  $y = (3x + 1)^3 \arccos \frac{1}{3x + 1}$

2.28. а)  $y = \sqrt[5]{x^4} \cos x$

б)  $y = \frac{3^x}{1 - 3^x}$

в)  $y = e^{\frac{1}{\sin x}}$

г)  $y = \sin^2 x + 2 \ln \sin x$

д)  $y = x - \ln \sqrt{\frac{1 - x}{1 + x}}$

2.30. а)  $y = 2x^5 \arccos x$

б)  $y = \frac{\sqrt{x}}{1 - \sqrt{x}}$

в)  $y = \ln^3 x + \ln \ln x$

г)  $y = \sqrt[4]{\frac{x^2 + 2}{x^2 - 1}}$

д)  $y = \ln \left( 2x - \sqrt{5x^2 - 4x} \right)$

**Задание 3.** Провести полное исследование функции и построить её график.

3.1. а)  $y = \frac{x^2}{4}(x^2 - 8)$

б)  $y = \frac{x^3 + 4}{x^2}$

3.2. а)  $y = 3x^4 - 4x^3$

б)  $y = \frac{2}{x^2 + 2x}$

3.3. а)  $y = -\frac{1}{16}(x^2 - 4)^2$

б)  $y = \frac{x^2 - 4x + 1}{x - 4}$

3.4. а)  $y = \frac{x^3}{27}(x - 4)$

б)  $y = \frac{4x}{(x + 1)^2}$

3.5. а)  $y = \frac{x^2}{64}(32 - x^2)$

б)  $y = \frac{3x^4 + 1}{x^3}$

3.6. а)  $y = \frac{x^3}{16}(8 - 3x)$

б)  $y = \frac{4}{3 + 2x - x^2}$

3.7. а)  $y = \frac{1}{9}(x^2 - 3)^2$

б)  $y = \frac{3x - 2}{x^3}$

3.8. а)  $y = \frac{x^2}{27}(x^2 - 18)$

б)  $y = \frac{x^2 - 3x + 3}{x - 1}$

3.9. а)  $y = \frac{1}{8}(3x^5 - 5x^3)$

б)  $y = \frac{8(x - 1)}{(x + 1)^2}$

3.10. а)  $y = \frac{x^4}{64}(x - 5)$

б)  $y = \frac{x}{x^2 - 4}$

3.11. а)  $y = x^4 - 8x^3 + 16x^2$

б)  $y = \frac{x^2 - x + 1}{x - 1}$

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

б)  $y = \frac{4x^2}{x^2 + 3}$

3.13. а)  $y = x^2 (x - 2)^2$

б)  $y = \frac{12x}{x^2 + 9}$

3.14. а)  $y = \frac{x^3}{9} (x + 4)$

б)  $y = \frac{4 - x^3}{x^2}$

3.15. а)  $y = \frac{x^3}{72} (x - 8)$

б)  $y = \frac{x^2 + 6x + 3}{x + 4}$

3.16. а)  $y = (x + 1)^2 (x - 1)^2$

б)  $y = \frac{(x - 1)^2}{x^2}$

3.17. а)  $y = \frac{1}{8} x^2 (x - 4)^2$

б)  $y = \frac{x^2}{(x - 1)^2}$

3.18. а)  $y = \frac{27}{32} x^2 (2 - x)$

б)  $y = \left(1 + \frac{1}{x}\right)^2$

3.19. а)  $y = 3x^4 + 4x^3$

б)  $y = \frac{3 - x^2}{x + 2}$

3.20. а)  $y = \frac{x^3 (x^2 - 15)}{81}$

б)  $y = \frac{2x^3 + 1}{x^2}$

3.21. а)  $y = \frac{x^3}{9} (4 - x)$

б)  $y = -\frac{8x}{x^2 + 4}$

3.22. а)  $y = \frac{x^3}{27} (15 - x^2)$

б)  $y = -\frac{2}{x^2 - 1}$

3.23. а)  $y = \frac{16}{27} (x + 1) (1 - x)^3$

б)  $y = \frac{x^3 - 32}{x^2}$

3.24. а)  $y = \frac{x^3}{36} (x + 8)$

б)  $y = \frac{1 - 2x^2}{x^2}$

3.25. а)  $y = \frac{x^4 - 8x^2 - 9}{5}$

б)  $y = \frac{8}{x^2 + 2x - 3}$

3.26. а)  $y = \frac{x^3}{27} (x + 4)$

б)  $y = -\left(\frac{x}{x + 2}\right)^2$

3.27. а)  $y = \frac{1}{8} x^2 (x + 4)^2$

б)  $y = \frac{x^2 - 1}{x^2 + 1}$

3.28. а)  $y = \frac{x^4}{64} (x + 5)$

б)  $y = \frac{x^3}{x^2 - 1}$

3.29. а)  $y = \frac{x^3}{27} (x^2 - 15)$

б)  $y = \frac{x^2 + 4x + 1}{x + 4}$

3.30. а)  $y = \frac{x^3}{36} (8 - x)$

б)  $y = \left(\frac{x}{x - 2}\right)^2$

**Задание 4.** Найти неопределённые интегралы.

- 4.1. a)  $\int \frac{(x-1)^2}{\sqrt{x}} dx$   
 б)  $\int \left(2 \sin 6x + \cos \frac{x}{4}\right) dx$       B)  $\int (4-3x) e^{-5x} dx$
- 4.2. a)  $\int \left(\frac{x^2}{3} - \frac{3}{x\sqrt{x}}\right) dx$   
 б)  $\int (6e^{-3x} + 3 \cos 2x) dx$       B)  $\int (4-3x) e^{-5x} dx$
- 4.3. a)  $\int \left(\frac{4}{5x} - \frac{2}{x^3} + 4\sqrt[3]{x}\right) dx$   
 б)  $\int \left(6e^{2x} + \sin \frac{x}{2}\right) dx$       B)  $\int (2+3x) e^{2x} dx$
- 4.4. a)  $\int \left(3\sqrt{x} + \frac{1}{x^2} - \frac{1}{3x}\right) dx$   
 б)  $\int \left(\cos 4x + \frac{1}{e^x}\right) dx$       B)  $\int (4x-2) \cos 2x dx$
- 4.5. a)  $\int \left(\frac{3}{\sqrt[3]{x}} + x\sqrt{x}\right) dx$   
 б)  $\int (2 \sin 6x + 4e^{\frac{x}{2}}) dx$       B)  $\int (4-16x) \sin 4x dx$
- 4.6. a)  $\int 2^x \left(5 - \frac{2^{-x}}{\sqrt{x}}\right) dx$   
 б)  $\int (2 \cos 3x + e^{-5x}) dx$       B)  $\int (5x-2) \cos 10x dx$
- 4.7. a)  $\int \left(4\sqrt{x} - \frac{5}{2\sqrt{x}} + 1\right) dx$   
 б)  $\int (4 \sin 4x - 3e^{\frac{x}{3}}) dx$       B)  $\int (1-6x) e^{2x} dx$
- 4.8. a)  $\int \frac{(\sqrt{x}-2)^2}{x} dx$   
 б)  $\int \left(\cos \frac{x}{2} + \frac{5}{e^{2x}}\right) dx$       B)  $\int (3x+2) \cos 3x dx$
- 4.9. a)  $\int \frac{7x + x^2 - \sqrt{x}}{x^2} dx$   
 б)  $\int \left(10 \sin \frac{x}{2} + \frac{3}{e^x}\right) dx$       B)  $\int (x-5) \sin 5x dx$
- 4.10. a)  $\int e^x \left(\frac{e^{-x}}{\sqrt{x^3}} - 8\right) dx$



$$\begin{array}{ll}
\text{6)} \int (2 \cos 6x - 2e^{\frac{x}{4}}) dx & \text{B)} \int (2 - 4x) \sin 2x dx \\
4.11. \text{ a)} \int \left( \sqrt{x} - \frac{2}{\sqrt{x}} \right)^2 dx & \\
\text{6)} \int \left( \frac{7}{5 \sin^2 x} + 2e^{-8x} \right) dx & \text{B)} \int (3 - 2x) \cos \frac{x}{2} dx \\
4.12. \text{ a)} \int \frac{(2-x)^2}{x^3} dx & \\
\text{6)} \int \left( \frac{1}{2 \sin^2 x} - 4e^{\frac{x}{4}} \right) dx & \text{B)} \int (4x - 3) \cos 4x dx \\
4.13. \text{ a)} \int \left( \frac{x^4}{2} - \frac{4}{\sqrt{x}} \right) dx & \\
\text{6)} \int (2 \sin 6x + e^{\frac{x}{10}}) dx & \text{B)} \int e^{-3x} (2 - 9x) dx \\
4.14. \text{ a)} \int \frac{x^3 \sin x + 7x}{x^3} dx & \\
\text{6)} \int \left( \cos \frac{x}{3} - \frac{2}{e^x} \right) dx & \text{B)} \int e^{5x} (3x - 8) dx \\
4.15. \text{ a)} \int \frac{7 - 4x^2 \sin x}{x^2} dx & \\
\text{6)} \int \left( 5 \cos \frac{2x}{5} + \frac{1}{e^{2x}} \right) dx & \text{B)} \int (4x + 5) e^{\frac{x}{2}} dx \\
4.16. \text{ a)} \int \frac{\sqrt{x} - 3x^5 + 1}{2x} dx & \\
\text{6)} \int \left( \frac{1}{e^{2x}} + 2 \cos \frac{2x}{3} \right) dx & \text{B)} \int (2 - x) e^{-x} dx \\
4.17. \text{ a)} \int \left( 6x^5 - \frac{1}{x\sqrt{x}} \right) dx & \\
\text{6)} \int \left( e^{10x} - \frac{10}{\sin^2 10x} \right) dx & \text{B)} \int (5x + 6) \cos 2x dx \\
4.18. \text{ a)} \int \frac{x - 2x^2 \cos x}{x^2} dx & \\
\text{6)} \int \left( \cos \frac{x}{3} + \frac{2}{\cos^2 3x} \right) dx & \text{B)} \int (3x - 2) \sin 6x dx \\
4.19. \text{ a)} \int \left( 5x^4 - \frac{1}{\sqrt{x}} + \frac{3}{x^2} \right) dx & \\
\text{6)} \int (2 \sin 8x + e^{5x}) dx & \text{B)} \int (2x - 3) \cos 4x dx
\end{array}$$

4.20. a)  $\int \frac{x^2 + x 3^x - 3}{x} dx$   
 б)  $\int \left( 2 \sin^2 3x + \frac{4}{e^{4x}} \right) dx$       B)  $\int (4x + 7) \sin \frac{x}{3} dx$

4.21. a)  $\int \frac{3x^3 + \sqrt{x} - 2}{x} dx$   
 б)  $\int (\cos^2 5x - e^{8x}) dx$       B)  $\int (2x - 5) \cos \frac{x}{4} dx$

4.22. a)  $\int \left( 7x^6 - \frac{3}{x^3} + \frac{2}{3x} \right) dx$   
 б)  $\int \left( \frac{14}{\cos^2 7x} - e^{\frac{x}{4}} \right) dx$       B)  $\int (8 - 3x) \sin 3x dx$

4.23. a)  $\int \frac{3x + 2x^2 \cos x}{x^2} dx$   
 б)  $\int \left( \frac{5}{\sin^2 10x} + 8e^{-\frac{x}{4}} \right) dx$       B)  $\int (x + 5) \sin \frac{x}{2} dx$

4.24. a)  $\int \frac{3x^3 5^x - 5}{x^3} dx$   
 б)  $\int \left( \cos \frac{x}{5} + 9e^{3x} \right) dx$       B)  $\int (x - 10) \sin 7x dx$

4.25. a)  $\int \frac{(\sqrt{x} + 2)^2}{x^2} dx$   
 б)  $\int \left( 2 \sin \frac{x}{5} - \frac{12}{e^{3x}} \right) dx$       B)  $\int (3 + 4x) e^{5x} dx$

4.26. a)  $\int \frac{(x + 2)^2}{2\sqrt{x}} dx$   
 б)  $\int (3e^{-2x} - 5 \cos 4x) dx$       B)  $\int (2x - 1) e^{-3x} dx$

4.27. a)  $\int \left( 6\sqrt{x} - \frac{2}{x^3} + \frac{1}{2x} \right) dx$   
 б)  $\int (4 \cos 7x - 3e^{\frac{x}{3}}) dx$       B)  $\int (5 - 2x) \sin 9x dx$

4.28. a)  $\int \left( 2\sqrt{x} - \frac{3}{4\sqrt{x}} - 5 \right) dx$   
 б)  $\int \left( \cos \frac{x}{4} - \frac{3}{e^{-4x}} \right) dx$       B)  $\int (2x - 4) \sin 6x dx$

4.29. a)  $\int \left( 3\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2 dx$

$$\text{б)} \int \left( \frac{2}{\cos^2 x} + 3 e^{-\frac{x}{3}} \right) dx$$

$$\text{в)} \int e^{4x} (1 - 5x) dx$$

$$4.30. \text{ а)} \int \frac{3\sqrt{x} + x^6 - 8}{4x} dx$$

$$\text{б)} \int \left( 2e^{-6x} - \frac{4}{\cos^2 5x} \right) dx$$

$$\text{в)} \int (7x + 2) \sin 5x dx$$

**Задание 5.** Вычислить определённые интегралы.

$$5.1. \text{ а)} \int_0^1 \frac{x^4 dx}{x^{10} + 3}$$

$$\text{б)} \int_1^e x^2 \ln x dx$$

$$5.2. \text{ а)} \int_0^{\frac{\pi}{6}} \sqrt{\sin x} \cos x dx$$

$$\text{б)} \int_2^{e^2} \ln x dx$$

$$5.3. \text{ а)} \int_e^{e^2} \frac{dx}{x \ln^2 x}$$

$$\text{б)} \int_0^{\pi} x \cos \left( \frac{x}{4} \right) dx$$

$$5.4. \text{ а)} \int_0^2 \frac{x dx}{16 + x^4}$$

$$\text{б)} \int_0^1 x \operatorname{arctg} x dx$$

$$5.5. \text{ а)} \int_0^1 \frac{x dx}{\sqrt{4 - x^4}}$$

$$\text{б)} \int_0^{\frac{\pi}{2}} x \sin 4x dx$$

$$5.6. \text{ а)} \int_0^{\frac{\pi}{6}} \frac{\sin x}{1 + \cos x} dx$$

$$\text{б)} \int_0^1 x e^{-2x} dx$$

$$5.7. \text{ а)} \int_0^1 \frac{x dx}{\sqrt{x^2 + 3}}$$

$$\text{б)} \int_0^1 x 3^x dx$$

$$5.8. \text{ а)} \int_0^{\frac{\pi}{2}} \frac{\cos x}{\sin x + 1} dx$$

$$\text{б)} \int_1^e \frac{\ln x}{x^2} dx$$

$$5.9. \text{ а)} \int_2^6 \sqrt{x - 2} dx$$

$$\text{б)} \int_0^{\pi} x \sin \left( \frac{x}{6} \right) dx$$

$$5.10. \text{ а)} \int_1^e \frac{dx}{x (\ln x + 2)}$$

$$\text{б)} \int_0^1 \operatorname{arctg} x dx$$

$$5.11. \text{ а)} \int_0^1 \frac{x^3 dx}{x^8 + 5}$$

$$\text{б)} \int_e^{e^2} x^4 \ln x dx$$

$$5.12. \quad \text{a)} \int_0^{\frac{\pi}{4}} \sqrt{\cos x} \sin x \, dx$$

$$\text{б)} \int_3^e x \ln x \, dx$$

$$5.13. \quad \text{a)} \int_{e^2}^{e^3} \frac{dx}{x \ln^4 x}$$

$$\text{б)} \int_0^{\pi/3} x \cos\left(\frac{3x}{2}\right) dx$$

$$5.14. \quad \text{a)} \int_0^3 \frac{x^2 dx}{9 + x^6}$$

$$\text{б)} \int_0^1 x \operatorname{arctg} x \, dx$$

$$5.15. \quad \text{a)} \int_0^2 \frac{x dx}{\sqrt{16 + x^4}}$$

$$\text{б)} \int_0^{\frac{\pi}{3}} x \sin 6x \, dx$$

$$5.16. \quad \text{a)} \int_0^{\frac{\pi}{3}} \frac{\sin x}{1 - \cos x} dx$$

$$\text{б)} \int_0^3 x e^{-x} dx$$

$$5.17. \quad \text{a)} \int_0^2 \frac{x^3 dx}{\sqrt{x^4 + 9}}$$

$$\text{б)} \int_0^3 x 3^{2x} dx$$

$$5.18. \quad \text{a)} \int_0^{\frac{\pi}{4}} \frac{\cos x}{\sin x + 3} dx$$

$$\text{б)} \int_e^{e^3} \frac{\ln x}{x^3} dx$$

$$5.19. \quad \text{a)} \int_{-1}^4 \sqrt{x + 5} dx$$

$$\text{б)} \int_0^{\pi/2} x \sin\left(\frac{x}{2}\right) dx$$

$$5.20. \quad \text{a)} \int_{e^2}^{e^4} \frac{dx}{x(\ln x - 1)}$$

$$\text{б)} \int_{-1}^1 \operatorname{arctg} x \, dx$$

$$5.21. \quad \text{a)} \int_0^1 \frac{x^2 dx}{x^6 - 9}$$

$$\text{б)} \int_1^{e^2} x^3 \ln x \, dx$$

$$5.22. \quad \text{a)} \int_0^{\frac{\pi}{3}} \frac{\sin x}{\sqrt{\cos x}} dx$$

$$\text{б)} \int_2^{e^3} x \ln x \, dx$$

$$5.23. \quad \text{a)} \int_e^{e^3} \frac{dx}{x \ln^3 x}$$

$$\text{б)} \int_0^{\pi/2} x \cos\left(\frac{2x}{3}\right) dx$$

$$5.24. \quad \text{a)} \int_0^4 \frac{x^3 dx}{4 + x^8}$$

$$\text{б)} \int_0^{1/2} x \operatorname{arctg} 2x \, dx$$

$$\begin{array}{ll}
5.25. & \text{a) } \int_0^1 \frac{x^2 dx}{\sqrt{9-x^6}} \qquad \text{б) } \int_0^{\frac{\pi}{6}} x \sin 3x dx \\
5.26. & \text{a) } \int_0^{\frac{\pi}{4}} \frac{\cos x}{1+\sin x} dx \qquad \text{б) } \int_0^2 x e^{3x} dx \\
5.27. & \text{a) } \int_0^2 \frac{x^2 dx}{\sqrt{x^3+1}} \qquad \text{б) } \int_0^2 x 2^{-x} dx \\
5.28. & \text{a) } \int_0^{\frac{\pi}{6}} \frac{\sin x}{\cos x+2} dx \qquad \text{б) } \int_1^{e^2} \frac{\ln x}{x^4} dx \\
5.29. & \text{a) } \int_0^8 \sqrt{x+1} dx \qquad \text{б) } \int_0^{\pi/2} x \sin\left(\frac{x}{3}\right) dx \\
5.30. & \text{a) } \int_e^{e^3} \frac{dx}{x(\ln x+1)} \qquad \text{б) } \int_0^{1/3} \operatorname{arccctg} 3x dx
\end{array}$$

**Задание 6.** Вычислить площадь фигуры, ограниченной линиями. Сделать чертёж.

$$\begin{array}{ll}
6.1. & y = 2x - x^2, y = -x \\
6.2. & y = x^2 - 4x, y = x \\
6.3. & y = \frac{4}{x}, y = 5 - x \\
6.4. & y = \frac{x^2}{4}, y = 5 - x^2 \\
6.5. & y = x^2, y = 2 - x^2 \\
6.6. & y = 1 - x^2, y = x - 1 \\
6.7. & y = 4 - x^2, y = x^2 - 2x \\
6.8. & y = (x - 2)^2, y = x \\
6.9. & y = (x - 2)^2, x = 0, y = 0 \\
6.10. & y = \frac{1}{x}, y = x, x = 2 \\
6.11. & y = (x + 1)^2, y = 0, x = 0 \\
6.12. & y = e^x, y = e^{-x}, x = 1 \\
6.13. & y = \sqrt{x+4}, y = 0, x = 0 \\
6.14. & y = (x + 2)^2, y = -x \\
6.15. & y = 0, y = x\sqrt{9-x^2}, 0 \leq x \leq 3 \\
6.16. & y = \sqrt{2-x}, y = 0, x = 0 \\
6.17. & y = -x^2 + 2x + 3, y = 2x + 2 \\
6.18. & y = x^2 - 3x, y = x \\
6.19. & y = \sqrt{2x}, x = 8, y = 0 \\
6.20. & y = 3 - 2x, y = x^2
\end{array}$$

$$6.21. \quad y = x^2, y = 2x^2, x = 3$$

$$6.22. \quad y = \frac{6}{x}, y = 7 - x$$

$$6.23. \quad y = x\sqrt{4 - x^2}, y = 0, 0 \leq x \leq 2$$

$$6.24. \quad y = x^2 + 4x, y = -x$$

$$6.25. \quad y = 4 - x^2, y = 2 - x$$

$$6.26. \quad y = x^2 + 2x - 3, y = 2x - 2$$

$$6.27. \quad y = -\sqrt{x}, x = 9, y = 0$$

$$6.28. \quad y = x^2 - 2, y = 6 - x^2$$

$$6.29. \quad y = -\frac{2}{x}, y = x - 3$$

$$6.30. \quad y = \frac{x^2}{3}, y = 4 - \frac{2}{3}x^2$$