ТИПОВОЙ РАСЧЕТ
«Дифференциальные уравнения.
Системы дифференциальных уравнений»

Задание 1. Решить дифференциальное уравнение с разделяющимися переменными.

1.1. $\left(x + xy^2\right)dx + \left(1 + x^2\right)dy = 0$.

1.2. $\left(2x + 1\right)dy + y^2 dx = 0$.

1.3. $\left(y^2 + xy^2\right)dx = (yx^2 - x^2)dy$.

1.4. $\left(3 + e^x\right)yy' = e^x$.

1.5. $6x\,dx - 6y\,dy = 2x^2 y\,dy - 3xy^2 dx$.

1.6. $(e^{2x} + 5)dy + ye^{2x}dx = 0$.

1.7. $y\left(1 + x^2\right)y' = 1 + y^2$.

1.8. $xy^2 + y' = y^2$.

1.9. $yy' + x^2 = 1$.

1.10. $xy\,dx + (x + 1)dy = 0$.

1.11. $y' = (2y + 1)\operatorname{ctg}x$.

1.12. $2x^2 yy' + y^2 = 2$.

1.13. $y' - xy^2 = x$.

1.14. $y' = \dfrac{1 + y^2}{1 + x^2}$.

1.15. $\left(1 + e^x\right)yy' = e^x$.

1.16. $y^2 y' + x^2 = 1$.

1.17. $xy' - y^2 = 1$.

1.18. $xy' + (x + 1)y = 0$.

1.19. $\left(1 + y^2\right)x dx + (1 + x^2)dy = 0$.

1.20. $x y dy + (x + 1)dx = 0$.

1.21. $\left(1 + y^2\right)dx + x y dy = 0$.

1.22. $\sqrt{y^2 + 1}dx = x y dy$.

1.23. $\left(x^2 - 1\right)y' + 2xy^2 = 0$.

1.24. $\left(e^x + 8\right)dy - ye^x dx = 0$.

1.25. $\left(y + xy\right)dx + (x - xy)dy = 0$.

1.26. $\left(1 + x^2\right)dy + y dx = 0$.

1.27. $\dfrac{y'}{x} = \dfrac{1 + y^2}{y(1 + x^2)}$.

1.28. $y' = e^y \cdot \sin x$.

1.29. $(1 + e^x)y' = ye^x$.

1.30. $x dx - y dy = yx^2 dy - xy^2 dx$.

Задание 2. Решить однородное дифференциальное уравнение.

2.1. $y' = \dfrac{xy + x^2 + 3y^2}{x^2 + 2xy}$	**2.5.** $y' = \dfrac{y}{x} + \sin^2 \dfrac{y}{x}$
2.2. $y' = \dfrac{3xy}{3x^2 - y^2}$	**2.6.** $2y' = \dfrac{y^2}{x^2} + 6\dfrac{y}{x} + 3$
2.3. $xy' = \dfrac{2x^2 y + 3y^3}{x^2 + 2y^2}$	**2.7.** $y' = \dfrac{y}{x} - \cos^2 \dfrac{y}{x}$
2.4. $xy' = \dfrac{y^2 - 4x^2}{2y}$	**2.8.** $3y' = \dfrac{y^2}{x^2} + 8\dfrac{y}{x} + 4$

2.9. $y' = \dfrac{y}{x} + \operatorname{tg} \dfrac{y}{x}$	**2.20.** $y' = \dfrac{y^2 + 2x^2}{xy}$
2.10. $xy' = \dfrac{x^2 + y^2}{y}$	**2.21.** $y' = 4 + \dfrac{y}{x} + \left(\dfrac{y}{x}\right)^2$
2.11. $y' = \dfrac{y^2}{x^2} + 4\dfrac{y}{x} + 2$	**2.22.** $y' = \dfrac{y}{x} + e^{-\frac{y}{x}}$
2.12. $y' = \dfrac{x^2 + 3xy - y^2}{3x^2 - 2xy}$	**2.23.** $y' = \dfrac{2xy}{2x^2 - y^2}$
2.13. $y' = \dfrac{xy}{x^2 + y^2}$	**2.24.** $y' = \dfrac{x^2 + 2xy - 5y^2}{2x^2 - 6xy}$
2.14. $y' = e^{\frac{y}{x}} + \dfrac{y}{x}$	**2.25.** $y' = \dfrac{y^2}{xy - x^2}$
2.15. $y' = \dfrac{y}{x} + \cos^2 \dfrac{y}{x}$	**2.26.** $y' = \dfrac{x^2 + 3xy - y^2}{3x^2 - 2xy}$
2.16. $y' = \dfrac{y^2}{x^2 + xy}$	**2.27.** $y' = \dfrac{y}{x} - \sin^2 \dfrac{y}{x}$
2.17. $y' = \dfrac{y}{x} - \operatorname{tg} \dfrac{y}{x}$	**2.28.** $y' = \dfrac{x^2 + y^2 + xy}{x^2}$
2.18. $y' = \dfrac{y^2 - x^2}{xy}$	**2.29.** $y' = \dfrac{4xy}{4x^2 - y^2}$
2.19. $4y' = \dfrac{y^2}{x^2} + 10\dfrac{y}{x} + 10$	**2.30.** $y' = \dfrac{y^2 + xy}{2x^2 + xy}$

Задание 3. Найти частное решение линейного дифференциального уравнения.

3.1. $y' - \dfrac{1}{x}y = x^2, \qquad y(1) = 0.$

3.2. $y' - y \operatorname{ctg} x = 2\sin x, \qquad y\left(\dfrac{\pi}{2}\right) = 0.$

3.3. $y' - y = e^x, \qquad y(0) = 1.$

3.4. $y' + y \operatorname{tg} x = \cos^2 x, \qquad y\left(\dfrac{\pi}{4}\right) = \dfrac{1}{2}.$

3.5. $y' - \dfrac{1}{x+2}\, y = x^2 + 2x, \qquad y(-1) = \dfrac{3}{2}.$

3.6. $y' + \dfrac{1}{x}\, y = x^2, \qquad y(1) = 0.$

3.7. $y' - \dfrac{1}{x}\, y = x \cdot \sin x, \qquad y\left(\dfrac{\pi}{2}\right) = 1.$

3.8. $y' + \dfrac{1}{2x}\, y = \sqrt{x}, \qquad y(1) = 1.$

3.9. $y' - 4y = e^{4x}, \qquad y(0) = \dfrac{1}{2}.$

3.10. $y' + \dfrac{2}{x+1}\, y = \dfrac{1}{(x+1)^2}, \qquad y(0) = 1.$

3.11. $y' - \dfrac{y}{x} = -\dfrac{1}{x^3}, \qquad y(1) = -1.$

3.12. $y' + \dfrac{1}{1+x}\, y = \dfrac{x^2}{1+x}, \qquad y(1) = 0.$

3.13. $y' - \dfrac{1}{x}\, y = x\cos^2 x, \qquad y\left(\dfrac{\pi}{2}\right) = 0.$

3.14. $y' + \dfrac{1}{2x}\, y = x\sqrt{x}, \qquad y(1) = 1.$

3.15. $y' - \dfrac{2}{x}\, y = x^3, \qquad y(1) = -\dfrac{5}{6}.$

3.16. $y' + \dfrac{1}{x}y = 3x$, $\qquad y(1) = 1$.

3.17. $y' - y\operatorname{ctg}x = -2\sin x$, $\qquad y(\pi/2) = 1$.

3.18. $y' + \dfrac{1}{x}y = \dfrac{3}{x}$, $\qquad y(1) = 3$.

3.19. $y' - 4xy = -4x$, $\qquad y(0) = -1$.

3.20. $y' - \dfrac{2}{x}y = 2x^3$, $\qquad y(1) = -2$.

3.21. $y' + y\operatorname{tg}x = -\dfrac{1}{\cos x}$, $\quad y(\pi) = -2$.

3.22. $y' + \dfrac{1}{x}y = \dfrac{1}{x^2}$, $\qquad y(e) = \dfrac{1}{e}$.

3.23. $y' - \dfrac{1}{x}y = -\dfrac{12}{x^3}$, $\qquad y(1) = 8$.

3.24. $y' + \dfrac{1}{x}y = \sin x$, $\qquad y\left(\dfrac{\pi}{2}\right) = -1$.

3.25. $y' - \operatorname{ctg}x \cdot y = \dfrac{1}{\sin x}$, $\qquad y\left(\dfrac{\pi}{2}\right) = 1$.

3.26. $y' - y = e^x$, $\qquad y(0) = 1$.

3.27. $y' - \dfrac{1}{x}y = x\cos x$, $\qquad y\left(\dfrac{\pi}{2}\right) = \dfrac{\pi}{2}$.

3.28. $y' - \dfrac{1}{x+1}y = e^x(x+1)$, $\ y(0) = 1$.

3.29. $y' + \dfrac{1}{2x+1}y = \dfrac{x}{2x+1}$, $\quad y(0) = -1$.

3.30. $y' - y\operatorname{tg}x = \dfrac{2x}{\cos x}$, $\quad y(2\pi) = 4\pi^2$.

Задание 4. Найти решение задачи Коши.

4.1. $y' + xy = (1+x)e^{-x}y^2, \quad y(0) = 1.$

4.2. $2(xy' + y) = xy^2, \quad y(1) = 2.$

4.3. $xy' - y = -y^2(\ln x + 2)\ln x, \quad y(1) = 1.$

4.4. $3(xy' + y) = y^2\ln x, \quad y(1) = 3.$

4.5. $y' + 4x^3y = 4y^2e^{4x}(1 - x^3), \quad y(0) = -1.$

4.6. $2xy' - 3y = -(5x^2 + 3)y^3, \quad y(1) = \dfrac{1}{\sqrt{2}}.$

4.7. $xy' + y = 2y^2\ln x, \quad y(1) = \frac{1}{2}.$

4.8. $y' + 4x^3y = 4(x^3 + 1)e^{-4x}y^2, \quad y(0) = 1.$

4.9. $2(y' + xy) = (1 + x)e^{-x}y^2, \quad y(0) = 2.$

4.10. $2y' + y\cos x = y^{-1}\cos x(1 + \sin x), \quad y(0) = 1.$

4.11. $3y' + 2xy = 2xy^{-2}e^{-2x^2}, \quad y(1) = 1.$

4.12. $3xy' + 5y = (4x - 5)y^4, \quad y(1) = 1.$

4.13. $3(xy' + y) = xy^2, \quad y(1) = 3.$

4.14. $2y' + 3y\cos x = e^{2x}(2 + 3\cos x)y^{-1}, \quad y(0) = 1.$

4.15. $y' - y = 2xy^2, \quad y(0) = \dfrac{1}{2}.$

4.16. $y' + 2xy = 2x^3y^3, \quad y(0) = \sqrt{2}.$

4.17. $2y' + 3y\cos x = (8 + 12\cos x)e^{2x}y^{-1}, \quad y(0) = 2.$

4.18. $8xy' - 12y = -(5x^2 + 3)y^3, \quad y(1) = \sqrt{2}.$

4.19. $y' + xy = (x - 1)e^x y^2, \quad y(0) = 1.$

4.20. $2xy' - 3y = -(20x^2 + 12)y^3$, $\quad y(0) = \dfrac{1}{2\sqrt{2}}$.

4.21. $xy' + y = y^2 \ln x$, $\quad y(1) = 1$.

4.22. $4y' + x^3 y = (x^3 + 8)e^{-2x}y^2$, $\quad y(0) = 1$.

4.23. $2(y' + y) = xy^2$, $\quad y(0) = 2$.

4.24. $2y' - 3y\cos x = -e^{-2x}(2 + 3\cos x)y^{-1}$, $\quad y(0) = 1$.

4.25. $2(xy' + y) = y^2 \ln x$, $\quad y(1) = 2$.

4.26. $y' + 2y\,\mathrm{cth}\,x = y^2\,\mathrm{ch}\,x$, $\quad y(1) = \dfrac{1}{\mathrm{sh}\,x}$.

4.27. $y' - y\,\mathrm{tg}\,x = -\dfrac{2}{3}y^4 \sin x$, $\quad y(0) = 1$.

4.28. $y' - y = xy^2$, $\quad y(0) = 1$.

4.29. $y' + y = xy^2$, $\quad y(0) = 1$.

4.30. $2(y' + xy) = (x - 1)e^x y^2$, $\quad y(0) = 2$.

Задание 5. Решить дифференциальное уравнение.

5.1. $y^{IV} = x + e^{2x}$.

5.2. $y^{IV} = 2x + \sin 3x$.

5.3. $y''' = 5e^{2x}$.

5.4. $y''' = \cos^2 x$.

5.5. $y''' = \dfrac{6}{x^3}$.

5.6. $y''' = \cos x \sin 3x$.

5.7. $y''' = 2x^3 - x + 2$.

5.9. $y''' = x\sin 2x$.

5.10. $y''' = x\,e^{-x}$.

5.11. $y''' = \sin\dfrac{x}{2} - 2e^{-x}$.

5.12. $y^{IV} = 2^{3x} - x^5$.

5.13. $y''' = 3\sin^2\dfrac{x}{2}$.

5.14. $y'' = 1 + \mathrm{ctg}^2 x$.

5.15. $y''' = 5^{2x} + 2x^3 - x + 2$.

5.8. $y^{IV} = \dfrac{12}{x^4}$.   **5.16.** $y''' = 1 - x^2 + 2^x$.

5.17. $y''' = \cos x \cos 2x$.   **5.24.** $y^V = \sin 2x - 2e^{-x}$.

5.18. $y''' = \dfrac{2\cos x}{\sin^3 x}$.   **5.25.** $y'' = \cos^2 3x + \dfrac{1}{x}$.

5.19. $y''' = 8\left(x^2 + e^{2x} + \sin 2x\right)$.   **5.26.** $y''' = 2x \sin x$.

5.20. $y^{IV} = 27 \cdot 5^{3x} + 120x^3$.   **5.27.** $y''' = \sin 3x \cdot \sin 5x$.

5.21. $y''' = \dfrac{1}{x^3}$.   **5.28.** $y^{IV} = 20\sin^2 5x$.

5.22. $y'' = \cos\left(1 - 2x\right)$.   **5.29.** $y''' = 0{,}1 \cdot e^{-2x} - 25\sin 2x$.

5.23. $y'' = x \sin x$.   **5.30.** $y'' = 1 + \operatorname{tg}^2 x$.

     Задание 6. Найти общее решение дифференциального уравнения.

6.1. $y'' x \ln x = y''$.

6.2. $xy''' + y'' = 1$.

6.3. $2y'' x = y''$.

6.4. $xy''' + y'' = x + 1$.

6.5. $y'' \operatorname{tg} x + y' + 1/\sin x = 0$.

6.6. $x^2 y'' + xy' = 1$.

6.7. $y''' \operatorname{ctg} 2x + 2y'' = 0$.

6.8. $x^3 y''' + x^2 y'' = 1$.

6.9. $y''' \operatorname{tg} x = 2y''$.

6.10. $y''' \operatorname{cth} 2x = 2y''$.

6.11. $x^4 y'' = 1 - x^3 y'$.

6.12. $xy''' + 2y'' = 0$.

6.13. $\left(1 + x^2\right) y'' + 2xy' = x^3$.

6.14. $x^5 y''' + x^4 y'' = 1$.

6.15. $xy'' - y'' + 1/x = 0$.

6.16. $xy''' + y'' + x = 0$.

6.17. $y'' \mathrm{th}\, x = y'''$.

6.18. $xy''' + y'' = \sqrt{x}$.

6.19. $y''' \mathrm{tg}\, x = y'' + 1$.

6.20. $y''' \mathrm{tg}\, 5x = 5y''$.

6.21. $y''' \mathrm{th}\, 7x = 7y''$.

6.22. $x^3 y''' + x^2 y'' = \sqrt{x}$.

6.23. $y'' \mathrm{cth}\, x - y' + 1/\mathrm{ch}\, x = 0$.

6.24. $\left(x + 1\right) y''' + y'' = x + 1$.

6.25. $\left(1 + \sin x\right) y''' = \cos x y''$.

6.26. $xy''' + y'' = 1/\sqrt{x}$.

6.27. $-xy''' + 2y'' = 2/x^2$.

6.28. $y'' \mathrm{ch}\, x + y' = \mathrm{ch}\, x$.

6.29. $x^4 y'' + x^3 y' = 4$.

6.30. $y'' + y' \dfrac{2x}{x^2 + 1} = 2x$.

Задание 7. Найти решение задачи Коши.

7.1. $4y^3 y'' = y^4 - 1,$
$y(0) = \sqrt{2}, \ y'(0) = \dfrac{1}{2\sqrt{2}}.$

7.9. $y'' = 128y^3,$
$y(0) = 1, \ y'(0) = 8.$

7.2. $y'' y^3 + 64 = 0,$
$y(0) = 4, \ y'(0) = 2.$

7.10. $y'' + 2\sin y \cos^3 y = 0,$
$y(0) = 0, \ y'(0) = 1.$

7.3. $y'' = 32\sin^3 y \cos y,$
$y(1) = \pi/2, \ y'(1) = 4.$

7.11. $y'' = 98y^3,$
$y(1) = 1, \ y'(1) = 7.$

7.4. $y'' y^3 + 49 = 0,$
$y(3) = -7, \ y'(3) = -1.$

7.12. $4y^3 y'' = 16y^4 - 1,$
$y(0) = \dfrac{\sqrt{2}}{2}, \ y'(0) = \dfrac{1}{\sqrt{2}}.$

7.5. $y'' + 8\sin y \cos^3 y = 0,$
$y(0) = 0, \ y'(0) = 2.$

7.13. $y'' = 72y^3,$
$y(2) = 1, \ y'(2) = 6.$

7.6. $y'' y^3 + 36 = 0,$
$y(0) = 3, \ y'(0) = 2.$

7.14. $y'' = 18\sin^3 y \cos y,$
$y(1) = \pi/2, \ y'(1) = 3.$

7.7. $4y^3 y'' = y^4 - 16,$
$y(0) = 2\sqrt{2}, \ y'(0) = \dfrac{1}{\sqrt{2}}.$

7.15. $y'' = 50y^3,$
$y(3) = 1, \ y'(3) = 5.$

7.8. $y'' y^3 + 25 = 0,$
$y(2) = -5, \ y'(2) = -1.$

7.16. $y'' + 18\sin y \cos^3 y = 0,$
$y(0) = 0, \ y'(0) = 3.$

7.17. $y'' = 8\sin^3 y \cos y,$
$y(1) = \pi/2, \ y'(1) = 2.$

7.18. $y'' y^3 + 16 = 0,$
$y(1) = 2, \ y'(1) = 2.$

7.19. $y'' = 50\sin^3 y \cos y,$
$y(1) = \pi/2, \ y'(1) = 5.$

7.20. $y'' y^3 + 9 = 0,$
$y(1) = 1, \ y'(1) = 3.$

7.21. $y'' + 50\sin y \cos^3 y = 0,$
$y(0) = 0, \ y'(0) = 5.$

7.22. $y'' y^3 + 4 = 0,$
$y(0) = -1, \ y'(0) = -2.$

7.23. $y^3 y'' = y^4 - 16,$
$y(0) = 2\sqrt{2}, \ y'(0) = \sqrt{2}.$

7.24. $y'' = 32 y^3,$
$y(4) = 1, \ y'(4) = 4.$

7.25. $y'' + 32\sin y \cos^3 y = 0,$
$y(0) = 0, \ y'(0) = 4.$

7.26. $y'' = 18 y^3,$
$y(1) = 1, \ y'(1) = 3.$

7.27. $4 y^3 y'' = 4\left(y^4 - 1\right),$
$y(0) = \sqrt{2}, \ y'(0) = \sqrt{2}.$

7.28. $y'' = 8 y^3,$
$y(0) = 1, \ y'(0) = 2.$

7.29. $y'' = 2\sin^3 y \cos y,$
$y(1) = \pi/2, \ y'(1) = 1.$

7.30. $y'' = 2 y^3,$
$y(-1) = 1, \ y'(-1) = 1.$

Задание 8. Записать фундаментальную систему решений.

8.1. $y''' - 5y'' + 9y' - 5y = 0$.

8.2. $y''' - 2y'' - 4y' + 8y = 0$.

8.3. $y^{IV} - 2y''' + 5y'' = 0$.

8.4. $y^{V} + 3y^{IV} + 7y''' + 5y'' = 0$.

8.5. $y''' - 6y'' + 12y' - 8y = 0$.

8.6. $y^{IV} + 9y'' = 0$.

8.7. $y^{IV} + 8y'' + 16y = 0$.

8.8. $2y''' - 10y'' + 6y' + 18y = 0$.

8.9. $y''' - 2y'' - 5y' + 6y = 0$.

8.10. $3y''' + 13y'' + 16y' + 4y = 0$.

8.11. $y^{IV} - 2y''' + 2y'' - 2y' + y = 0$.

8.12. $y^{IV} + 5y''' + 6y'' - 4y' - 8y = 0$.

8.13. $y''' - 2y'' + 5y' + 26y = 0$.

8.14. $y^{IV} - 2y''' + y'' + 2y' - 2y = 0$.

8.15. $y^{IV} - 4y''' + 8y'' - 8y' + 4y = 0$.

8.16. $2y''' - 9y'' + 27y = 0$.

8.17. $y^{IV} + 2y''' - y' - 2y = 0$.

8.18. $y^{IV} + 6y'' + 9y = 0$.

8.19. $6y''' - 29y'' + 39y' - 10y = 0$.

8.20. $y^{V} + 9y''' = 0$.

8.21. $y^{IV} + 4y''' - 2y'' - 12y' + 9y = 0$.

8.22. $y^{IV} - 4y''' + 6y'' - 4y' + y = 0$.

8.23. $4y^{V} - 16y^{IV} + 16y''' = 0$.

8.24. $y''' - y'' - 7y' + 15y = 0$.

8.25. $y^{IV} + 4y''' + 6y'' + 4y' + y = 0$.

8.26. $y''' - 5y'' + 24y' - 20y = 0$.

8.27. $y''' + 9y'' + 28y' + 30y = 0$.

8.28. $y^{IV} + 4y''' - 26y'' - 60y' + 225y = 0$.

8.29. $3y^{V} - 5y^{IV} = 0$.

8.30. $2y''' - 11y'' + 20y' + 13y = 0$.

Задание 9. Найти общее решение ЛОДУ, если корни его характеристического уравнения имеют следующий вид.

9.1. $k_1 = -2$, $k_{2,3,4} = 0$, $k_{5,6} = 3$, $k_{7,8} = 2 \pm 3i$.

9.2. $k_{1,2,3} = -3$, $k_{4,5} = 1 \pm 2i$, $k_{6,7} = k_{8,9} = 2 \pm i$, $k_{10} = 0$.

9.3. $k_1 = 0$, $k_{2,3} = -2$, $k_{4,5} = \pm 3i$, $k_{6,7} = k_{8,9} = k_{10,11} = -1 \pm 3i$.

9.4. $k_1 = 3$, $k_{2,3,4} = 5$, $k_{5,6} = 1 \pm 3i$, $k_{7,8} = k_{9,10} = 2 \pm i$.

9.5. $k_1 = -5$, $k_{2,3,4} = -2$, $k_{5,6} = \pm i$, $k_{7,8} = k_{9,10} = -2 \pm i$.

9.6. $k_{1,2} = 0$, $k_{3,4} = k_{5,6} = -1 \pm 10i$, $k_7 = 2$, $k_{8,9} = 3 \pm 5i$.

9.7. $k_{1,2,3} = -1$, $k_{4,5} = k_{6,7} = k_{8,9} = \pm i$, $k_{10,11} = 1 \pm 8i$, $k_{12} = 0$.

9.8. $k_{1,2} = -7$, $k_{3,4} = k_{5,6} = -9 \pm i$, $k_{7,8} = \pm 3i$, $k_9 = 5$.

9.9. $k_{1,2,3,4} = 2$, $k_{5,6} = k_{7,8} = -2 \pm 3i$, $k_9 = 0$, $k_{10,11} = \pm 9i$.

9.10. $k_1 = 0$, $k_{2,3,4} = 1$, $k_{5,6} = 1 \pm i$, $k_{7,8} = k_{9,10} = -5 \pm 6i$.

9.11. $k_{1,2} = -2$, $k_3 = 3$, $k_{4,5} = -3 \pm i$, $k_{6,7} = k_{8,9} = 1 \pm 3i$.

9.12. $k_1 = -8$, $k_{2,3,4} = 4$, $k_{5,6} = 2 \pm 5i$, $k_{7,8} = k_{9,10} = -3 \pm 2i$.

9.13. $k_1 = 1$, $k_{2,3} = -2$, $k_{4,5} = 1 \pm i$, $k_{6,7} = k_{8,9} = k_{10,11} = -2 \pm i$.

9.14. $k_{1,2} = -9$, $k_{3,4} = 2 \pm 4i$, $k_{5,6} = k_{7,8} = 1 \pm i$, $k_9 = 2$.

9.15. $k_1 = -1$, $k_{2,3} = 2$, $k_{4,5} = k_{6,7} = k_{8,9} = 2 \pm 7i$.

9.16. $k_1 = 0$, $k_{2,3} = 3$, $k_{4,5} = -1 \pm i$,

$k_{6,7} = k_{8,9} = k_{10,11} = -10 \pm 3i$.

9.17. $k_1 = -5$, $k_{2,3,4} = 1$, $k_{5,6} = k_{7,8} = -11 \pm 4i$ $k_{9,10} = 3 \pm 2i$.

9.18. $k_{1,2,3} = -1$, $k_4 = 2$, $k_{5,6} = -2 \pm 9i$, $k_{7,8} = k_{9,10} = 5 \pm 4i$.

9.19. $k_1 = -2$, $k_{2,3} = -3$, $k_{4,5} = 3 \pm 2i$,

$k_{6,7} = k_{8,9} = k_{10,11} = -2 \pm i$.

9.20. $k_1 = -3$, $k_{2,3,4} = 0$, $k_{5,6} = -2 \pm 2i$, $k_{7,8} = k_{9,10} = \pm i$.

9.21. $k_1 = -6$, $k_{2,3,4} = 5$, $k_{5,6} = k_{7,8} = -7 \pm 4i$, $k_{9,10} = 1 \pm 8i$.

9.22. $k_1 = -4$, $k_{2,3} = -5$, $k_{4,5} = 3 \pm 2i$, $k_{6,7} = k_{8,9} = k_{10,11} = \pm 12i$.

9.23. $k_1 = -7$, $k_{2,3} = 4$, $k_{4,5} = -5 \pm i$,

$k_{6,7} = k_{8,9} = k_{10,11} = 1 \pm 10i$.

9.24. $k_{1,2} = -3$, $k_3 = 9$, $k_{4,5} = -1 \pm 9i$, $k_{6,7} = k_{8,9} = k_{10,11} = 12 \pm i$.

9.25. $k_1 = 0$, $k_{2,3,4} = 6$, $k_{5,6} = 1 \pm 2i$, $k_{7,8} = k_{9,10} = -11 \pm 3i$.

9.26. $k_1 = -7$, $k_{2,3} = 3$, $k_{4,5} = -1 \pm 13i$,

$k_{6,7} = k_{8,9} = k_{10,11} = 1 \pm 13i$.

9.27. $k_{1,2} = -8$, $k_{3,4} = 1 \pm i$, $k_5 = -1$,

$k_{6,7} = k_{8,9} = k_{10,11} = -2 \pm 2i$.

9.28. $k_1 = -1$, $k_{2,3,4} = 5$, $k_{5,6} = 1 \pm 7i$, $k_{7,8} = k_{9,10} = 2 \pm i$.

9.29. $k_{1,2} = 0$, $k_3 = 5$, $k_{4,5} = -2 \pm 11i$,

$k_{6,7} = k_{8,9} = k_{10,11} = -3 \pm i$.

9.30. $k_1 = 6$, $k_{2,3,4} = 1$, $k_{5,6} = k_{7,8} = -2 \pm 3i$, $k_{9,10} = \pm 13i$.

Задание 10. Записать частное решение ЛНДУ с неопределенными коэффициентами, не вычисляя их.

№ п/п	Уравнение	Вид правой части $f(x)$
1	$y''' + 3y'' + 3y' + y = f(x)$	а) $f(x) = 3x^2 + 5$ б) $f(x) = x^2 e^{-x}$ в) $f(x) = e^{-x}((x+1)\cos x + 3\sin x)$
2	$y''' + 9y' = f(x)$	а) $f(x) = x + 3$ б) $f(x) = (x-1)^2 e^{3x}$ в) $f(x) = x\sin 3x$
3	$y''' - 5y'' + 4y' = f(x)$	а) $f(x) = 8x + 5$ б) $f(x) = (2x+7)e^{4x}$ в) $f(x) = 2\cos 4x + x\sin 4x$
4	$y''' - 5y'' + 8y' - 4y = f(x)$	а) $f(x) = x^2 - 4x + 4$ б) $f(x) = (x^2 + 5)e^{2x}$ в) $f(x) = e^{2x}\sin 6x$
5	$y''' + 2y'' + 5y' = f(x)$	а) $f(x) = -x + 2$ б) $f(x) = (1 - x^2)e^{-x}$ в) $f(x) = e^{-x}(x+1)\cos 2x$
6	$y''' + 7y'' + 10y' = f(x)$	а) $f(x) = x^3 - 2x$ б) $f(x) = (4x - 3)e^{-5x}$

		в) $f(x) = xe^{-2x}\cos 5x$
7	$y''' - 3y'' + 3y' - y = f(x)$	а) $f(x) = x^2$ б) $f(x) = x^2 e^x$ в) $f(x) = (x+5)\cos x$
8	$y''' - 4y'' + 13y' = f(x)$	а) $f(x) = x^2 - 4x + 13$ б) $f(x) = e^{2x}(x^2 - x)$ в) $f(x) = e^{2x}(x^2 \cos 3x + x\sin 3x)$
9	$y''' - 4y'' + 4y' = f(x)$	а) $f(x) = x^2 + 2$ б) $f(x) = xe^{2x}$ в) $f(x) = (x-1)\sin 2x$
10	$y''' + 6y'' + 10y' = f(x)$	а) $f(x) = 3x - 5$ б) $f(x) = x^2 e^{-3x}$ в) $f(x) = e^{-3x}x\sin x$
11	$y^{IV} - y = f(x)$	а) $f(x) = x^2 - 1$ б) $f(x) = (x^2 + 2)e^{-x}$ в) $f(x) = 2\sin x - x\cos x$
12	$y''' + 5y'' + 8y' + 4y = f(x)$	а) $f(x) = x^2 + 4x + 4$ б) $f(x) = x^2 e^{-2x}$ в) $f(x) = \cos 2x + x^2 \sin 2x$
13	$y''' - 8y'' + 20y' = f(x)$	а) $f(x) = x^3 + 4$

		б) $f(x) = (2x^2 - 7)e^{4x}$
		в) $f(x) = 5xe^{4x}\sin 2x$
14	$y''' + 2y'' = f(x)$	а) $f(x) = x^2 + x + 1$
		б) $f(x) = (x^2 + x + 1)e^{-2x}$
		в) $f(x) = e^{-2x}(\sin x + 2\cos x)$
15	$4y''' - 3y' - y = f(x)$	а) $f(x) = x^2 - 2$
		б) $f(x) = x^2 e^{-\frac{x}{2}}$
		в) $f(x) = 5\cos\dfrac{x}{2} + (x-1)\sin\dfrac{x}{2}$
16	$y''' - 4y'' + 8y' = f(x)$	а) $f(x) = x^2 - 4x + 8$
		б) $f(x) = e^{2x}(x - 3)$
		в) $f(x) = e^{2x}(x\sin 2x - 3\cos 2x)$
17	$y''' + 2y'' + y' = f(x)$	а) $f(x) = x^2$
		б) $f(x) = x^2 e^{-x}$
		в) $f(x) = (3x + 8)\cos x$
18	$9y''' - 3y'' - 5y' - y = f(x)$	а) $f(x) = 3x - 1$
		б) $f(x) = xe^{-\frac{x}{3}}$
		в) $f(x) = 4\cos\dfrac{x}{3} + (x^2 + 1)\sin\dfrac{x}{3}$
19	$y^{IV} - y = f(x)$	а) $f(x) = (x^2 + 3)$

		б) $f(x) = e^x(10x+1)$
		в) $f(x) = 2\cos x + (x^2 + 3)\sin x$
20	$y''' - y'' - 2y' = f(x)$	а) $f(x) = 6 + x^2$
		б) $f(x) = (1 - x^2)e^{2x}$
		в) $f(x) = e^{2x}(6\sin x + x^2 \cos x)$
21	$4y''' - 8y'' + 5y' - 1 = f(x)$	а) $f(x) = 4x + 7$
		б) $f(x) = (4x+7)e^{\frac{x}{2}}$
		в) $f(x) = (x^2 + 2x + 3)\sin\frac{x}{2}$
22	$y''' - 2y'' + 5y' = f(x)$	а) $f(x) = x^2 - 2x + 5$
		б) $f(x) = xe^x$
		в) $f(x) = xe^x \cos 2x$
23	$y''' + 4y'' + y' - 6y = f(x)$	а) $f(x) = (x-3)^2$
		б) $f(x) = e^{-2x}(x-3)^2$
		в) $f(x) = (3x+5)\sin 2x$
24	$9y''' - 6y'' + y' = f(x)$	а) $f(x) = 3x - 4$
		б) $f(x) = (3x-4)e^{\frac{x}{3}}$
		в) $f(x) = \cos\frac{x}{3} + (x+5)\sin\frac{x}{3}$
25	$y''' + 6y'' + 13y' = f(x)$	а) $f(x) = x^3 + 5$

		б) $f(x) = xe^{-3x}$
		в) $f(x) = xe^{-3x}\cos 2x$
26	$y^{IV} - 81y = f(x)$	а) $f(x) = x^2 - 9$ б) $f(x) = (5x + 2)e^{3x}$ в) $f(x) = x^2 \cos 3x$
27	$y''' - 3y'' + 3y' - y = f(x)$	а) $f(x) = 3x^2 + 1$ б) $f(x) = (3x^2 + 1)e^x$ в) $f(x) = x\cos x + (x^2 + 2)\sin x$
28	$y''' + 4y'' + 8y' = f(x)$	а) $f(x) = x^2$ б) $f(x) = x^2 e^{-2x}$ в) $f(x) = e^{-2x}x^2 \cos 2x$
29	$y''' + 2y'' - 3y' = f(x)$	а) $f(x) = x - 4$ б) $f(x) = (x - 4)e^x$ в) $f(x) = (x - 2)\cos 3x + 6\sin 3x$
30	$y''' + y'' - 2y' = f(x)$	а) $f(x) = x$ б) $f(x) = x\, e^{-2x}$ в) $f(x) = x\, \cos x$

Задание 11. Решить задачу Коши.

11.1. $2x'' - x' - x = 2e^t$, если $x(0) = 2$, $x'(0) = 3$.

11.2. $x'' - 4x' + 3x = e^{5t}$, если $x(0) = 3$, $x'(0) = 9$.

11.3. $x'' - 8x' + 16x = 4e^{2t}$, если $x(0) = 0$, $x'(0) = 1$.

11.4. $x'' + x = 8\cos 3t$, если $x\left(\dfrac{\pi}{4}\right) = 4$, $x'\left(\dfrac{\pi}{4}\right) = 1$.

11.5. $2x'' - x' = 1$, если $x(0) = 0$, $x'(0) = 1$.

11.6. $x'' + x = \sin 2t$, если $x(0) = x'(0) = 0$.

11.7. $x'' + 4x = \sin 2t$, если $x(0) = \dfrac{1}{4}$, $x'(0) = 0$.

11.8. $x'' - x = 2e^{-t}$, если $x(0) = 0$, $x'(0) = 1$.

11.9. $x'' - 4x' + 8x = 9e^{2t}\sin t$, если $x(0) = x'(0) = 4$.

11.10. $x'' + x' - 2x = 3e^{t}$, если $x(0) = -1$, $x'(0) = 0$.

11.11. $x'' - 2x' + 10x = 10t^2 + 6t + 10$, если $x(0) = 0$, $x'(0) = 3$.

11.12. $x'' - x' = 2(1 - t)$, если $x(0) = 1$, $x'(0) = 1$.

11.13. $x'' - 2x' = e^{t}\left(t^2 + t - 3\right)$, если $x(0) = x'(0) = 2$.

11.14. $x'' + x' = -\cos 2t$, если $x(0) = x'(0) = 1$.

11.15. $2x'' + x' - x = te^{t}$, если $x(0) = 2$, $x'(0) = 3$.

11.16. $x'' + 36x = 6\sin 6t$, если $x(0) = 1$, $x'(0) = \dfrac{1}{2}$.

11.17. $x'' + 4x = 2t$, если $x(0) = 2$, $x'(0) = 0$.

11.18. $x'' + x = (2 - 2t)e^{t}$, если $x(0) = 2$, $x'(0) = 4$.

11.19. $x'' - 6x' + 9x = -9t$, если $x(0) = 1$, $x'(0) = 3$.

11.20. $x'' - 3x' + 2x = e^{-t}\cos t$, если $x(0) = -\dfrac{4}{10}$, $x'(0) = \dfrac{3}{10}$.

11.21. $x'' + 5x' = 6te^{-t}$, если $x(0) = \dfrac{3}{4}$, $x'(0) = -\dfrac{3}{4}$.

11.22. $x'' + 10x' + 16x = 16t + 26$, если $x(0) = 1$, $x'(0) = 3$.

11.23. $x'' - 4x' + 5x = 8\cos t$, если $x(0) = 1$, $x'(0) = 1$.

11.24. $x'' - 4x' + 5x = e^{2t}$, если $x(0) = 1$, $x'(0) = 4$.

11.25. $x'' + 5x' + 6x = 6t^2 + 4t + 3$, если $x(0) = 1$, $x'(0) = -3$.

11.26. $x'' - 2x' + x = 2e^t$, если $x(0) = 1$, $x'(0) = 3$.

11.27. $x'' + 4x = -12\sin 4t + 8$, если $x(0) = x'(0) = 2$.

11.28. $4x'' + 16x' + 15x = 19e^{-\frac{3}{2}t}$, если $x(0) = x'(0) = 0$.

11.29. $x'' + 4x = \cos 2t - \sin 2t$, если $x(0) = 1$, $x'(0) = -1$.

11.30. $x'' - 2x' + x = te^t$, если $x(0) = x'(0) = 0$.

Задание 12. Записать общее решение ЛНДУ $x'' + a_1 x' + a_2 x = f(t)$ с неопределенными коэффициентами, не вычисляя их.

12.1. $x'' - 2x' + 10x = 2e^{3t} + te^t + 25 + \cos 2t$.

12.2. $x'' - 6x' + 9x = \sin 3t + te^t + 1 + e^{2t}\cos t$.

12.3. $x'' + 9x' = t^2 e^{2t} + t + e^{-t}\sin 3t + t\cos 3t$.

12.4. $x'' + 8x' + 16x = 2 + e^{-4t} + \sin 5t + e^t\cos 2t$.

12.5. $x'' + 7x' + 12x = t + 1 + e^{-3t} + \sin t + e^t\cos t$.

12.6. $x'' + 4x' = t^2 e^{2t} + 2\sin^2 t + 3 + e^t\cos t$.

12.7. $x'' + x' = t + e^{-t} + t\cos 2t + e^t\sin t$.

12.8. $x'' + 4x' + 29x = 2e^{-2t}\sin 5t + t^2 e^{4t} + t - 1 + \cos t$.

12.9. $x'' - 4x' - 5x = 2e^{-t} + \sin 5t + t^2 + e^t\cos t$.

12.10. $x'' + 10x' + 16x = 4 + te^{-2t} + e^t \sin 2t + 2\cos 2t$.

12.11. $x'' + 16x = 4 + te^{-4t} + 2\sin 4t + e^t \cos t$.

12.12. $x'' - 2x' + x = e^t + 2t^2 + e^{-3t} \cos t + \sin 3t$.

12.13. $x'' - 4x' + 8x = 10e^{-2t} + \sin t + 11 + 3e^{2t} \cos 2t$.

12.14. $x'' + 25x = 7e^{-5t} + e^t \sin t + t^2 + t\cos 5t + 14$.

12.15. $x'' - 30x' + 225x = t^4 + e^{15t} + \sin \dfrac{t}{2} + e^t \cos t$.

12.16. $x'' - 5x' + 6x = 9e^{2t} + e^t \sin t + 12t^2 + t\cos 2t$.

12.17. $x'' - 3x' + 2x = 2e^{2t} + e^{-2t} \cos t + 8t^3 + \sin 2t$.

12.18. $x'' + 2x' + 10x = 7e^{-t} \sin 3t + te^t + 17 + \cos t$.

12.19. $x'' + x' = t^2 e^{-t} + e^{2t} \sin 2t + t^5 + \cos t$.

12.20. $x'' + 4x' - 32x = \sin 4t + (t^2 - 1)e^{-8t} + 18 + e^t \cos t$.

12.21. $x'' - 2x' + 2x = e^t (\cos t + 2\sin t) + t^2 e^{-3t} + \cos 2t$.

12.22. $x'' - 4x' + 20x = e^{2t} \sin 4t + 2 + 5e^{2t} + \cos t$.

12.23. $x'' - 2x' = t + e^t + e^{-t} \sin t + t\cos 2t$.

12.24. $x'' + 7x' + 12x = t^2 + e^{-3t} + e^t \sin 2t + \cos t$.

12.25. $x'' + 4x' + 29x = 2e^{-2t} + e^{3t} \cos t + t + \cos 2t$.

12.26. $2x'' + x' - x = 2e^t + 25 + e^{-t} \sin 2t + t\cos t$.

12.27. $x'' - 7x' + 6x = te^t + \sin t + e^{-t} \cos 2t + 2$.

12.28. $x'' - 2x' + 2x = e^t + \sin t + 2t + e^{3t} \cos 2t$.

12.29. $x'' + 4x' + 3x = e^t + e^{-t} \sin 3t + t^2 + \cos 3t$.

12.30. $x'' + x' = 2t + e^{2t} + \cos t + e^t \cos 2t$.

Задание 13. Найти решение задачи Коши.

13.1. $y'' + \pi^2 y = \pi^2 / \cos \pi x$, $\quad y(0) = 3$, $\quad y'(0) = 0$.

13.2. $y'' + 3y' = 9e^{3x} / (1 + e^{3x})$, $\quad y(0) = \ln 4$, $\quad y'(0) = 3(1 - \ln 2)$.

13.3. $y'' + 4y = 8\,ctg\,2x$, $\quad y\left(\frac{\pi}{4}\right) = 5$, $\quad y'\left(\frac{\pi}{4}\right) = 4$.

13.4. $y'' - 6y' + 8y = 4 / \left(1 + e^{-2x}\right)$, $y(0) = 1 + 2\ln 2$, $y'(0) = 6\ln 2$.

13.5. $y'' - 9y' + 18y = 9e^{3x} / \left(1 + e^{-3x}\right)$, $\quad y(0) = 0$, $\quad y'(0) = 0$.

13.6. $y'' + \pi^2 y = \pi^2 / \sin \pi x$, $\quad y\left(\frac{1}{2}\right) = 1$, $\quad y'\left(\frac{1}{2}\right) = \frac{\pi^2}{2}$.

13.7. $y'' + \frac{1}{\pi^2} y = 1 / \pi^2 \cos\left(\frac{x}{\pi}\right)$, $\quad y(0) = 2$, $\quad y'(0) = 0$.

13.8. $y'' - 3y' = 9e^{-3x} / \left(3 + e^{-3x}\right)$, $y(0) = 4\ln 4$, $y'(0) = 3(3\ln 4 - 1)$.

13.9. $y'' + y = 4\,ctg\,x$, $\quad y\left(\frac{\pi}{2}\right) = 4$, $\quad y'\left(\frac{\pi}{2}\right) = 4$.

13.10. $y'' - 6y' + 8y = 4 / \left(2 + e^{-2x}\right)$, $\quad y(0) = 1 + 3\ln 3$, $y'(0) = 10\ln 3$.

13.11. $y'' + 6y' + 8y = 4e^{-2x} / \left(2 + e^{2x}\right)$, $\quad y(0) = 0$, $\quad y'(0) = 0$.

13.12. $y'' + 9y = 9 / \sin 3x$, $\quad y\left(\frac{\pi}{6}\right) = 4$, $\quad y'\left(\frac{\pi}{6}\right) = \frac{3\pi}{2}$.

13.13. $y'' + 9y = 9 / \cos 3x$, $\quad y(0) = 1$, $\quad y'(0) = 0$.

13.14. $y'' - y' = e^{-x} / \left(2 + e^{-x}\right)$, $\quad y(0) = \ln 27$, $y'(0) = \ln 9 - 1$.

13.15. $y'' + 4y = 4\,ctg\,2x$, $\quad y\left(\frac{\pi}{4}\right) = 3$, $\quad y'\left(\frac{\pi}{4}\right) = 2$.

13.16. $y'' - 3y' + 2y = \dfrac{1}{\left(3 + e^{-x}\right)}$, $y(0) = 1 + 8\ln 2$, $y'(0) = 14\ln 2$.

13.17. $y'' - 6y' + 8y = \dfrac{4e^{2x}}{\left(1 + e^{-2x}\right)}$, $y(0) = 0$, $y'(0) = 0$.

13.18. $y'' + 16y = \dfrac{16}{\sin 4x}$, $y\left(\frac{\pi}{8}\right) = 3$, $y'\left(\frac{\pi}{8}\right) = 2\pi$.

13.19. $y'' + 16y = \dfrac{16}{\cos 4x}$, $y(0) = 3$, $y'(0) = 0$.

13.20. $y'' - 2y' = \dfrac{4e^{-2x}}{\left(1 + e^{-2x}\right)}$, $y(0) = \ln 4$, $y'(0) = \ln 4 - 2$.

13.21. $y'' + \dfrac{y}{4} = \dfrac{1}{4}\operatorname{ctg}\left(\frac{x}{2}\right)$, $y(\pi) = 2$, $y'(\pi) = \frac{1}{2}$.

13.22. $y'' - 3y' + 2y = \dfrac{1}{\left(2 + e^{-x}\right)}$, $y(0) = 1 + 3\ln 3$, $y'(0) = 5\ln 3$.

13.23. $y'' + 3y' + 2y = \dfrac{e^{-x}}{\left(2 + e^{x}\right)}$, $y(0) = 0$, $y'(0) = 0$.

13.24. $y'' + 4y = \dfrac{4}{\sin 2x}$, $y\left(\frac{\pi}{4}\right) = 2$, $y'\left(\frac{\pi}{4}\right) = \pi$.

13.25. $y'' + 4y = \dfrac{4}{\cos 2x}$, $y(0) = 2$, $y'(0) = 0$.

13.26. $y'' + y' = \dfrac{e^{x}}{\left(2 + e^{x}\right)}$, $y(0) = \ln 27$, $y'(0) = 1 - \ln 9$.

13.27. $y'' + y = 2\operatorname{ctg}x$, $y\left(\frac{\pi}{2}\right) = 1$, $y'\left(\frac{\pi}{2}\right) = 2$.

13.28. $y'' - 3y' + 2y = \dfrac{1}{\left(1 + e^{-x}\right)}$, $y(0) = 1 + 2\ln 2$, $y'(0) = 3\ln 2$.

13.29. $y'' - 3y' + 2y = \dfrac{e^{x}}{\left(1 + e^{-x}\right)}$, $y(0) = 0$, $y'(0) = 0$.

13.30. $y'' + y = \dfrac{1}{\sin x}$, $y\left(\frac{\pi}{2}\right) = 1$, $y'\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$.

Задание 14. Решить систему $\begin{cases} \dot{x} = a_{11}x + a_{12}y, \\ \dot{y} = a_{21}x + a_{22}y \end{cases}$ двумя способами: 1) исключением неизвестной и 2) матричным методом.

14.1. $\begin{cases} \dot{x} = x + 4y, \\ \dot{y} = 2x + 3y. \end{cases}$

14.9. $\begin{cases} \dot{x} = 5x + 4y, \\ \dot{y} = -2x + 11y. \end{cases}$

14.2. $\begin{cases} \dot{x} = 2x + y, \\ \dot{y} = 3x + 4y. \end{cases}$

14.10. $\begin{cases} \dot{x} = x - 5y, \\ \dot{y} = 5x + y. \end{cases}$

14.3. $\begin{cases} \dot{x} = x - 3y, \\ \dot{y} = 3x + y. \end{cases}$

14.11. $\begin{cases} \dot{x} = 2x + 3y, \\ \dot{y} = x. \end{cases}$

14.4. $\begin{cases} \dot{x} = -3x + 2y, \\ \dot{y} = -2x + y. \end{cases}$

14.12. $\begin{cases} \dot{x} = -2x - 3y, \\ \dot{y} = -x. \end{cases}$

14.5. $\begin{cases} \dot{x} = 2y, \\ \dot{y} = x - y. \end{cases}$

14.13. $\begin{cases} \dot{x} = x + 4y, \\ \dot{y} = x + y. \end{cases}$

14.6. $\begin{cases} \dot{x} = 3x - y, \\ \dot{y} = x + y. \end{cases}$

14.14. $\begin{cases} \dot{x} = 2y - x, \\ \dot{y} = x. \end{cases}$

14.7. $\begin{cases} \dot{x} = 4y - 2x, \\ \dot{y} = 2x. \end{cases}$

14.15. $\begin{cases} \dot{x} = 7x + y, \\ \dot{y} = -2x + 5y. \end{cases}$

14.8. $\begin{cases} \dot{x} = x - y, \\ \dot{y} = 2x - y. \end{cases}$

14.16. $\begin{cases} \dot{x} = 5x - 3y, \\ \dot{y} = x + y. \end{cases}$

14.17. $\begin{cases} \dot{x} = 9y, \\ \dot{y} = x. \end{cases}$ **14.24.** $\begin{cases} \dot{x} = -2x + 4y, \\ \dot{y} = 3y - x. \end{cases}$

14.18. $\begin{cases} \dot{x} = y, \\ \dot{y} = 2x + y. \end{cases}$ **14.25.** $\begin{cases} \dot{x} = -9y, \\ \dot{y} = x. \end{cases}$

14.19. $\begin{cases} \dot{x} = 4y, \\ \dot{y} = -x. \end{cases}$ **14.26.** $\begin{cases} \dot{x} = 2x + 4y, \\ \dot{y} = -x - 2y. \end{cases}$

14.20. $\begin{cases} \dot{x} = -3x - y, \\ \dot{y} = 2x - y. \end{cases}$ **14.27.** $\begin{cases} \dot{x} = 2x - y, \\ \dot{y} = 3x - 2y. \end{cases}$

14.21. $\begin{cases} \dot{x} = -y, \\ \dot{y} = x. \end{cases}$ **14.28.** $\begin{cases} \dot{x} = -4y, \\ \dot{y} = x. \end{cases}$

14.22. $\begin{cases} \dot{x} = -4y, \\ \dot{y} = -4x. \end{cases}$ **14.29.** $\begin{cases} \dot{x} = x - y, \\ \dot{y} = 2x + 3y. \end{cases}$

14.23. $\begin{cases} \dot{x} = 4x - 2y, \\ \dot{y} = 2y + x. \end{cases}$ **14.30.** $\begin{cases} \dot{x} = -9y, \\ \dot{y} = -x. \end{cases}$

Задание 15. Решить систему дифференциальных уравнений двумя способами: 1) методом вариации произвольных постоянных и 2) операторным методом.

15.1. $\begin{cases} x' = x + 3y + 2, \\ y' = x - y + 1; \end{cases}$ $x(0) = -1$, $y(0) = 2$.

15.2. $\begin{cases} x' = 2x + 3y + 1, \\ y' = 4x - 2y; \end{cases}$ $x(0) = -1$, $y(0) = 0$.

15.3. $\begin{cases} x' = 2x + 5y, \\ y' = x - 2y + 2; \end{cases}$ $x(0) = 1$, $y(0) = 1$.

15.4. $\begin{cases} x' = -2x + 6y + 1, \\ y' = 2x + 2; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.5. $\begin{cases} x' = 3x + y, \\ y' = -5x - 3y + 2; \end{cases}$ $x(0) = 2$, $y(0) = 2$.

15.6. $\begin{cases} x' = x + 2y + 1, \\ y' = 4x - y; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.7. $\begin{cases} x' = -3x - 4y + 1, \\ y' = 2x + 3y; \end{cases}$ $x(0) = 0$, $y(0) = 2$.

15.8. $\begin{cases} x' = -2x + 5y + 1, \\ y' = x + 2y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 2$.

15.9. $\begin{cases} x' = x + 4y, \\ y' = 2x - y + 9; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

15.10. $\begin{cases} x' = -x + 3y + 1, \\ y' = x + y; \end{cases}$ $x(0) = 1$, $y(0) = 2$.

15.11. $\begin{cases} x' = x + 2y, \\ y' = 2x + y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 5$.

15.12. $\begin{cases} x' = 2x + 2y + 2, \\ y' = 4y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.13. $\begin{cases} x' = 3y + 2, \\ y' = x + 2y; \end{cases}$ $x(0) = -1$, $y(0) = 0$.

15.14. $\begin{cases} x' = 3x + 2y, \\ y' = \dfrac{5}{2}x - y + 2; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.15. $\begin{cases} x' = x + y, \\ y' = 4x + y + 1; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

15.16. $\begin{cases} x' = 2x - 2y, \\ y' = -4x + 1; \end{cases}$ $x(0) = 3$, $y(0) = 1$.

15.17. $\begin{cases} x' = x - 2y + 1, \\ y' = -3x; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.18. $\begin{cases} x' = 2x + 8y + 1, \\ y' = 3x + 4y; \end{cases}$ $x(0) = 2$, $y(0) = 1$.

15.19. $\begin{cases} x' = 3x + 5y + 2, \\ y' = 3x + y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 2$.

15.20. $\begin{cases} x' = x + 4y + 1, \\ y' = 2x + 3y; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.21. $\begin{cases} x' = 2y + 1, \\ y' = 2x + 3; \end{cases}$ $x(0) = -1$, $y(0) = 0$.

15.22. $\begin{cases} x' = -x - 2y + 1, \\ y' = -\dfrac{3}{2}x + y; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

15.23. $\begin{cases} x' = -x + 3y + 2, \\ y' = x + y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.24. $\begin{cases} x' = 2y, \\ y' = 2x + 3y + 1; \end{cases}$ $x(0) = 2$, $y(0) = 1$.

15.25. $\begin{cases} x' = y + 3, \\ y' = x + 2; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

15.26. $\begin{cases} x' = -2x + y, \\ y' = 3x - 1; \end{cases}$ $x(0) = 0$ $y(0) = 1$.

15.27. $\begin{cases} x' = x + 3y + 3, \\ y' = x - y + 1; \end{cases}$ $x(0) = 0$, $y(0) = 1$.

15.28. $\begin{cases} x' = x + 3y, \\ y' = x - y + 1; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

15.29. $\begin{cases} x' = 4x + 3, \\ y' = x + 2y; \end{cases}$ $x(0) = -1$, $y(0) = 0$.

15.30. $\begin{cases} x' = -2x + y + 2, \\ y' = 3x; \end{cases}$ $x(0) = 1$, $y(0) = 0$.

Задание 16. Операционным методом решить задачу Коши.

16.1. $x'' + x = 6e^{-t}$, $x(0) = 3$, $x'(0) = 1$.

16.2. $x'' - x = t^2$, $x(0) = 0$, $x'(0) = 1$.

16.3. $x'' + x' = t^2 + 2t$, $x(0) = 0$, $x'(0) = -2$.

16.4. $x'' - x = \cos 3t$, $x(0) = 1$, $x'(0) = 1$.

16.5. $x'' + x' + x = 7e^{2t}$, $x(0) = 1$, $x'(0) = 4$.

16.6. $x'' + x' - 2x = -2(t+1)$, $x(0) = 1$, $x'(0) = 1$.

16.7. $x'' - 9x = \sin t - \cos t$, $x(0) = -3$, $x'(0) = 2$.

16.8. $x'' + 2x' = 2 + e^t$, $x(0) = 1$, $x'(0) = 2$.

16.9. $2x'' - x = \sin 3t$, $x(0) = 2$, $x'(0) = 1$.

16.10. $x'' + 2x' = \sin \dfrac{t}{2}$, $x(0) = -2$, $x'(0) = 4$.

16.11. $x'' + x = \operatorname{sh} t$, $x(0) = 2$, $x'(0) = 1$.

16.12. $x'' + 4x' + 29x = e^{-2t}$, $x(0) = 0$, $x'(0) = 1$.

16.13. $x'' - 3x' + 2x = e^t$, $x(0) = 1$, $x'(0) = 0$.

16.14. $2x'' + 3x' + x = 3e^t$, $x(0) = 0$, $x'(0) = 1$.

16.15. $x'' - 2x' - 3x = 2t$, $x(0) = 1$, $x'(0) = 1$.

16.16. $x'' + 4x = \sin 2t$, $x(0) = 0$, $x'(0) = 1$.

16.17. $2x'' + 5x' = 29\cos t$, $x(0) = -1$, $x'(0) = 0$.

16.18. $x'' + x' + x = t^2 + t$, $x(0) = 1$, $x'(0) = -3$.

16.19. $x'' + 4x = 8\sin 2t$, $x(0) = 3$, $x'(0) = -1$.

16.20. $x'' - x' - 6x = 2$, $x(0) = 1$, $x'(0) = 0$.

16.21. $x'' + 4x = 4e^{2t} + 4t$, $x(0) = 1$, $x'(0) = 2$.

16.22. $x'' + 4x' + 4x = t^3 e^{2t}$, $x(0) = 1$, $x'(0) = 2$.

16.23. $x'' - 3x' + 2x = 12e^{3t}$, $x(0) = 2$, $x'(0) = 6$.

16.24. $x'' + 4x = 3\sin t + 10\cos 3t$, $x(0) = -2$, $x'(0) = 3$.

16.25. $x'' + 2x' + 10x = 2e^{-t}\cos 3x$, $x(0) = 5$, $x'(0) = 1$.

16.26. $x'' + 3x' - 10x = 47\cos 3t - \sin 3t$, $x(0) = 3$, $x'(0) = -1$.

16.27. $x'' + x' - 2x = e^{-t}$, $x(0) = -1$, $x'(0) = 0$.

16.28. $x'' - 2x' = e^t(t^2 + t - 3)$, $x(0) = 2$, $x'(0) = 2$.

16.29. $x'' + x = 2\cos t$, $x(0) = 0$, $x'(0) = 1$.

16.30. $x'' - x = 4\sin t + 5\cos 2t$, $x(0) = -1$, $x'(0) = -2$.