

Задание 1. Разложить в ряд Фурье периодическую (с периодом $T = 2\pi$) функцию $f(x)$, заданную на отрезке $[-\pi; \pi]$. Постройте график данной функции при $x \in [-4\pi; 4\pi]$. Запишите равенство, получаемое из найденного разложения при $x = x_0$.

$$1. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 4x - 3, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$2. f(x) = |\sin x|; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$3. f(x) = \begin{cases} 7 - 3x, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$4. f(x) = \sin 3x; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$5. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 3x - 1, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$6. f(x) = \cos 4x; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$7. f(x) = \begin{cases} 3 - 2x, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$8. f(x) = \sin 4x; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$9. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 1 - 4x, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$10. f(x) = 2x + 3; \quad -\pi \leq x \leq \pi; \quad x_0 = 0;$$

$$11. f(x) = \begin{cases} 3x + 2, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$12. f(x) = x + \operatorname{sign} x; \quad -\pi \leq x \leq \pi; \quad x_0 = \frac{\pi}{2};$$

$$13. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 4 - 2x, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$14. f(x) = \sin \frac{x}{2}; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$15. f(x) = \begin{cases} 6x - 2, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$16. f(x) = \cos \frac{x}{2}; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$17. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 6x - 5, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$18. f(x) = x - \operatorname{sign} x; \quad -\pi \leq x \leq \pi; \quad x_0 = \frac{\pi}{2};$$

$$19. f(x) = \begin{cases} 3x - 5, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$20. f(x) = \begin{cases} -1, & -\pi \leq x < 0; \\ 3, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$21. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 4 - 9x, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$22. f(x) = \begin{cases} \sin x, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = \pi;$$

$$23. f(x) = \begin{cases} 5x + 1, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$24. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ \sin x, & 0 \leq x < \pi; \end{cases} \quad x_0 = \frac{\pi}{2};$$

$$25. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 3 - 8x, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$26. f(x) = \begin{cases} 1, & -\pi \leq x < 0; \\ \cos x, & 0 \leq x < \pi; \end{cases} \quad x_0 = \pi;$$

$$27. f(x) = \begin{cases} 2x - 11, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$28. f(x) = 1 - \frac{|x|}{\pi}; \quad -\pi \leq x \leq \pi; \quad x_0 = \pi;$$

$$29. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 10x - 3, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$30. f(x) = \begin{cases} -1; & -\pi \leq x < -\frac{\pi}{2}; \\ \sin x; & -\frac{\pi}{2} \leq x < 0; \\ 1; & 0 \leq x < \pi; \end{cases} \quad x_0 = \frac{\pi}{2};$$

$$31. f(x) = \begin{cases} 7x - 1, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$32. f(x) = 2x - \operatorname{sign} x; \quad -\pi \leq x \leq \pi; \quad x_0 = \frac{\pi}{2};$$

$$33. f(x) = \begin{cases} 0, & -\pi \leq x < 0; \\ 4 + 3x, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0;$$

$$34. f(x) = 2x + \operatorname{sign} x; \quad -\pi \leq x \leq \pi; \quad x_0 = \frac{\pi}{2};$$

$$35. f(x) = \begin{cases} 5x - 2, & -\pi \leq x < 0; \\ 0, & 0 \leq x < \pi; \end{cases} \quad x_0 = 0.$$

Задание 2. Разложить в ряд Фурье в указанном интервале периодическую функцию $f(x)$ (с периодом $T=2l$).

$$1. f(x) = \begin{cases} 0, & -2 \leq x < 0; \\ x, & 0 \leq x < 1; \\ 2 - x, & 1 \leq x \leq 2; \end{cases} \quad T = 4;$$

$$2. f(x) = |x| - 5, \quad -2 \leq x \leq 2; \quad T = 4;$$

$$3. f(x) = \begin{cases} 1, & -1 \leq x < 0; \\ x, & 0 \leq x < 1; \end{cases} \quad T = 2;$$

$$4. f(x) = 1 - |x|, \quad -3 \leq x \leq 3; \quad T = 6;$$

$$5. f(x) = \begin{cases} 0, & -2 \leq x < 0; \\ x, & 0 \leq x < 1; \\ 2 - x, & 1 \leq x \leq 2; \end{cases} \quad T = 4;$$

$$6. f(x) = 2 - |x|, \quad -2 \leq x \leq 2; \quad T = 4;$$

$$7. f(x) = \sin 2x, \quad -\frac{\pi}{4} \leq x \leq \frac{\pi}{4}; \quad T = \frac{\pi}{2};$$

$$8. f(x) = \begin{cases} -1, & -3 \leq x < -1; \\ x, & -1 \leq x < 1; \\ 1, & 1 \leq x \leq 3; \end{cases} T = 6;$$

$$9. f(x) = \cos 2x, \quad -\frac{\pi}{4} \leq x \leq \frac{\pi}{4}; \quad T = \frac{\pi}{2};$$

$$10. f(x) = \begin{cases} x, & -1,5 \leq x < -0,5; \\ 1, & -0,5 \leq x < 0,5; \\ 3-x, & 0,5 \leq x \leq 1,5; \end{cases} T = 3;$$

$$11. f(x) = \cos 3x, \quad -\frac{\pi}{3} \leq x \leq \frac{\pi}{3}; \quad T = \frac{2\pi}{3};$$

$$12. f(x) = \sin 3x, \quad -\frac{\pi}{6} \leq x \leq \frac{\pi}{6}; \quad T = \frac{\pi}{3};$$

$$13. f(x) = \begin{cases} x+2, & -2 \leq x < -1; \\ 1, & -1 \leq x < 1; \\ 2-x, & 1 \leq x \leq 2; \end{cases} T = 4;$$

$$14. f(x) = |x| - 3, \quad -4 \leq x \leq 4; \quad T = 8;$$

$$15. f(x) = \begin{cases} -2x, & -2 \leq x < 0; \\ 2, & x = 0; \\ 4, & 0 < x \leq 2; \end{cases} T = 4;$$

$$16. f(x) = 4x - 3, \quad -5 \leq x \leq 5; \quad T = 10;$$

$$17. f(x) = \begin{cases} x+3, & -3 \leq x < -1; \\ 1, & -1 \leq x < 1; \\ 3-x, & 1 \leq x \leq 3; \end{cases} T = 6;$$

$$18. f(x) = 2x - 3, \quad -3 \leq x \leq 3; \quad T = 6;$$

$$19. f(x) = \begin{cases} -x, & -4 \leq x < 0; \\ 1, & x = 0; \\ 2, & 0 < x \leq 4; \end{cases} T = 8;$$

$$20. f(x) = 2x + 2, \quad -2 \leq x \leq 2; \quad T = 4;$$

$$21. f(x) = \cos \frac{x}{2}, \quad -2\pi \leq x \leq 2\pi; \quad T = 4\pi;$$

$$22. f(x) = \begin{cases} -1, & -2 \leq x < 0; \\ -\frac{1}{2}, & x = 0; \\ \frac{x}{2}, & 0 < x \leq 2; \end{cases} T = 4;$$

$$23. f(x) = \begin{cases} x, & -2 \leq x < -1; \\ 1, & -1 \leq x < 1; \\ 2-x, & 1 \leq x \leq 2; \end{cases} T = 4;$$

$$24. f(x) = 2x - 3, \quad -3 \leq x \leq 3; \quad T = 6;$$

$$25. f(x) = \begin{cases} 1, & -2 \leq x < -1; \\ 2-|x|, & -1 \leq x < 1; \\ 1, & 1 \leq x \leq 2; \end{cases} T = 4;$$

$$26. f(x) = \begin{cases} 2, & -1 \leq x < 0; \\ 1, & 0 \leq x < 1; \end{cases} T = 2;$$

$$27. f(x) = 3 - 2x, \quad -3 \leq x \leq 3; \quad T = 6;$$

$$28. f(x) = \begin{cases} -1, & -2 \leq x < -1; \\ -x, & -1 \leq x < 1; \\ 1, & 1 \leq x \leq 2; \end{cases} T = 4;$$

$$29. f(x) = 5x - 1, \quad -5 \leq x \leq 5; \quad T = 10;$$

$$30. f(x) = \cos \frac{x}{2}, \quad -2\pi \leq x \leq 2\pi; \quad T = 4\pi;$$

$$31. f(x) = \begin{cases} 3, & -3 \leq x < 0; \\ \frac{3}{2}, & x = 0; \\ -x, & 0 < x \leq 3; \end{cases} T = 6;$$

$$32. f(x) = |x| - 2, \quad -4 \leq x \leq 4; \quad T = 8;$$

$$33. f(x) = \begin{cases} 2 + x, & -2 \leq x < -1; \\ 1, & -1 \leq x < 1; \\ 2 - x, & 1 \leq x \leq 2; \end{cases} T = 4;$$

$$34. f(x) = 1 + 2x, \quad -3 \leq x \leq 3; \quad T = 6;$$

$$35. f(x) = \begin{cases} 2, & -1,5 \leq x < 0; \\ -2, & 0 \leq x < 1,5; \end{cases} T = 3;$$