3.1. Используя таблицу значений Y_i функции $y = f(x)$, вычисленных в точках X_i, $i = 0,...,3$ построить интерполяционные многочлены Лагранжа и Ньютона, проходящие через точки $\{X_i, Y_i\}$. Вычислить значение погрешности интерполяции в точке X^*.

1. $y = \sin(x)$, а) $X_i = 0.1\pi,\ 0.2\pi, 0.3\pi, 0.4\pi;$ б) $X_i = 0.1\pi, \dfrac{\pi}{6}, 0.3\pi, 0.4\pi;$ $X^* = \dfrac{\pi}{4}$.

2. $y = \cos(x)$, а) $X_i = 0, \dfrac{\pi}{6}, \dfrac{2\pi}{6}, \dfrac{3\pi}{6}$;   б) $X_i = 0, \dfrac{\pi}{6}, \dfrac{5\pi}{12}, \dfrac{\pi}{2};$ $X^* = \dfrac{\pi}{4}$.

3. $y = tg(x)$, а) $X_i = 0, \dfrac{\pi}{8}, \dfrac{2\pi}{8}, \dfrac{3\pi}{8}$;   б) $X_i = 0, \dfrac{\pi}{8}, \dfrac{\pi}{3}, \dfrac{3\pi}{8};$ $X^* = \dfrac{3\pi}{16}$.

4. $y = ctg(x)$, а) $X_i = \dfrac{\pi}{8}, \dfrac{2\pi}{8}, \dfrac{3\pi}{8}, \dfrac{4\pi}{8}$;   б) $X_i = \dfrac{\pi}{8}, \dfrac{5\pi}{16}, \dfrac{3\pi}{8}, \dfrac{\pi}{2};$ $X^* = \dfrac{\pi}{3}$.

5. $y = \ln(x)$, а) $X_i = 0.2, 0.6, 1.0, 1.4$;   б) $X_i = 0.2, 0.6, 1.0, 1.4;$ $X^* = 0.8$.

6. $y = e^x$,   а) $X_i = -2, -1, 0, 1$;   б) $X_i = -2, -1, 0.2, 1;$ $X^* = -0.5$.

7. $y = \sqrt{x}$,   а) $X_i = 0, 1.7, 3.4, 5.1$;   б) $X_i = 0, 1.7, 4.0, 5.1;$ $X^* = 3.0$.

8. $y = \arcsin(x)$, а) $X_i = -0.4, -0.1, 0.2, 0.5$; б) $X_i = -0.4, 0, 0.2, 0.5;$ $X^* = 0.1$.

9. $y = \arccos(x)$, а) $X_i = -0.4, -0.1, 0.2, 0.5$; б) $X_i = -0.4, 0, 0.2, 0.5;$ $X^* = 0.1$.

10. $y = arctg(x)$, а) $X_i = -3, -1, 1, 3$;   б) $X_i = -3, 0, 1, 3;$ $X^* = -0.5$.

11. $y = arcctg(x)$, а) $X_i = -3, -1, 1, 3$;   б) $X_i = -3, 0, 1, 3;$ $X^* = -0.5$.

12. $y = \sin(x) + x$, а) $X_i = 0, \dfrac{\pi}{6}, \dfrac{2\pi}{6}, \dfrac{3\pi}{6}$;   б) $X_i = 0, \dfrac{\pi}{6}, \dfrac{\pi}{4}, \dfrac{\pi}{2};$ $X^* = 1.0$.

13. $y = \cos(x) + x$, а) $X_i = 0, \dfrac{\pi}{6}, \dfrac{2\pi}{6}, \dfrac{3\pi}{6}$;   б) $X_i = 0, \dfrac{\pi}{6}, \dfrac{\pi}{4}, \dfrac{\pi}{2};$ $X^* = 1.0$.

14. $y = tg(x) + x$, а) $X_i = 0, \dfrac{\pi}{8}, \dfrac{2\pi}{8}, \dfrac{3\pi}{8}$; б) $X_i = 0, \dfrac{\pi}{8}, \dfrac{\pi}{3}, \dfrac{3\pi}{8};$ $X^* = \dfrac{3\pi}{16}$.

15. $y = ctg(x) + x$, а) $X_i = \dfrac{\pi}{8}, \dfrac{2\pi}{8}, \dfrac{3\pi}{8}, \dfrac{4\pi}{8}$; б) $X_i = \dfrac{\pi}{8}, \dfrac{\pi}{3}, \dfrac{3\pi}{8}, \dfrac{\pi}{2};$ $X^* = \dfrac{3\pi}{16}$.

16. $y = \ln(x) + x$, а) $X_i = 0.1, 0.5, 0.9, 1.3$;   б) $X_i = 0.1, 0.5, 1.1, 1.3;$ $X^* = 0.8$.

17. $y = e^x + x$,   а) $X_i = -2, -1, 0, 1$;   б) $X_i = -2, -1, 0.2, 1;$ $X^* = -0.5$.

18. $y = \sqrt{x} + x$, а) $X_i = 0, 1.7, 3.4, 5.1$;   б) $X_i = 0, 1.7, 4.0, 5.1;$ $X^* = 3.0$.

19. $y = \arcsin(x) + x$, а) $X_i = -0.4, -0.1, 0.2, 0.5$; б) $X_i = -0.4, 0, 0.2, 0.5;$ $X^* = 0.1$.

20. $y = \arccos(x) + x$, а) $X_i = -0.4, -0.1, 0.2, 0.5$; б) $X_i = -0.4, 0, 0.2, 0.5;$ $X^* = 0.1$.

21. $y = arctg(x) + x$, а) $X_i = -3, -1, 1, 3$;   б) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

22. $y = arcctg(x) + x$, а) $X_i = -3, -1, 1, 3$;   б) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

23. $y = \dfrac{1}{x}$,   а) $X_i = 0.1, 0.5, 0.9, 1.3$;   б) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

24. $y = \dfrac{1}{x^2}$,   а) $X_i = 0.1, 0.5, 0.9, 1.3$;   б) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

25. $y = \dfrac{1}{x} + x$,   а) $X_i = 0.1, 0.5, 0.9, 1.3$;   б) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

26. $y = \dfrac{1}{x^2} + x^2$, а) $X_i = 0.1, 0.5, 0.9, 1.3$; б) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

27. $y = x\sin(x)$, а) $X_i = 0, \dfrac{\pi}{6}, \dfrac{2\pi}{6}, \dfrac{3\pi}{6}$; б) $X_i = 0, \dfrac{\pi}{6}, \dfrac{5\pi}{12}, \dfrac{\pi}{2}$; $X^* = \dfrac{\pi}{4}$.

28. $y = x\cos(x)$, а) $X_i = 0, \dfrac{\pi}{6}, \dfrac{2\pi}{6}, \dfrac{3\pi}{6}$; б) $X_i = 0, \dfrac{\pi}{6}, \dfrac{5\pi}{12}, \dfrac{\pi}{2}$; $X^* = \dfrac{\pi}{4}$.

29. $y = xe^x$,   а) $X_i = -2, -1, 0, 1$;   б) $X_i = -2, -1, 0.2, 1$; $X^* = -0.5$.

30. $y = x^2 e^x$, а) $X_i = -1.2, -0.7, -0.2, 0.3$; б) $X_i = -1.2, -0.7, -0, 0.3$; $X^* = -0.5$.