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.
$$y = \sin(x)$$
, a) $X_i = 0.1\pi$, 0.2π , 0.3π , 0.4π ; 6) $X_i = 0.1\pi$, $\frac{\pi}{6}$, 0.3π , 0.4π ; $X^* = \frac{\pi}{4}$.

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

3.
$$y = tg(x)$$
, a) $X_i = 0$, $\frac{\pi}{8}$, $\frac{2\pi}{8}$, $\frac{3\pi}{8}$; 6) $X_i = 0$, $\frac{\pi}{8}$, $\frac{\pi}{3}$, $\frac{3\pi}{8}$; $X^* = \frac{3\pi}{16}$.

4.
$$y = ctg(x)$$
, a) $X_i = \frac{\pi}{8}, \frac{2\pi}{8}, \frac{3\pi}{8}, \frac{4\pi}{8}$; 6) $X_i = \frac{\pi}{8}, \frac{5\pi}{16}, \frac{3\pi}{8}, \frac{\pi}{2}$; $X^* = \frac{\pi}{3}$.

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

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

7.
$$y = \sqrt{x}$$
, a) $X_i = 0, 1.7, 3.4, 5.1$; 6) $X_i = 0, 1.7, 4.0, 5.1$; $X^* = 3.0$.

8.
$$y = \arcsin(x)$$
, a) $X_i = -0.4, -0.1, 0.2, 0.5$; 6) $X_i = -0.4, 0, 0.2, 0.5$; $X^* = 0.1$.

9.
$$y = \arccos(x)$$
, a) $X_i = -0.4, -0.1, 0.2, 0.5$; 6) $X_i = -0.4, 0, 0.2, 0.5$; $X^* = 0.1$.

10.
$$y = arctg(x)$$
, a) $X_i = -3, -1, 1, 3$; 6) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

11.
$$y = arcctg(x)$$
, a) $X_i = -3, -1, 1, 3$; 6) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

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

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

14.
$$y = tg(x) + x$$
, a) $X_i = 0$, $\frac{\pi}{8}$, $\frac{2\pi}{8}$, $\frac{3\pi}{8}$; 6) $X_i = 0$, $\frac{\pi}{8}$, $\frac{\pi}{3}$, $\frac{3\pi}{8}$; $X^* = \frac{3\pi}{16}$.

15.
$$y = ctg(x) + x$$
, a) $X_i = \frac{\pi}{8}, \frac{2\pi}{8}, \frac{3\pi}{8}, \frac{4\pi}{8}$; 6) $X_i = \frac{\pi}{8}, \frac{\pi}{3}, \frac{3\pi}{8}, \frac{\pi}{2}$; $X^* = \frac{3\pi}{16}$.

16.
$$y = \ln(x) + x$$
, a) $X_i = 0.1, 0.5, 0.9, 1.3$; 6) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

17.
$$y = e^x + x$$
, a) $X_i = -2, -1, 0, 1$; 6) $X_i = -2, -1, 0.2, 1$; $X^* = -0.5$.

18.
$$y = \sqrt{x} + x$$
, a) $X_i = 0, 1.7, 3.4, 5.1$; 6) $X_i = 0, 1.7, 4.0, 5.1$; $X^* = 3.0$.

19.
$$y = \arcsin(x) + x$$
, a) $X_i = -0.4, -0.1, 0.2, 0.5$; 6) $X_i = -0.4, 0, 0.2, 0.5$; $X^* = 0.1$.

20.
$$y = \arccos(x) + x$$
, a) $X_i = -0.4, -0.1, 0.2, 0.5$; 6) $X_i = -0.4, 0, 0.2, 0.5$; $X^* = 0.1$.

21.
$$y = arctg(x) + x$$
, a) $X_i = -3, -1, 1, 3$; 6) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

6)
$$X_i = -3, 0, 1, 3$$

$$X^* = -0.5$$
.

22.
$$y = arcctg(x) + x$$
, a) $X_i = -3, -1, 1, 3$; 6) $X_i = -3, 0, 1, 3$; $X^* = -0.5$.

6)
$$X_i = -3, 0, 1, 3$$
;

$$X^* = -0.5$$

23.
$$y = \frac{1}{x}$$
, a) $X_i = 0.1, 0.5, 0.9, 1.3$; b) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

6)
$$X_i = 0.1, 0.5, 1.1, 1.3;$$

$$X^* = 0.8.$$

24.
$$y = \frac{1}{r^2}$$
, a) $X_i = 0.1, 0.5, 0.9, 1.3$; 6) $X_i = 0.1, 0.5, 1.1, 1.3$;

6)
$$X_i = 0.1, 0.5, 1.1, 1.3;$$

$$X^* = 0.8$$
.

25.
$$y = \frac{1}{x} + x$$
,

a)
$$X_i = 0.1, 0.5, 0.9, 1.3$$
;

25.
$$y = \frac{1}{x} + x$$
, a) $X_i = 0.1, 0.5, 0.9, 1.3$; 6) $X_i = 0.1, 0.5, 1.1, 1.3$; $X^* = 0.8$.

$$X^* = 0.8$$

26.
$$y = \frac{1}{x^2} + x^2$$
, a) $X_i = 0.1, 0.5, 0.9, 1.3$; 6) $X_i = 0.1, 0.5, 1.1, 1.3$;

$$X^* = 0.8$$
.

27.
$$y = x \sin(x)$$
, a) $X_i = 0$, $\frac{\pi}{6}$, $\frac{2\pi}{6}$, $\frac{3\pi}{6}$; 6) $X_i = 0$, $\frac{\pi}{6}$, $\frac{5\pi}{12}$, $\frac{\pi}{2}$;

$$X^* = \frac{\pi}{4}.$$

28.
$$y = x\cos(x)$$
, a) $X_i = 0$, $\frac{\pi}{6}$, $\frac{2\pi}{6}$, $\frac{3\pi}{6}$; 6) $X_i = 0$, $\frac{\pi}{6}$, $\frac{5\pi}{12}$, $\frac{\pi}{2}$;

$$X^* = \frac{\pi}{4}.$$

29.
$$y = xe^x$$
, a) $X_i = -2, -1, 0, 1$;

6)
$$X_i = -2, -1, 0.2, 1;$$
 $X^* = -0.5.$

$$X^* = -0.5$$

30.
$$y = x^2 e^x$$
, a) $X_i = -1.2, -0.7, -0.2, 0.3$; 6) $X_i = -1.2, -0.7, -0, 0.3$; $X^* = -0.5$.

$$X^* = -0.5.$$