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)  $X_i = 0.1\pi$ ,  $0.2\pi$ ,  $0.3\pi$ ,  $0.4\pi$ ; 6)  $X_i = 0.1\pi$ ,  $\frac{\pi}{6}$ ,  $0.3\pi$ ,  $0.4\pi$ ;  $X^* = \frac{\pi}{4}$ .

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)  $X_i = -1.2, -0.7, -0, 0.3$ ;  $X^* = -0.5$ .

$$X^* = -0.5$$