4 *MUSTAQIL UY ISHI*

1. Qatorning yig'indisini toping.
2.- 6. Qatorni yaqinlashishga tekshiring.
7. Qator yig'indisini α aniqlikda hisoblang.
8. Qatorning yaqinlashish sohasini toping.
9. Qatorning yig'indisini toping.
10. Funksiyani x ning darajalari bo'yicha Teylor qatoriga yoying.

1-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+15n+56}$.

2. $\sum_{n=1}^{\infty}\frac{1}{(2n-1)2^{2n-1}}$.

3. $\sum_{n=1}^{\infty}\frac{1}{n3^{2n}}$.

4. $\sum_{n=1}^{\infty}\frac{1}{\ln^n(n+1)}$.

5. $\sum_{n=1}^{\infty}\frac{1}{n\ln^2 3n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{n}{3^n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n!}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{x^n}{n\cdot 3^n}$.

9. $\sum_{n=2}^{\infty}(n+1)x^{n-2}$.

10. $\frac{3}{2-x-x^2}$.

2-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+19n+90}$.

2. $\sum_{n=1}^{\infty}\sin\frac{\pi}{2^n}$.

3. $\sum_{n=1}^{\infty}\frac{1}{(2n+1)!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n}{2n+1}\right)^n$.

5. $\sum_{n=2}^{\infty}\frac{1}{(n+2)\ln^2 n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{(n+1)}{\sqrt{n^3}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(3n)!}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{3^n x^n}{\sqrt[3]{n}}$.

9. $\sum_{n=3}^{\infty}(n+4)x^{n-3}$.

10. $\ln(1-x-6x^2)$.

3-variant

1. $\sum_{n=1}^{\infty}\frac{3}{9n^2-3n-2}$.

2. $\sum_{n=1}^{\infty}\frac{n+1}{n^2+1}$.

3. $\sum_{n=1}^{\infty}\frac{2^n(n+2)!}{n^5}$.

4. $\sum_{n=1}^{\infty}\left(\arcsin\frac{1}{n}\right)^n$.

5. $\sum_{n=1}^{\infty}\frac{1}{(n-1)\ln n}$.

6. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{n\cdot 4^n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{3n^2}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{(x-3)^n}{n!}$.

9. $\sum_{n=0}^{\infty}n(2n+1)x^{n+2}$.

10. $x^2\sqrt{4-3x}$.

4-variant

1. $\sum_{n=1}^{\infty}\frac{6}{4n^2-9}$.

2. $\sum_{n=1}^{\infty}\frac{1}{n^2-4n+5}$.

3. $\sum_{n=1}^{\infty}\frac{n^n}{(n+1)!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n+2}{2n}\right)^{3n}$.

5. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[4]{(4n+3)^3}}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{1}{n\ln n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{n^3}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}(3+x)^n$.

9. $\sum_{n=0}^{\infty}(2n^2-n-2)x^{n+1}$.

10. $\frac{sh2x-2x}{x}$.

5-variant

1. $\sum_{n=1}^{\infty}\frac{5^n-2^n}{10^n}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt{n^2+2n}}$.

3. $\sum_{n=1}^{\infty}\frac{n+4}{n!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n}{4n+1}\right)^{2n}$.

5. $\sum_{n=1}^{\infty}\left(\frac{3+n}{9+n^2}\right)^2$.

6. $\sum_{n=1}^{\infty}(-1)^n\left(\frac{2n}{2n+1}\right)^n$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(2n)!}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{(x+6)^n}{n^2}$.

9. $\sum_{n=3}^{\infty}(n+3)x^{n-2}$.

10. $(x-1)\sin 5x$.

6-variant

1. $\sum_{n=1}^{\infty}\frac{3^n+4^n}{12^n}$.

2. $\sum_{n=1}^{\infty}\left(\frac{1+n}{1+n^3}\right)^2$.

3. $\sum_{n=1}^{\infty}\frac{2^n}{n!}$.

4. $\sum_{n=1}^{\infty}\left(\arcsin\frac{1}{3^n}\right)^n$.

5. $\sum_{n=2}^{\infty}\frac{1}{(n+2)\ln^2 n}$.

6. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{(n+1)!}$.

7. $\sum_{n=1}^{\infty}\left(-\frac{2}{5}\right)^n$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{(x-3)^n}{n!}$.

9. $\sum_{n=0}^{\infty}(n+5)x^{n-1}$.

10. $\frac{sh3x-1}{x^2}$.

7-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+6n+5}$.

2. $\sum_{n=1}^{\infty}(n+1)tg\frac{\pi}{3^n}$.

3. $\sum_{n=1}^{\infty}\frac{3^n}{2^n(2n+1)}$.

4. $\sum_{n=1}^{\infty}\left(\sin\frac{\pi}{n^2}\right)^{2n}$.

5. $\sum_{n=1}^{\infty}\frac{1}{(n+1)\ln^2(n+1)}$.

6. $\sum_{n=1}^{\infty}(-1)^n\ln\left(1+\frac{1}{n}\right)$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{3^n n!}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{(x-1)^n}{n\cdot 9^n}$.

9. $\sum_{n=0}^{\infty}(2n^2+5n+3)x^{n+1}$.

10. $\frac{9}{20-x-x^2}$.

8-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+n-12}$.

2. $\sum_{n=1}^{\infty}\frac{2n-1}{2n^2+1}$.

3. $\sum_{n=1}^{\infty}\frac{(2n+1)!}{2^n(n!)}$.

4. $\sum_{n=1}^{\infty}\left(\frac{3n-1}{3n}\right)^{n^2}$.

5. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[3]{(3n-2)^4}}$.

6. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{(n+1)^{\frac{3}{2}}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(2n+1)!n!}$, $\alpha=0{,}0001$.

8. $\sum_{n=1}^{\infty}\frac{(x-2)^n}{(3n+1)2^n}$.

9. $\sum_{n=0}^{\infty}(2n^2-n-1)x^n$.

10. $\frac{\sin 2x}{x}-\cos 2x$.

9-variant

1. $\sum_{n=1}^{\infty}\frac{1}{9n^2+3n-2}$.

2. $\sum_{n=1}^{\infty}\left(1-\cos\frac{\pi}{n}\right)$.

3. $\sum_{n=1}^{\infty}\frac{2n+1}{\sqrt{n\cdot 3^n}}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n+3}{3n-1}\right)^{n^2}$.

5. $\sum_{n=2}^{\infty}\frac{1}{(2n-1)\ln 2n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{\sin\sqrt{n}}{n\sqrt{n}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(2n)!n!}$, $\alpha=0{,}00001$.

8. $\sum_{n=1}^{\infty}(x+5)^n tg\frac{1}{3^n}$.

9. $\sum_{n=1}^{\infty}(n+3)x^{n-1}$.

10. $(3+e^{-x})^2$.

10-variant

1. $\sum_{n=1}^{\infty}\frac{7^n-3^n}{21^n}$.

2. $\sum_{n=1}^{\infty}\frac{1}{n^2-\cos^2 n}$.

3. $\sum_{n=1}^{\infty}\frac{n+4}{n!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{2n+1}{3n+1}\right)^{\frac{n}{2}}$.

5. $\sum_{n=1}^{\infty}\frac{1}{(3n+1)\ln^2 n}$.

6. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{2^n(n+1)}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(2n+1)!}$, $\alpha=0{,}0001$.

8. $\sum_{n=1}^{\infty}(2-x)^n\sin\frac{\pi}{2^n}$.

9. $\sum_{n=2}^{\infty}(n+4)x^{n-2}$.

10. $\sqrt[4]{16-5x}$.

11-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+9n+20}$.

2. $\sum_{n=1}^{\infty}\frac{n}{n^2\sqrt[3]{n+5}}$.

3. $\sum_{n=1}^{\infty}\frac{n}{2^n}$.

4. $\sum_{n=1}^{\infty}\left(tg\frac{\pi}{2n+1}\right)^n$.

5. $\sum_{n=1}^{\infty}\frac{1}{(2n+1)\ln^2 2n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{1}{\sqrt{5n-1}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{n^n n!}$, $\alpha=0{,}0001$.

8. $\sum_{n=1}^{\infty}\frac{n!}{n^n}x^n$.

9. $\sum_{n=0}^{\infty}(n^2+5n+3)x^n$.

10. $\frac{7}{12+x-x^2}$.

12-variant

1. $\sum_{n=1}^{\infty}\frac{12}{36n^2+12n-35}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[3]{n+1}}\sin\frac{1}{\sqrt{n}}$.

3. $\sum_{n=1}^{\infty}\frac{n!}{n^n}$.

4. $\sum_{n=1}^{\infty}3^n\left(\frac{n}{n+1}\right)^{n^2}$.

5. $\sum_{n=1}^{\infty}\frac{1}{n\ln 5n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{1}{n\sqrt[3]{n}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{(2n)^3}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{(x-1)^{2n}}{(2n-1)}$.

9. $\sum_{n=0}^{\infty}(n^2-2n-1)x^{n+2}$.

10. $(x-1)shx$.

13-variant

1. $\sum_{n=1}^{\infty}\frac{9^n-2^n}{18^n}$.

2. $\sum_{n=1}^{\infty}n\left(e^{\frac{1}{n}}-1\right)^2$.

3. $\sum_{n=1}^{\infty}\frac{(n!)^2}{(2n)!}$.

4. $\sum_{n=1}^{\infty}\left(arctg\frac{1}{3n+1}\right)^n$.

5. $\sum_{n=1}^{\infty}\frac{4+n}{16+n^2}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{5n+1}{7n-2}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{2+n^3}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{3^n x^n}{n!}$.

9. $\sum_{n=3}^{\infty}(n+1)x^{n-3}$.

10. $\frac{x^2}{\sqrt{4-5x}}$.

14-variant

1. $\sum_{n=2}^{\infty}\frac{1}{n^2+n-2}$.

2. $\sum_{n=1}^{\infty}n\sin\frac{1}{\sqrt{n^3}}$;

3. $\sum_{n=1}^{\infty}\frac{n^2+3}{(n+1)!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n+1}{n}\right)^{n^2}\cdot\frac{1}{3^n}$.

5. $\sum_{n=2}^{\infty}\frac{1}{(2n-1)\ln(2n-1)}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{n+4}{3^n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n n}{2^n}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{n!}{(n+1)^n}x^n$.

9. $\sum_{n=0}^{\infty}(n^2+n+1)x^{n+3}$.

10. $\frac{arctgx}{x}$.

15-variant

1. $\sum\limits_{n=1}^{\infty}\frac{6}{9n^2+12n-5}$.

2. $\sum\limits_{n=1}^{\infty}\ln\frac{n^2+4}{n^2+3}$.

3. $\sum\limits_{n=1}^{\infty}\frac{1\cdot 4\cdot 7\cdot\ldots\cdot(3n-2)}{7\cdot 9\cdot 11\cdot\ldots\cdot(2n+5)}$.

4. $\sum\limits_{n=1}^{\infty}\left(\frac{n+1}{n}\right)^n\frac{1}{5^n}$.

5. $\sum\limits_{n=1}^{\infty}\frac{1}{(n+5)\ln^2(n+4)}$.

6. $\sum\limits_{n=1}^{\infty}(-1)^n\frac{1}{\ln(n+2)}$.

7. $\sum\limits_{n=1}^{\infty}\frac{(-1)^n(2n+1)}{n^3(n+1)}$, $\alpha=0{,}01$.

8. $\sum\limits_{n=1}^{\infty}\frac{3^n n!}{n^n}x^n$.

9. $\sum\limits_{n=3}^{\infty}(n+2)x^{n-3}$.

10. $\frac{x}{\sqrt[3]{27-2x}}$.

16-variant

1. $\sum\limits_{n=1}^{\infty}\frac{8^n-3^n}{24^n}$.

2. $\sum\limits_{n=1}^{\infty}\left(e^{\frac{\sqrt{n}}{n^2-1}}-1\right)^2$.

3. $\sum\limits_{n=1}^{\infty}\frac{3^n(n^2-1)}{n!}$.

4. $\sum\limits_{n=1}^{\infty}2^n\left(\frac{n}{n+1}\right)^n$.

5. $\sum\limits_{n=1}^{\infty}\frac{1}{\sqrt[6]{(3n+2)^7}}$.

6. $\sum\limits_{n=1}^{\infty}(-1)^n\frac{1}{(2n-1)^3}$.

7. $\sum\limits_{n=1}^{\infty}\frac{(-1)^n}{(2n-1)^3(2n+1)^2}$, $\alpha=0{,}001$.

8. $\sum\limits_{n=1}^{\infty}\frac{(x-1)^n}{2^n(n+4)}$.

9. $\sum\limits_{n=0}^{\infty}(n^2+2n+2)x^{n+2}$.

10. $\frac{6}{8+2x-x^2}$.

17-variant

1. $\sum\limits_{n=1}^{\infty}\frac{1}{n^2+4n+3}$.

2. $\sum\limits_{n=1}^{\infty}\arcsin\frac{n+1}{n^3-2}$.

3. $\sum\limits_{n=1}^{\infty}\frac{3n+1}{\sqrt{n3^n}}$.

4. $\sum\limits_{n=1}^{\infty}\left(\frac{n+1}{n}\right)^{n^2}\frac{1}{2^n}$.

5. $\sum\limits_{n=2}^{\infty}\frac{1}{(3n-1)\ln n}$.

6. $\sum\limits_{n=1}^{\infty}(-1)^{n+1}\frac{1}{n\ln^2 n}$.

7. $\sum\limits_{n=1}^{\infty}\frac{(-1)^{n+1}}{n(n^2+1)}$, $\alpha=0{,}001$.

8. $\sum\limits_{n=1}^{\infty}\frac{(x+2)^n}{\sqrt[3]{n^2+1}\sqrt{n+1}}$.

9. $\sum\limits_{n=2}^{\infty}(n+5)x^{n-2}$.

10. $(x-1)chx$.

18-variant

1. $\sum_{n=1}^{\infty}\frac{1}{16n^2-8n-15}$.

2. $\sum_{n=1}^{\infty}\frac{1}{n^2-\ln n}$.

3. $\sum_{n=1}^{\infty}\frac{(3n+2)!}{10^n n^2}$.

4. $\sum_{n=1}^{\infty}\left(\frac{2n^2+1}{n^2+1}\right)^{n^2}$.

5. $\sum_{n=2}^{\infty}\frac{1}{(n+2)\ln^2 n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{n-3}{n^2-1}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{(n^3+1)^2}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{(x-3)^n}{(2n-1)3^n}$.

9. $\sum_{n=0}^{\infty}(2n^2+7n+5)x^{n+1}$.

10. $\ln(1-x-12x^2)$.

19-variant

1. $\sum_{n=1}^{\infty}\frac{1}{4n^2+8n+3}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[3]{n}}\,arctg\frac{\pi}{4\sqrt{n}}$.

3. $\sum_{n=1}^{\infty}\frac{3\cdot5\cdot7\cdot\ldots\cdot(2n+1)}{2\cdot5\cdot8\cdot\ldots\cdot(3n-1)}$.

4. $\sum_{n=1}^{\infty}\left(\frac{n^2+2}{2n^2+1}\right)^{n^2}$.

5. $\sum_{n=2}^{\infty}\frac{1}{(n+3)\ln^2 2n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\left(\frac{4n}{5n+1}\right)^n$.

7. $\sum_{n=1}^{\infty}\left(-\frac{2}{3}\right)^n$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{(x+1)^n}{5^n}$.

9. $\sum_{n=1}^{\infty}(n+4)x^{n-1}$.

10. $2x\sin^2\left(\frac{x}{2}\right)-x$.

20-variant

1. $\sum_{n=1}^{\infty}\frac{7^n-2^n}{14^n}$.

2. $\sum_{n=1}^{\infty}\frac{\sin\frac{2\pi}{3n-1}}{\sqrt[3]{n}}$.

3. $\sum_{n=1}^{\infty}\frac{n^n}{(n+2)!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{3n-2}{4n+3}\right)^{n^2}$.

5. $\sum_{n=2}^{\infty}\frac{1}{n\ln^3 2n}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{3^n}{2n+2}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n n}{7^n}$, $\alpha=0{,}0001$.

8. $\sum_{n=1}^{\infty}\left(\frac{nx}{3}\right)^n$.

9. $\sum_{n=0}^{\infty}(n^2-2n-2)x^{n+1}$.

10. $\ln(1-x-20x^2)$.

21-variant

1. $\sum_{n=1}^{\infty}\frac{1}{4n^2+4n-3}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[3]{n}}\sin\frac{1}{n}$.

3. $\sum_{n=1}^{\infty}\left(\frac{9}{10}\right)^n n^6$.

4. $\sum_{n=1}^{\infty}2^n\left(\frac{n}{n+1}\right)^{n^2}$.

5. $\sum_{n=1}^{\infty}\left(\frac{2+n}{4+n^2}\right)^2$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{1}{(3n+1)^n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{(2n)!2n}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{n^2(x-2)^n}{n+1}$.

9. $\sum_{n=0}^{\infty}(n^2+7n+4)x^n$.

10. $\frac{5}{6+x-x^2}$.

22-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+13n+42}$.

2. $\sum_{n=1}^{\infty}\frac{1}{n-1}arctg\frac{\pi}{\sqrt[3]{n-1}}$.

3. $\sum_{n=1}^{\infty}\left(\frac{4}{5}\right)^n\cdot\left(\frac{1}{n}\right)^5$.

4. $\sum_{n=1}^{\infty}4^n\left(\frac{n-1}{n}\right)^{n^2}$.

5. $\sum_{n=1}^{\infty}\frac{1}{\sqrt{(5n-4)^3}}$.

6. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{1}{(2n-1)!}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n}{2^n n!}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{2^n(x+1)^n}{n(n+2)}$.

9. $\sum_{n=0}^{\infty}(n+2)x^{n-1}$.

10. $\ln(1+x-12x^2)$.

23-variant

1. $\sum_{n=1}^{\infty}\frac{1}{9n^2+21n-8}$.

2. $\sum_{n=1}^{\infty}\frac{1}{2^{n-1}+n-1}$.

3. $\sum_{n=1}^{\infty}\frac{1\cdot5\cdot9\cdot\ldots\cdot(4n-3)}{1\cdot4\cdot7\cdot\ldots\cdot(3n-2)}$.

4. $\sum_{n=1}^{\infty}2^{n-1}e^{-n}$.

5. $\sum_{n=3}^{\infty}\frac{1}{n\ln(n-1)}$.

6. $\sum_{n=1}^{\infty}(-1)^n\left(\frac{2n+1}{2n}\right)^n$.

7. $\sum_{n=0}^{\infty}\frac{(-1)^n n}{4^n(2n+1)}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\left(\frac{x+4}{n+5}\right)^n x^n$.

9. $\sum_{n=0}^{\infty}(n^2+6n+5)x^{n+1}$.

10. $(2-e^x)^2$.

24-variant

1. $\sum_{n=1}^{\infty}\frac{4^n-3^n}{12^n}$.

2. $\sum_{n=1}^{\infty}n^3\operatorname{tg}\frac{5\pi}{n}$.

3. $(2n+1)\sin\frac{\pi}{3^n}$.

4. $\sum_{n=1}^{\infty}\left(\frac{3n^2-1}{4n^2+2n+1}\right)^n$.

5. $\sum_{n=1}^{\infty}\frac{1}{n\ln^2(2n+1)}$.

6. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{n+1}{n}$.

7. $\sum_{n=0}^{\infty}\frac{(-1)^n 2^n}{(n+1)^n}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{(2x-3)^{3n}}{8^n}$.

9. $\sum_{n=0}^{\infty}(n^2-n+1)x^n$.

10. $\ln(1+x-6x^2)$.

25-variant

1. $\sum_{n=1}^{\infty}\frac{1}{4n^2+8n+3}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt{n+3}}\left(e^{\frac{1}{\sqrt{n}}}-1\right)$.

3. $\sum_{n=1}^{\infty}\frac{(n+1)^{\frac{n}{2}}}{n!}$.

4. $\sum_{n=1}^{\infty}\frac{2^{n+1}}{n^n}$.

5. $\sum_{n=2}^{\infty}\frac{1}{2\ln(n^2-1)}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{n^3}{2^n}$.

7. $\sum_{n=0}^{\infty}\frac{(-1)^n n}{(n^3+1)^2}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{5^n}{n\sqrt{n}}x^n$.

9. $\sum_{n=1}^{\infty}(n+6)x^{n-1}$.

10. $\frac{1}{\sqrt[4]{16-3x}}$.

26-variant

1. $\sum_{n=1}^{\infty}\frac{1}{9n^2-12n-5}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt{n+1}}\sin\frac{1}{\sqrt{n+1}}$.

3. $\sum_{n=1}^{\infty}\frac{(n+1)^n}{n!}$.

4. $\sum_{n=1}^{\infty}\left(\frac{2n^2+n+1}{3n^2+n+1}\right)^n$.

5. $\sum_{n=5}^{\infty}\frac{1}{(n-2)\sqrt{\ln(n-3)}}$.

6. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{2n+1}{n(n+1)}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n n^2}{3^n}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\left(1+\frac{1}{n}\right)^n x^n$.

9. $\sum_{n=0}^{\infty}(2n^2-2n+1)x^n$.

10. $\frac{7}{12-x-x^2}$.

27-variant

1. $\sum_{n=1}^{\infty}\frac{1}{4n^2+16n+15}$.

2. $\sum_{n=1}^{\infty}\frac{n+1}{n\sqrt[3]{n}}$.

3. $\sum_{n=1}^{\infty}\frac{n!}{5^n(n+1)!}$.

4. $\sum_{n=1}^{\infty}\left(tg\frac{\pi}{5^n}\right)^{3n}$.

5. $\sum_{n=1}^{\infty}\left(\frac{1+n}{1+n^2}\right)^2$.

6. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{2^{n-1}}{(n-1)!}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n(2n+1)}{(2n)!n!}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{x^{3n}}{n^3}$.

9. $\sum_{n=0}^{\infty}(n^2+2n-1)x^{n+1}$.

10. $\ln(1+2x-8x^2)$.

28-variant

1. $\sum_{n=1}^{\infty}\frac{4^n+5^n}{20^n}$.

2. $\sum_{n=1}^{\infty}\frac{1}{\sqrt{n}}\arcsin\frac{n}{\sqrt{n^2+1}}$.

3. $\sum_{n=1}^{\infty}\frac{n^{\frac{n}{2}}}{4^n}$.

4. $\sum_{n=1}^{\infty}\frac{n^n}{(2n^2+1)^{\frac{n}{2}}}$.

5. $\sum_{n=1}^{\infty}\frac{1}{(n+1)\ln^3(n+1)}$.

6. $\sum_{n=1}^{\infty}(-1)^n\frac{n}{3n^2+1}$.

7. $\sum_{n=0}^{\infty}\frac{(-1)^n}{(n+1)^n}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{(x-1)^n}{2^n(n+4)}$.

9. $\sum_{n=2}^{\infty}nx^{n-2}$.

10. $\frac{x}{\sqrt[3]{8-x}}$.

29-variant

1. $\sum_{n=1}^{\infty}\frac{1}{n^2+7n+12}$.

2. $\sum_{n=1}^{\infty}\frac{n^2+2}{n^3+2}$.

3. $\sum_{n=1}^{\infty}\frac{1\cdot 7\cdot 13\cdot\ldots\cdot(6n-5)}{2\cdot 3\cdot 4\cdot\ldots\cdot(n+1)}$.

4. $\sum_{n=1}^{\infty}\left(\arcsin\frac{1}{3n}\right)^{2n}$.

5. $\sum_{n=1}^{\infty}\frac{1}{2n\sqrt{\ln(3n-1)}}$.

6. $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{\sqrt[3]{(n+1)^4}}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^n2}{n^2(n+3)}$, $\alpha=0{,}01$.

8. $\sum_{n=1}^{\infty}\frac{\sqrt{n}(x-3)^n}{n!}$.

9. $\sum_{n=2}^{\infty}(n+2)x^{n-2}$.

10. $\frac{5}{6-x-x^2}$.

30-variant

1. $\sum_{n=1}^{\infty}\frac{1}{4n^2+8n-5}$.

2. $\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{2\pi}{\sqrt{4n+3}}$.

3. $\sum_{n=1}^{\infty}\frac{(n+3)!}{n^n}$.

4. $\sum_{n=1}^{\infty}\frac{1}{3^n}\left(\frac{5n+1}{5n}\right)^{n^2}$.

5. $\sum_{n=1}^{\infty}\frac{1}{\sqrt[4]{(3n+13)^5}}$.

6. $\sum_{n=1}^{\infty}(-1)^{n-1}\frac{n+5}{3^n}$.

7. $\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{3^n(n+1)}$, $\alpha=0{,}001$.

8. $\sum_{n=1}^{\infty}\frac{3^n(x-1)^n}{\sqrt[3]{n}}$.

9. $\sum_{n=0}^{\infty}(2n^2+n+1)x^{n+1}$.

10. $\frac{\arcsin x - x}{x}$.

NAMUNAVIY VARIANT YECHIMI

1. Qatorning yig'indisini toping:

1.30. $\sum_{n=1}^{\infty}\frac{1}{4n^2+8n-5}$.

Qatorning umumiy hadini sodda kasrlar yig'indisiga keltiramiz:

$$a_n=\frac{1}{4n^2+8n-5}=\frac{1}{(2n-1)(2n+5)}=\frac{1}{6}\left(\frac{1}{2n-1}-\frac{1}{2n+5}\right)$$

Bundan

$$a_1=\frac{1}{6}\left(1-\frac{1}{7}\right),\quad a_2=\frac{1}{6}\left(\frac{1}{3}-\frac{1}{9}\right),\quad a_3=\frac{1}{6}\left(\frac{1}{5}-\frac{1}{11}\right),\quad a_4=\frac{1}{6}\left(\frac{1}{7}-\frac{1}{13}\right),\dots$$

U holda

$$S_n=\frac{1}{6}\left(1-\frac{1}{7}\right)+\frac{1}{6}\left(\frac{1}{3}-\frac{1}{9}\right)+\frac{1}{6}\left(\frac{1}{5}-\frac{1}{11}\right)+\frac{1}{6}\left(\frac{1}{7}-\frac{1}{13}\right)+\dots+\frac{1}{6}\left(\frac{1}{2n-1}-\frac{1}{2n+5}\right)=$$

$$=\frac{1}{6}\left(1-\frac{1}{7}+\frac{1}{3}-\frac{1}{9}+\frac{1}{5}-\frac{1}{11}+\frac{1}{7}-\frac{1}{13}+\dots+\frac{1}{2n-1}+\frac{1}{2n+5}\right)=$$

$$=\frac{1}{6}\left(1+\frac{1}{3}+\frac{1}{5}-\frac{1}{2n+1}-\frac{1}{2n+3}-\frac{1}{2n+5}\right).$$

Bundan

$$\lim_{n\to\infty}S_n=\lim_{n\to\infty}\frac{1}{6}\left(1+\frac{1}{3}+\frac{1}{5}-\frac{1}{2n+1}-\frac{1}{2n+3}-\frac{1}{2n+5}\right)=\frac{23}{90}.$$

Demak, qator yaqinlashadi va uning yig'indisi $\frac{23}{90}$ ga teng.

2. Qatorni yaqinlashishga tekshiring:

2.30. $\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{2\pi}{\sqrt{4n+3}}$.

Qatorni yaqinlashishga taqqoslashning limit alomati bilan tekshiramiz. Etalon qator sifatida umumiy hadi $b_n=\frac{\pi}{n\sqrt{n}}$ bo'lgan yaqinlashuvchi qatorni olamiz.

Berilgan va etalon qatorlar hadlari nisbatlarining limitini topamiz:

$$\lim_{n\to\infty}\frac{a_n}{b_n}=\lim_{n\to\infty}\frac{\frac{1}{n}\sin\frac{2\pi}{\sqrt{4n+3}}}{\frac{\pi}{n\sqrt{n}}}=\lim_{n\to\infty}\frac{\sqrt{n}}{\pi}\cdot\sin\frac{2\pi}{\sqrt{4n+3}}=$$

$$=\lim_{n\to\infty}\frac{\sqrt{n}}{\pi}\cdot\frac{2\pi}{\sqrt{4n+3}}\cdot\frac{\sin\frac{2\pi}{\sqrt{4n+3}}}{\frac{2\pi}{\sqrt{4n+3}}}=\lim_{n\to\infty}\frac{2\sqrt{n}}{\sqrt{4n+3}}=1.$$

Demak, taqqoslashning limit alomatiga ko'ra berilgan qator yaqinlashadi.

3. Qatorni yaqinlashishga tekshiring:

3.30. $\sum_{n=1}^{\infty}\frac{(n+3)!}{n^n}$.

Berilgan qatorda $a_n=\frac{(n+3)!}{n^n}$, $a_{n+1}=\frac{(n+4)!}{(n+1)^{n+1}}$. U holda

$$\lim_{n\to\infty}\frac{a_{n+1}}{a_n}=\lim_{n\to\infty}\frac{(n+4)!\cdot n^n}{(n+1)^{n+1}\cdot(n+3)!}=\lim_{n\to\infty}\left(\frac{n+4}{n+1}\right)\cdot\left(\frac{n}{n+1}\right)^n=\lim_{n\to\infty}\frac{1}{\left(1+\frac{1}{n}\right)^n}=\frac{1}{e}<1.$$

Demak, Dalamber alomatiga ko'ra qator yaqinlashadi.

4. Qatorni yaqinlashishga tekshiring:

4.30. $\sum_{n=1}^{\infty}\frac{1}{3^n}\left(\frac{5n+1}{5n}\right)^{n^2}$.

Qatorni yaqinlashishga Koshining ildiz alomati bilan tekshiramiz:

$$\lim_{n\to\infty}\sqrt[n]{a_n}=\lim_{n\to\infty}\sqrt[n]{\frac{1}{3^n}\left(\frac{5n+1}{5n}\right)^{n^2}}=\lim_{n\to\infty}\frac{1}{3}\left(\frac{5n+1}{5n}\right)^n=\frac{1}{3}\lim_{n\to\infty}\left[\left(1+\frac{1}{5n}\right)^{5n}\right]^{\frac{1}{5}}=\frac{\sqrt[5]{e}}{3}<1.$$

Demak, qator yaqinlashadi.

5. Qatorni yaqinlashishga tekshiring:

5.30. $\sum\limits_{n=1}^{\infty}\frac{1}{\sqrt[4]{(3n+13)^5}}$.

Qatorni yaqinlashishga Koshining integral alomati bilan tekshiramiz:

$$\int\limits_1^{+\infty}\frac{dx}{\sqrt[4]{(3x+13)^5}}=\lim_{n\to+\infty}\int\limits_1^b\frac{dx}{\sqrt[4]{(3x+13)^5}}=-\frac{4}{3}\lim_{n\to+\infty}\frac{1}{\sqrt[4]{3x+13}}\Bigg|_1^b=$$

$$=-\frac{4}{3}\left(\lim_{n\to\infty}\frac{1}{\sqrt[4]{4b+13}}-\frac{1}{\sqrt[4]{16}}\right)=\frac{2}{3}.$$

Xosmas integral yaqinlashadi.

Demak, Koshining integral alomatiga ko‘ra berilgan qator yaqinlashadi.

6. Qatorni yaqinlashishga tekshiring:

6.30. $\sum\limits_{n=1}^{\infty}(-1)^{n-1}\frac{n+5}{3^n}$.

Qatorning yoyilmasini yozamiz:

$$\sum_{n=1}^{\infty}(-1)^{n-1}\frac{n+5}{3^n}=\frac{6}{3}-\frac{7}{9}+\frac{8}{27}-\frac{9}{81}+\ldots+(-1)^{n-1}\frac{n+5}{3^n}+\ldots$$

Demak, qator ishora almashinuvchi. Bu qator hadlarining absolut qiymatlaridan tashkil topgan $\sum\limits_{n=1}^{\infty}\frac{n+5}{3^n}$ qatorni Dalamber alomati bilan yaqinlashishga tekshiramiz:

$$\lim_{n\to\infty}\frac{a_{n+1}}{a_n}=\lim_{n\to\infty}\frac{n+6}{3^{n+1}}\cdot\frac{3^n}{n+5}=\frac{1}{3}\lim_{n\to\infty}\frac{n+6}{n+5}=\frac{1}{3}<1.$$

$\sum\limits_{n=1}^{\infty}\frac{n+5}{3^n}$ qator yaqinlashadi.

Demak, berilgan qator absolut yaqinlashadi.

7. Qator yig‘indisini α aniqlikda hisoblang:

7.30. $\sum\limits_{n=1}^{\infty}\frac{(-1)^{n+1}}{3^n(n+1)}$, $\alpha=0{,}001$.

Qatorning yig‘indisi $S=S_n+R_n$ ga teng bo‘ladi, bu yerda R_n – qatorning n – qoldig‘i. Misolning shartiga ko‘ra $|R_n|\le 0{,}001$. Ishora almashinuvchi qatorlar uchun qatorning qoldig‘i moduli bo‘yicha birnchi tashlab yuboriladigan haddan kichik bo‘lishi kerak, ya’ni $|R_n|<a_{n+1}$.

Berilgan qator uchun $|R_n| < \dfrac{1}{3^{n+1}(n+2)} \leq 0{,}001$ tengsizlik bajarilishi kerak. Bu tengsizlik $n=4$ da bajariladi. Demak, qatorning yig'indisini topish uchun birinchi to'rtta hadni olish yetarli bo'ladi:

$$\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{3^n(n+1)} \approx \frac{1}{3\cdot 2}-\frac{1}{9\cdot 3}+\frac{1}{27\cdot 4}-\frac{1}{81\cdot 5}=0{,}137.$$

8. Qatorning yaqinlashish sohasini toping:

8.30. $\sum\limits_{n=1}^{\infty}\dfrac{3^n(x-1)^n}{\sqrt[3]{n}}$.

Qatorning yaqinlashish radiusini topamiz. Berilgan qator uchun

$$a_n=\frac{3^n}{\sqrt[3]{n}},\ a_{n+1}=\frac{3^{n+1}}{\sqrt[3]{n+1}}.$$

Bundan

$$R=\lim_{n\to+\infty}\left|\frac{a_n}{a_{n+1}}\right|=\lim_{n\to+\infty}\frac{3^n\cdot\sqrt[3]{n+1}}{\sqrt[3]{n}\cdot 3^{n+1}}=\frac{1}{3}.$$

Demak, qator $\left(1-\dfrac{1}{3};1+\dfrac{1}{3}\right)$, ya'ni $\left(\dfrac{2}{3};\dfrac{4}{3}\right)$ oraliqda yaqinlashadi.

Intervalning chegaraviy nuqtalarida tekshiramiz.

$x=\dfrac{2}{3}$ da qator $\sum\limits_{n=1}^{\infty}\dfrac{(-1)^n}{\sqrt[3]{n}}$ ko'rinishni oladi. Leybnits alomatiga ko'ra

$$1)\ 1>\frac{1}{\sqrt[3]{2}}>\frac{1}{\sqrt[3]{3}}>...; \qquad 2)\ \lim_{n\to+\infty}\frac{1}{\sqrt[3]{n}}=0.$$

Demak, qator $x=\dfrac{2}{3}$ da yaqinlashadi.

$x=\dfrac{4}{3}$ da qator $\sum\limits_{n=1}^{\infty}\dfrac{1}{\sqrt[3]{n}}$ ko'rinishini oladi. Bu qator uzoqlashuvchi.

Shunday qilib, qatorning yaqinlashish sohasi $\left[\dfrac{2}{3};\dfrac{4}{3}\right)$ dan iborat.

9. Qatorning yig'indisini toping:

9.30. $\sum\limits_{n=0}^{\infty}(n^2+6n+5)x^{n+1}$.

Qatorni uchta qator yig'indisiga keltiramiz:

$$\sum_{n=0}^{\infty}(2n^2+n+1)x^{n+1}=2x\sum_{n=0}^{\infty}n^2x^n+x\sum_{n=0}^{\infty}nx^n+x\sum_{n=0}^{\infty}x^n.$$

Har bir qatorning yig'indisini alohida hisoblaymiz:

$$\sum_{n=0}^{\infty}x^n=\frac{1}{1-x},\ |x|<1;$$

$$\sum_{n=0}^{\infty} nx^n = x\sum_{n=0}^{\infty} nx^{n-1} = x\sum_{n=0}^{\infty}\frac{d}{dx}(x^n) = x\frac{d}{dx}\left(\sum_{n=0}^{\infty}x^n\right) = x\frac{d}{dx}\left(\frac{1}{1-x}\right) = \frac{x}{(1-x)^2};$$

$$\sum_{n=0}^{\infty} n^2x^n = x\sum_{n=0}^{\infty} n^2x^{n-1} = x\sum_{n=0}^{\infty}\frac{d}{dx}(nx^n) = x\frac{d}{dx}\left(x\frac{d}{dx}\left(\sum_{n=0}^{\infty}x^n\right)\right) =$$

$$= x\frac{d}{dx}\left(x\frac{d}{dx}\left(\frac{1}{1-x}\right)\right) = x\frac{d}{dx}\left(\frac{x}{(1-x)^2}\right) = \frac{x(x+1)}{(1-x)^3}.$$

Bundan

$$\sum_{n=0}^{\infty}(2n^2+n+1)x^{n+1} = 2x\cdot\frac{x(x+1)}{(1-x)^3} + x\cdot\frac{x}{(1-x)^2} + x\cdot\frac{1}{1-x}$$

yoki

$$\sum_{n=0}^{\infty}(2n^2+n+1)x^{n+1} = \frac{2x^3+x^2+x}{(1-x)^3},\ |x|<1.$$

10. Funksiyani x ning darajalari bo‘yicha Teylor qatoriga yoying:

10.30. $\dfrac{\arcsin x - x}{x}$.

Avval $f(x)=\arcsin x$ funksiyaning qatorga yoyilmasini topamiz. Buning uchun

$$f'(x) = \frac{1}{\sqrt{1-x^2}} = (1-x^2)^{-\frac{1}{2}}$$

funksiyani qatorga yoyamiz. Bunda

$$(1+x)^{\alpha} = 1+\sum_{n=1}^{\infty}\frac{\alpha(\alpha-1)\cdots(\alpha-n+1)}{n!}x^n =$$

$$= 1+\alpha x+\frac{\alpha(\alpha-1)}{2!}x^2+\ldots+\frac{\alpha(\alpha-1)\cdots(\alpha-n+1)}{n!}x^n+\ldots, \qquad -1<x<1;$$

yoyilmadan foydalanamiz. U holda

$$f'(x) = (1-x^2)^{-\frac{1}{2}} = 1+\frac{1}{2}x^2+\frac{3}{4}\cdot\frac{1}{2!}x^4+\frac{15}{8}\cdot\frac{1}{3!}x^6+\ldots$$

bo‘ladi. Bundan

$$f(x) = \arcsin x = \int(1-x^2)^{-\frac{1}{2}}dx =$$

$$= x+\frac{1}{2\cdot 3}x^3+\frac{1\cdot 3}{2\cdot 4\cdot 5}x^5+\frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6\cdot 7}x^7+\ldots+\frac{1\cdot 3\cdot 5\cdot\ldots\cdot(2n-1)}{2\cdot 4\cdot 6\cdot\ldots\cdot(2n)\cdot(2n+1)}x^{2n+1}+\ldots$$

kelib chiqadi. Demak, berilgan qatorning Teylor qatoriga yoyilmasi

$$\frac{\arcsin x - x}{x} = \sum_{n=1}^{\infty}\frac{1\cdot 3\cdot 5\cdot\ldots\cdot(2n-1)}{2\cdot 4\cdot 6\cdot\ldots\cdot(2n)\cdot(2n+1)}x^{2n+1},\ |x|<1$$

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