1–40 ■ Test the series for convergence or divergence.

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

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

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

4. $\displaystyle\sum_{i=1}^{\infty} \frac{i^4}{4^i}$

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

6. $\displaystyle\sum_{n=1}^{\infty} n^2 e^{-n^3}$

7. $\displaystyle\sum_{k=1}^{\infty} k^{-1.7}$

8. $\displaystyle\sum_{n=0}^{\infty} \frac{10^n}{n!}$

9. $\displaystyle\sum_{n=1}^{\infty} \frac{n}{e^n}$

10. $\displaystyle\sum_{m=1}^{\infty} \frac{2m}{8m - 5}$

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

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

13. $\displaystyle\sum_{n=2}^{\infty} \frac{2}{n(\ln n)^3}$

14. $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{n}}{e^{\sqrt{n}}}$

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

16. $\displaystyle\sum_{n=1}^{\infty} \frac{3}{4n - 5}$

17. $\displaystyle\sum_{n=1}^{\infty} \frac{3^n}{5^n + n}$

18. $\displaystyle\sum_{k=1}^{\infty} \frac{k + 5}{5^k}$

19. $\displaystyle\sum_{n=0}^{\infty} \frac{n!}{2 \cdot 5 \cdot 8 \cdot \cdots \cdot (3n + 2)}$

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

21. $\displaystyle\sum_{i=1}^{\infty} \frac{1}{\sqrt{i(i + 1)}}$

22. $\displaystyle\sum_{n=1}^{\infty} \frac{n^2}{\sqrt{n^5 + n^2 + 2}}$

23. $\displaystyle\sum_{n=1}^{\infty} (-1)^n 2^{1/n}$

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

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

26. $\displaystyle\sum_{n=1}^{\infty} \frac{\tan(1/n)}{n}$

27. $\displaystyle\sum_{n=0}^{\infty} (-\pi)^n$

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

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

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

31. $\displaystyle\sum_{k=1}^{\infty} \frac{k \ln k}{(k + 1)^3}$

32. $\displaystyle\sum_{n=1}^{\infty} \frac{e^{1/n}}{n^2}$

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

34. $\displaystyle\sum_{j=1}^{\infty} (-1)^j \frac{\sqrt{j}}{j + 5}$

35. $\displaystyle\sum_{n=1}^{\infty} \frac{\tan^{-1} n}{n\sqrt{n}}$

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

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

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

39. $\displaystyle\sum_{n=1}^{\infty} (\sqrt[n]{2} - 1)^n$

40. $\displaystyle\sum_{n=1}^{\infty} (\sqrt[n]{2} - 1)$

1–32 ■ Determine whether the series is absolutely convergent, conditionally convergent, or divergent.

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

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

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

4. $\displaystyle\sum_{n=0}^{\infty} \frac{(-3)^n}{n!}$

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

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

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

8. $\displaystyle\sum_{n=1}^{\infty} e^{-n} n!$

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

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

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

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

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

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

15. $\displaystyle\sum_{n=1}^{\infty} \frac{(-2)^n}{n3^{n+1}}$

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

17. $\displaystyle\sum_{n=1}^{\infty} \frac{(n + 1)5^n}{n3^{2n}}$

18. $\displaystyle\sum_{n=1}^{\infty} \frac{\cos(n\pi/6)}{n\sqrt{n}}$

19. $\displaystyle\sum_{n=1}^{\infty} \frac{n!}{(-10)^n}$

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

21. $\displaystyle\sum_{n=1}^{\infty} \frac{\cos(n\pi/3)}{n!}$

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

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

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

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

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

ANSWERS

1. Conv. (Comp. w/ $1/n^{3/2}$)
2. Div. ($\lim_{n\to\infty} a_n \neq 0$)
3. Conv. (Comp. w/ G/S $(4/9)^n$)
4. Conv. (RATIO)
5. Conv. (A/S)
6. Conv. (INT.)
7. Conv. (P-test, $p > 1$)
8. Conv. (RATIO)
9. Conv. (INT. - BY PARTS)
10. Div. (Comp. w/ $1/4n$)
11. Div. (Comp. w/ $1/n$)
12. (Div - (ROOT))
13. Conv. (INT.)
14. Conv. (INT.)
15. Conv. (RATIO)
16. Div. (Comp. $1/4n$)
17. Conv. (Comp. w/ G/S $(3/5)^n$)
18. Conv. (Comp. w/ G/S $(2/5)^n$)
19. Conv. (RATIO)
20. Conv. (A/S)

21. Div. ($\lim$ Comp. w/ $1/i$)
22. Conv. (Comp w/ $1/n^{3/2}$)
23. Div. ($\lim_{n\to\infty} a_n \neq 0$)
24. Conv. (Comp. w/ $1/n^2$)
25. Conv (A/S)
26. Div (Comp w/ $1/n$)
27. Div. ($\lim_{n\to\infty} a_n \neq 0$)
28. Conv. (Comp w/ $1/n^{7/6}$
29. (Conv. (ROOT))
30. Div ($\lim_{n\to\infty} a_n \neq 0$)
31. Conv. (Comp w/ $1/k^{3/2}$)
32. Conv. ($\lim$ comp or Comp w/ $2/n^2$)
33. Conv. (RATIO)
34. Div. ($\lim_{n\to\infty} a_n \neq 0$)
35. Conv. (Comp w/ $4/n^{3/2}$)
36. (Div. (ROOT))
37. Div ($\lim_{n\to\infty} a_n \neq 0$)
38. (Conv. (ROOT))
39. (Conv. ROOT)