

AP Calculus BC

Infinite Series

Ratio and Root Test

Name _____

Use the Ratio Test to determine the convergence or divergence of the series.

1. $\sum_{n=0}^{\infty} \frac{n!}{3^n}$

Diverges

2. $\sum_{n=0}^{\infty} \frac{3^n}{n!}$

Converges

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

Converges

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

Diverges

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

Converges

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

Diverges

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

Ratio Test Inconclusive
Converges Conditionally

8. $\sum_{n=0}^{\infty} \frac{(-1)^n 2^n}{n!}$

Converges

9. $\sum_{n=1}^{\infty} \frac{n!}{n3^n}$

Diverges

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

Diverges

11. $\sum_{n=0}^{\infty} \frac{4^n}{n!}$

Converges

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

Diverges

13. $\sum_{n=0}^{\infty} \frac{3^n}{(n+1)^n}$

Converges

14. $\sum_{n=0}^{\infty} \frac{(n!)^2}{(3n)!}$

Converges

15. $\sum_{n=0}^{\infty} \frac{4^n}{3^n + 1}$

Diverges

16. $\sum_{n=0}^{\infty} \frac{(-1)^n 2^{4n}}{(2n+1)!}$

Converges

Verify that the Ratio Test is inconclusive for the series.

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

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

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

Use the Root Test to determine the convergence or divergence of the series.

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

Converges

$$21. \sum_{n=1}^{\infty} \left(\frac{2n}{n+1} \right)^n$$

Diverges

$$22. \sum_{n=2}^{\infty} \left(\frac{2n+1}{n-1} \right)^n$$

Diverges

$$23. \sum_{n=1}^{\infty} \left(\frac{4n+3}{2n-1} \right)^n$$

Diverges

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

Converges

$$25. \sum_{n=1}^{\infty} \left(\frac{-3n}{2n+1} \right)^{3n}$$

Diverges

$$26. \sum_{n=1}^{\infty} \left(2^{\sqrt{n}} + 1 \right)^n$$

Diverges

$$27. \sum_{n=0}^{\infty} e^{-n}$$

Converges

$$28. \sum_{n=1}^{\infty} \frac{n}{4^n}$$

Converges

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

Converges

$$30. \sum_{n=1}^{\infty} \left(\frac{\ln n}{n} \right)^n$$

Converges

$$31. \sum_{n=1}^{\infty} \frac{(n!)^n}{(n^n)^2}$$

Diverges