

Write your questions
and thoughts here!

 p -Series

Let p be a positive constant of the series $\sum_{n=1}^{\infty} \frac{1}{n^p} = \frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \dots$

The series converges if

The series diverges if

Harmonic Series

Do the following series converge or diverge?

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

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

For what values of k will the series converge?

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

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

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

Things we should now recognize**Series**

- Geometric
- Harmonic
- p -Series

Tests for convergence/divergence

- Nth Term Test for Divergence
- Integral Test

10.5 Harmonic Series and p -series

Practice

Calculus

Determine the convergence or divergence of the following p -series.

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

2. $\sum_{n=1}^{\infty} \frac{1}{n^{0.13}}$

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

What are all the values of p for which...

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

5. $\sum_{n=1}^{\infty} \frac{1}{n^{3p}}$ diverges?

6. Both series $\sum_{n=1}^{\infty} n^{-5p}$ and $\sum_{n=1}^{\infty} \left(\frac{p}{5}\right)^n$ converge?

7. $\int_1^{\infty} \frac{1}{x^{3p+4}} dx$ converges?

Find the positive values of p for which the infinite series converge?

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

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

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

10.5 Harmonic Series and p -series

11. Which of the following infinite series converge?

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

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

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

A. None

B. II only

C. III only

D. I and II only

E. II and III only

12. Which of the following infinite series converge?

I. $\sum_{n=1}^{\infty} 3^{-n}$

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

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

A. I only

B. II only

C. III only

D. I and II only

E. I and III only

13. Which of the following infinite series is a divergent p -series?

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

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

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

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

14. Which of the following is not a p -series?

A. $\sum_{n=1}^{\infty} n^{-3}$

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

C. $\sum_{n=1}^{25} \frac{1}{n^{\pi}}$

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

15. Which of the following is a harmonic series?

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

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

C. $\sum_{n=1}^{1000} \frac{1}{n}$

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

16. Find the positive values of k for which the series $\sum_{n=3}^{\infty} \frac{1}{(n \ln n)(\ln(\ln n))^k}$ converges.