10.5 Harmonic Series and p-series

Calculus

Solutions

Practice

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

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

P>1

Converges

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

1.
$$\sum_{n=1}^{\infty} n^{-\frac{3}{2}} = \frac{1}{\sqrt{3}}$$
 $\rho = \frac{3}{2}$ 2. $\sum_{n=1}^{\infty} \frac{1}{n^{0.13}}$ $\rho = 0.13$ 3. $\sum_{n=1}^{\infty} \frac{1}{n\sqrt{n}} = \frac{1}{\sqrt{3}}$ $\rho = \frac{3}{2}$

converges

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

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

$$\frac{\nu}{\nu},\frac{(v_{-1}+\frac{\nu}{2})}{2}$$

5. $\sum \frac{1}{n^{3p}}$ 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? P25 26 P 2 5

$$3p + 4 > 1$$

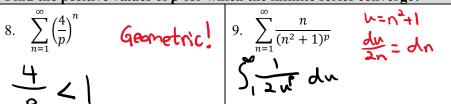
 $3p > -3$

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

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



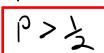
$$9. \sum_{n=1}^{\infty} \frac{n}{(n^2+1)^p}$$



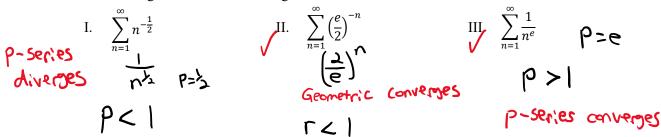


$$10. \sum_{n=1}^{\infty} \frac{1}{n^{2p}}$$





11. Which of the following infinite series converge?



- A. None
- D. I and II only

B. II only
E. II and III only

W=3741

C. III only

12. Which of the following infinite series converge?

I.
$$\sum_{n=1}^{\infty} \frac{1}{(3n+1)^3}$$
III.
$$\sum_{n=1}^{\infty} \frac{1}{\sqrt[3]{n}}$$
Converges

Converges

P-series

P-series

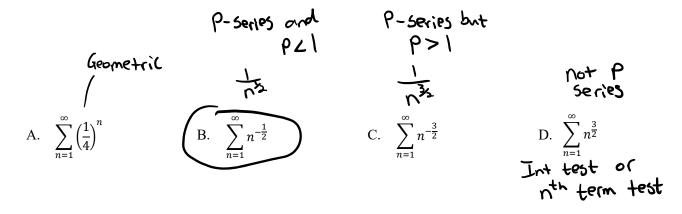
P>1 -> converges

A. I only
D. I and II only

- B. II only
- E. I and III only

C. III only

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

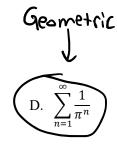


14. Which of the following is not a *p*-series?









15. Which of the following is a harmonic series?

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

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

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.

$$h = \ln(\ln n)$$
 $du = \frac{1}{\ln n} \cdot \frac{1}{n} dn$

nlnn.du = dn