What you'll Learn About
The Integral Test/P-Series Test/Comparison Test

Integral Test

converges because the area converges

$\sum_1 \frac{1}{n^2} = \cancel{\frac{1}{n(n+1)}}$

A) $\sum_{n=1}^{\infty} \frac{1}{n^2} = 1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \cdots$

$\lim_{b\to\infty} \int_1^b \frac{1}{x^2} = \lim_{b\to\infty} \int_1^b x^{-2} = \lim_{b\to\infty} \left[-x^{-1}\right]_1^b$

$= \lim_{b\to\infty} \left[-\frac{1}{x}\right]_1^b = \lim_{b\to\infty} \left[-\frac{1}{b} - (-1)\right] = 1$

Area Converges

Series Diverges b/c area diverges

HARMONIC SERIES

B) $\sum_{n=1}^{\infty} \frac{1}{n} = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \cdots$

$\lim_{n\to\infty} \frac{1}{n} = 0$ Do another Test

$\lim_{b\to\infty} \int_1^b \frac{1}{x}\,dx = \lim_{b\to\infty} \left[\ln x\right]_1^b = \lim_{b\to\infty} \left[\ln b - \ln 1\right] = \infty$

Area Diverges

$\boxed{\text{b/c Diverges area diverges}}$

C) $\sum_{n=1}^{\infty} \frac{1}{n^{1/3}}$

$\lim_{b\to\infty} \int_1^b x^{-1/3}\,dx = \lim_{b\to\infty} \left[\frac{3}{2}x^{2/3}\right]_1^b = \lim_{b\to\infty} \left[\frac{3}{2}b^{2/3} - \frac{3}{2}\right]$

= Area Divers