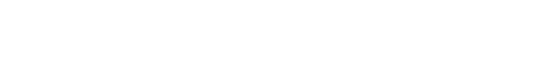


#### narmonic series

# harmonic series







### harmonic series

the harmonic series is the infinite series formed by summing all positive unit fractions

The harmonic series  $\sum_{n=1}^{\infty} \frac{1}{n}$  diverges (does not have a finite limit).

#### Proof by contradiction.

- Suppose the series converges to S:  $S = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} + \cdots$
- Then:  $\frac{1}{2}S = \frac{1}{2} + \frac{1}{4} + \dots + \frac{1}{2n} + \dots$
- Therefore, the sum of the odd-numbered terms:  $1+\frac{1}{3}+\cdots+\frac{1}{2n-1}+\cdots$  must be the other half of S
- However this is impossible since  $\frac{1}{2n-1} > \frac{1}{2n}$  for each positive integer n.

## limit of a function