## Precalc 12.4

Determine whether a series is convergent or divergent

Convergent (approaching a limit) some geometric series and some others

Divergent (not approaching a limit) some geometric, all arithmetic and some others

ratio
ratio
ratio test

general term

reference series comparison test (n>1)

What kind of series is it? What is the rule (r)?

Determine whether each arithmetic or geometric seried is convergent of divergent. a.  $-\frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \cdots$  What kind of series is it?

b.  $2 + 4 + 8 + 16 + \cdots$ 

1=2

div.

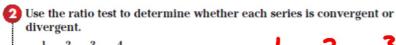
Pure geometric (what is r?)
Pure arithmetic

Mixed...

Ratio Test

Let  $a_n$  and  $a_{n+1}$  represent two consecutive terms of a series of positive terms. Suppose  $\lim_{n\to\infty}\frac{a_{n+1}}{a_n}$  exists and that  $r=\lim_{n\to\infty}\frac{a_{n+1}}{a_n}$ . The series is convergent if r<1 and divergent if r>1. If r=1, the test provides no information.

- 1. Find general term
- 2. Find the next (general) term after that  $a_{n+1}$
- (3) Apply the ratio test (limits)
- 4. Answer the question rsi D



Suggestion: make a table

a. 
$$\frac{1}{2} + \frac{2}{4} + \frac{3}{8} + \frac{4}{16} + \cdots$$

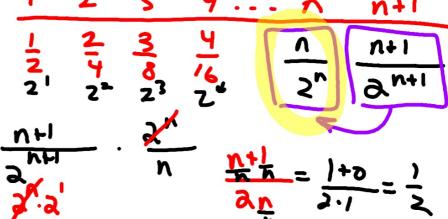
a,

2. Find the next (general) term

а...

3. Apply the ratio test (liptic) r=

4. Answer the question: Conv or div



$$\frac{1}{\frac{1}{2}} = \frac{2}{3} + \frac{3}{4} + \frac{4}{5} + \cdots$$

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$$\frac{1}{\frac{1}{2}} = \frac{1}{\frac{1}{2}} + \frac{1}{\frac{1}{2}$$

5!

Use the ratio test to determine whether the series

$$1 + \frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \cdots$$
 is convergent or divergent.

$$\frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \cdots \text{ is convergent or divergent.}$$

$$\frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \cdots \text{ is convergent or divergent.}$$

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$$\frac{1$$

P789

Summary of Series for Reference

- 1. Convergent:  $a_1 + a_1r + a_1r^2 + \cdots + a_1r^{n-1} + \cdots$ , |r| < 1
- 2. Divergent:  $a_1 + a_1r + a_1r^2 + \cdots + a_1r^{n-1} + \cdots, |r| > 1$
- 3. Divergent:  $a_1 + (a_1 + d) + (a_1 + 2d) + (a_1 + 3d) + \cdots$
- 4. Divergent:  $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \cdots + \frac{1}{n} + \cdots$  This series is known as 5. Convergent:  $1 + \frac{1}{2^p} + \frac{1}{3^p} + \cdots + \frac{1}{n^p} + \cdots$ , p > 1 p-series

Will give you this

Determine whether the series  $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \cdots$  is convergent or divergent.

harmonic series: see p.789 trust me:)

Use the comparison test to determine whether the following series are convergent or divergent.

a.  $\frac{4}{5} + \frac{4}{7} + \frac{4}{9} + \frac{4}{11} + \cdots$ 

Find the general term, compare to the series that it most resembles.

If n>1 (I always use n=2)

Convergent:

If each term< corresponding convergent series

Divergent:

If each term> corresponding divergent series

2n+3

b. 
$$\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$$