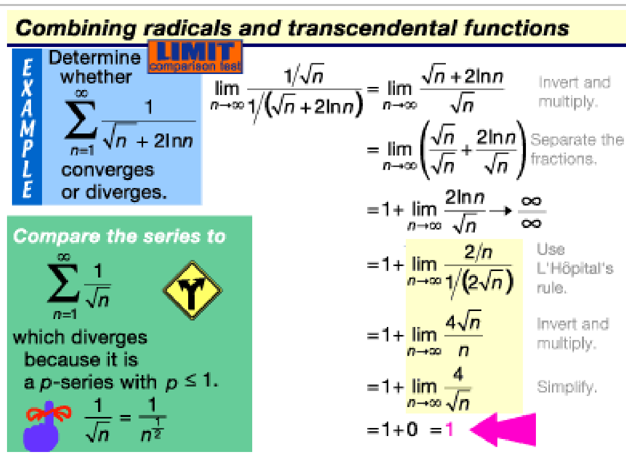
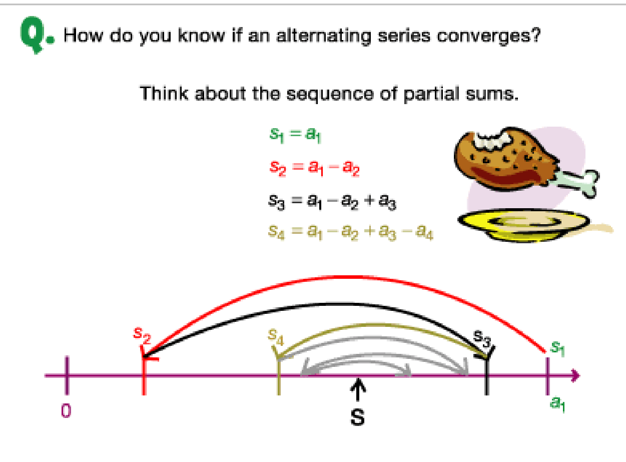
Alternating Series

- An **alternating series** is a series whose terms alternate between positive and negative values.
- The alternating series test states that an alternating series $\sum_{n=1}^{\infty}(-1)^{n+1}a_n$ converges if the a_n values are positive, decreasing, and approaching zero.



Alternating series get their name from the fact that the terms alternate between being positive and negative.

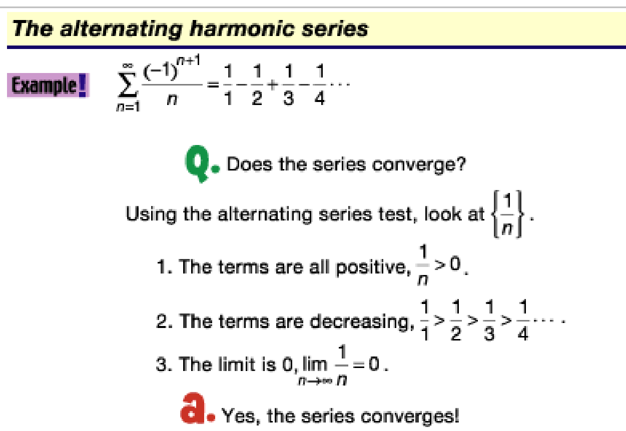
Raising (–1) to the n+1th power makes it alternate between –1 and +1. Make sure that a_n is positive, though.



For any kind of series, the important information to know is whether it converges or diverges.

Suppose each a_n is smaller than the one before and the signs are alternating. That means that you are either subtracting less than the current sum, or you are adding less than was just subtracted.

Alternating between adding and subtracting means that the partial sums begin to approach some value S. Thus, the series converges if a_n is approaching zero. This is the basis for the **alternating series test**.



This series, called the alternating harmonic series, consists of the terms of the harmonic series with alternating signs.

There are three steps you have to take when using the alternating series test.

- Check the sign of the non-alternating part of the terms.
- Verify that the non-alternating part is decreasing.
- Make sure the non-alternating parts are approaching zero.

Since all the conditions are met, the series converges by the alternating series test.

