Precalc 12.4

Determine whether a series is convergent or divergent
Use the comparison test

converge

diverge

ratio

ratio test

general term

reference series

comparison test (n>1)

Total distance the ball bounces

video: fibanocci sequences
http://mathandmultimedia.com/2011/04/09/nature-by-numbers-video-by-cristobal-vila/

Quiz 12.3-12.4

D: $8 + 6 + 4 + 2 \ldots$

C $-\frac{1}{4} + -\frac{1}{8} + -\frac{1}{16} \ldots$

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.

r<1 Convergent
r>1 Divergent

What if the ratio test is inconclusive? (r=1)

p. 789, also handout

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 the harmonic series.*
5. **Convergent:** $1 + \frac{1}{2^p} + \frac{1}{3^p} + \cdots + \frac{1}{n^p} + \cdots$, $p > 1$

p series

Find general term
Compare to series that it most resembles
n>1 if conv, yours has to be less
if div, yours has to be more

Go straight to comparison test (probably bec. r=1...)

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

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

1 2 3 4

$2n+3$

n

$\frac{4}{2n+3}$

1 2 3 4

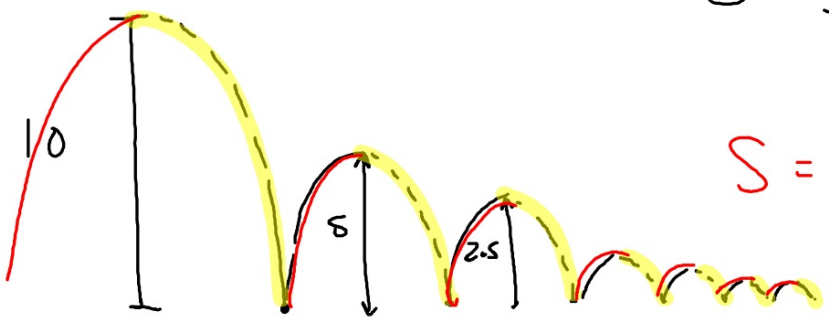
b. $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$

$$\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$$

$a_1 = 10 \quad r = 0.5$

A ball is dropped from a height of 10 feet. Each bounce of the ball is 1/2 as high as the previous bounce. How far (total) does the ball travel?

(on the way down) (on the way up)



$$S = \frac{a_1}{1-r} = \frac{10}{1-0.5} = \frac{10}{0.5} = 20$$

$$S = \frac{a_1}{1-r} = \frac{5}{1-0.5} = \frac{5}{0.5} = 10$$

$$= 30 \text{ ft}$$