February 14

What is your favorite part of Valentine's Day?

February 14

Students will verbally explain how to determine if an alternating series converges
(using the words:
alternating, limit, decreasing...)

Alternating Series Test

An alternating series $\sum (-1)^n a_n$ converges if: (Leibniz Test)

① each a_n is positive

② $a_n > a_{n+1}$ (terms are decreasing)

③ $\lim\limits_{n\to\infty} a_n = 0$

Alternating Series Test

Determine if $\sum\limits_{n=1}^{\infty} (-1)^n \left(\frac{n!}{3^n}\right)$ converges

Alternating

① $\frac{n!}{3^n} > 0$ yes!

② $\frac{n!}{3^n} \geq \frac{(n+1)!}{3^{n+1}}$ No!

$\frac{(n+1)}{3} \cdot \frac{n!}{3^n}$

greater than 1 (when $n>3$)

$\sum\limits_{n=1}^{\infty} (-1)^n \left(\frac{n!}{3^n}\right)$ diverges by AST

Determine if $\sum\limits_{n=2}^{\infty} (-1)^n \frac{1}{n \cdot \ln(n)}$ converges

Alternating!

① $\frac{1}{n \cdot \ln(n)} > 0$ yes

② $\frac{1}{n \cdot \ln(n)} > \frac{1}{(n+1)\ln(n+1)}$ Yes

③ $\lim\limits_{n\to\infty} \frac{1}{n \cdot \ln(n)} = 0$ Yes

$\sum\limits_{n=2}^{\infty} \frac{(-1)^n}{n \cdot \ln(n)}$ converges by AST

Determine if $\sum\limits_{n=1}^{\infty} (-1)^n \frac{1}{n}$ converges

Alternating!

① $\frac{1}{n} > 0$ Yes

② $\frac{1}{n} > \frac{1}{n+1}$ Yes

③ $\lim\limits_{n\to\infty} \frac{1}{n} = 0$ Yes

$\sum\limits_{n=1}^{\infty} (-1)^n \frac{1}{n}$ converges by AST

"conditionally convergent"

Harmonic Series $\sum \frac{1}{n}$ Diverges

Alt. Harmonic Series $\sum (-1)^n \frac{1}{n}$ Converges

Absolute Convergence

If $\sum |a_n|$ converges

then $\sum a_n$ converges absolutely

Conditional Convergence

If $\sum |a_n|$ diverges

but $\sum a_n$ converges

then $\sum a_n$ converges conditionally