

# MAT 137 (Calculus II) Prof. Swift

## Series True/False - Group Work

Indicate if the statement is True or False. If it is false, give a counter-example.

F Every geometric series converges.  $1+2+4+8+\dots$  diverges

T Every absolutely convergent series converges.

F Every alternating series converges.  $1-1+1-1+1-\dots$  diverges

F Every telescoping series converges.

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

$$S_n = \sum_{i=1}^n i^2 - (i+1)^2$$

$$= 1 - 4 + 4 - 9 + 9 - 16 + \dots + \cancel{(i-1)^2} - \cancel{i^2} + \cancel{i^2} + (n-1)^2 - n^2 + n^2 - (n+1)^2$$

$$S_n = 1 - (n+1)^2$$

$\lim_{n \rightarrow \infty} S_n$  DNE, so  $\sum_{n=1}^{\infty} n^2 - (n+1)^2$  diverges.

There are many more ~~ex~~ counter-examples!

$$\left. \begin{array}{l} 1-1+1-1+1-\dots \text{ diverges} \\ S_n = 1 \text{ if } n \text{ is even} \\ S_n = 0 \text{ if } n \text{ is odd} \\ \{S_n\} = \{1, -1, 1-1+1, 1-1+1-1, \dots\} \\ = \{1, 0, 1, 0, 1, 0, \dots\} \end{array} \right\}$$