

Math 301 — Limit Theorems

Problem 1. For each of the following statements, determine whether it is true or false. If it is true, prove it or cite a theorem. If it is false, give a counterexample.

- a. If a sequence is bounded, then it converges.
- b. If $a_n + b_n \rightarrow a + b$, then $a_n \rightarrow a$ and $b_n \rightarrow b$.
- c. If $a_n b_n \rightarrow ab$, then $a_n \rightarrow a$ and $b_n \rightarrow b$.
- d. If there exists $c \in \mathbb{R}$ such that $a_n < c$ for all $n \in \mathbb{N}$ and $a_n \rightarrow a$, then $a < c$.
- e. If $(a_n + b_n)$ and (b_n) are convergent sequences, then (a_n) is a convergent sequence.