

**Problem 1** *Show whether the following sequences are increasing, decreasing or neither.*

1)  $a_n = \frac{n!}{2^n}$ .

2)  $a_n = ne^{-n}$ .

**Problem 2** *Let  $x_n$  and  $y_n$  be two sequences of real numbers and suppose that  $x_n \leq y_n$  for all  $n \in \mathbb{N}$ . Show that*

$$\lim x_n = \infty \implies \lim y_n = \infty.$$

**Problem 3** Let  $x_1 > 1$  and  $x_{n+1} := 2 - 1/x_n$  for  $n \in \mathbb{N}$ . Show that  $x_n$  is bounded and monotone. Find the limit.

**Problem 4** Let  $x_1 = 1$  and  $x_{n+1} := \sqrt{2 + x_n}$  for  $n \in \mathbb{N}$ . Show that  $x_n$  is bounded and monotone. Find the limit.