1. Complete these problems from the book:
   (a) P53: Exercise 2.1.3
   (b) P54: Exercise 2.1.15
   (c) P64: Exercise 2.2.7
   (d) P71: Exercise 2.3.7
2. Show that if $(x_n)_{n\in\mathbb{N}}$ is a convergent sequence then every subsequence of $(x_n)_{n\in\mathbb{N}}$ is also convergent. Moreover if
$$x := \lim_{n\to\infty} x_n$$
then for any subsequence $(x_{n_i})_i$,
$$x = \lim_{i\to\infty} x_{n_i}$$
3. Let $(x_n)_{n\in\mathbb{N}}$ be a sequence and assume one of the following properties:
   (a) there is some $x$ such that any subsequence $(x_{n_i})_i$ contains another subsequence $(x_{n_{i_j}})_j$ which is convergent to $x$.
   (b) any subsequence $(x_{n_i})_i$ contains another subsequence $(x_{n_{i_j}})_j$ which is convergent (a priori not necessarily to the same $x$)

   Show in which cases $(x_n)_n$ is convergent. Give a counterexample for the other cases.
4. (bonus) Find the following limit. Show all work.
$$\lim_{n\to\infty}\left(\frac{1}{\sqrt{n^2+1}}+\frac{1}{\sqrt{n^2+2}}+\ldots+\frac{1}{\sqrt{n^2+2n}}\right)$$