

17) Let $\mathbb{R}_{\geq 0} = \{a \in \mathbb{R} \mid a \geq 0\}$ be the set of nonnegative real numbers. For each of the following functions determine whether the function is one-to-one, and whether it is onto. (It might be helpful to sketch the function, e.g. by using www.desmos.org.) Justify your answer.:

- a) $f: \mathbb{R} \rightarrow \mathbb{R}, x \mapsto |x|$ (absolut value)
- b) $f: \mathbb{R} \rightarrow \mathbb{R}_{\geq 0}, x \mapsto |x|$
- c) $f: \mathbb{R} \rightarrow \mathbb{R}, x \mapsto x^3 - 3x^2 + 1$
- d) $f: \mathbb{R}_{\geq 0} \rightarrow \mathbb{R}, x \mapsto \frac{1}{x+1}$.
- e) For $A = \mathbb{R} \setminus \{0\}$ let $f: A \rightarrow A, x \mapsto \frac{1}{x}$.

18) For $\mathbb{R}_{\geq 0}$ as in problem 17, let $f: \mathbb{R}_{\geq 0} \rightarrow \mathbb{R}_{\geq 0}, x \mapsto (x+2)^2 - 4$. Show that the function is one-to-one and onto, and find the inverse function.

Hint: You might find it easiest to find the inverse first and use its existence to show the properties.

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