

Math 2001 - Assignment 13

Due December 2, 2016

- (1) (a) Show that

$$f : \mathbb{R} - \{1\} \rightarrow \mathbb{R} - \{2\}, x \mapsto \frac{2x + 1}{x - 1}$$

is bijective.

- (b) Determine f^{-1} .

- (2) Try to you find an inverse for $f : \mathbb{R} \rightarrow \mathbb{R}^+, x \mapsto e^{x^3+1}$. Is f bijective?
- (3) Find the inverse for $f : \mathbb{R}^2 \rightarrow \mathbb{R}^2, (x, y) \mapsto (3x + y, x - 2y)$.
- (4) Let c be the function on the power set of \mathbb{Z} that maps every set to its complement, i.e.,

$$c : P(\mathbb{Z}) \rightarrow P(\mathbb{Z}), X \mapsto \bar{X}.$$

Determine c^{-1} .

- (5) The following **writing project** is worth 10 points. It will be graded on clarity and correctness, should be typed and handed it on a separate piece of paper.

Let $m, n \in \mathbb{N}$. How many surjective functions are there from $\{1, \dots, m\}$ onto $\{1, \dots, n\}$?

Your write up should include the following:

- Describe the problem. What is surjective?
- State the main result in a few sentences.
- Prove the result. Hint: inclusion-exclusion.
- Give precise arguments for all your statements.