

Recitation 6

- Here is a set of additional problems. They range from being very easy to very tough. The best way to learn the material in 310 is to solve problems on your own.
 - Feel free to ask (and answer) questions about this problem set on Piazza.
 - This is an **optional** problem set; do not turn this in for grading.
 - While you don't have to turn this in, be warned that this material **can** appear in a quiz or exam.
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1. For each of the following functions defined from the reals to the reals, indicate whether it is an injection and/or a surjection and/or a bijection.

- (a) $f(x) = x + 2$
- (b) $f(x) = 7x$
- (c) $f(x) = x^3$
- (d) $f(x) = \sin x$
- (e) $f(x) = e^x$

2. Let k be a positive integer, and define $f : \mathbb{R} \rightarrow \mathbb{R}$ as $f(x) = x^k$. For what values of k is $f(x)$ an onto function? Provide a brief explanation.

3. Define a function $f : \{1, 2, 3\} \rightarrow \mathbb{N}$ such that $f(1) = 3, f(2) = 5, f(3) = 1$.

- (i) Is f one-to-one?
- (ii) Is f onto?
- (iii) What is the range of f ?

4. Let $f : A \rightarrow B$ and $g : B \rightarrow C$ be functions. Let $h : A \rightarrow C$ be their composition, i.e., $h(a) = g(f(a))$.

- (a) Prove that if f and g are surjections, then so is h .
- (b) Prove that if f and g are bijections then so is h .