1. For each of the following functions, state whether or not it is injective, and whether or not it is surjective. Justify your answers.
   
   (a) $f : \mathbb{N} \to \mathbb{N}$, where $f(n) = n^2$.
   (b) $f : \mathbb{Z} \to \mathbb{N}$, where $f(n) = n^2$.
   (c) $f : \mathbb{R} \to \mathbb{R}$, where $f(n) = 3n + 7$.
   (d) $f : \mathbb{N} \to \mathbb{N}$, where $f(n) = \lfloor n/3 \rfloor$.
   (e) $f : \mathbb{N} \to \mathbb{N}$, where $f(n) = 3 \lfloor n/3 \rfloor$.
   (f) $f : \mathbb{N} \to \mathbb{N}$, where $f(n) = \begin{cases} n + 1, & \text{if } n \text{ is even} \\ n - 1, & \text{if } n \text{ is odd} \end{cases}$.

2. Suppose you graph a function $f : \mathbb{R} \to \mathbb{R}$. The fact that $f$ is a function means that any straight vertical line will intersect the graph of $f$ at exactly one point. What similar statement can you make about the graph of $f$ if $f$ is
   
   (a) injective?
   (b) surjective?
   (c) bijective?

3. Section 1.6, exercise 22.

4. Section 1.6, exercise 50. Be sure your graph extends into both positive and negative values of $x$.


6. Section 2.3, exercise 12. Justify your answer. The function $n!$ is defined on page 85. (Hint: Think about the unique factorization of 100! into primes. What about this factorization determines the number of zeros at the end of the decimal representation of 100! ?)