CSE 321: Discrete Structures
Assignment #3
April 22, 2002
due: Monday, April 29

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) $f : \mathbf{N} \to \mathbf{N}$, where $f(n) = n^2$.
   (b) $f : \mathbf{Z} \to \mathbf{N}$, where $f(n) = n^2$.
   (c) $f : \mathbf{R} \to \mathbf{R}$, where $f(n) = 3n + 7$.
   (d) $f : \mathbf{N} \to \mathbf{N}$, where $f(n) = \lceil n/3 \rceil$.
   (e) $f : \mathbf{N} \to \mathbf{N}$, where $f(n) = 3\lceil n/3 \rceil$.
   (f) $f : \mathbf{N} \to \mathbf{N}$, 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 $f : \mathbf{R} \to \mathbf{R}$. 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.
5. Section 2.3, exercise 4. Give a careful proof.
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! ?)