CMPSC 360 - Additional Questions for Homework on Section 2.3.

A. Prove that the following functions are injective.

(i) $f : \mathbb{R} \to \mathbb{R}$ given by $f(x) = 5x + 3$.
(ii) $g : \mathbb{R} \to \mathbb{R}$ given by $g(x) = x^3 - 1$.
(iii) $h : \mathbb{R} \to \mathbb{R}$ given by $h(x) = e^x$.
(iv) $p : [0, \infty) \to [0, \infty)$ given by $p(x) = x^2$.
(v) $q : \mathbb{Z} \to \mathbb{Z}$ given by $q(n) = 2n^3$.

B. Which of the functions in A are surjective? Prove or disprove surjectivity for each.

C. Prove that the following functions are surjective.

(i) $f : \mathbb{R} \to \mathbb{R}$ given by $f(x) = x - 5$.
(ii) $g : \mathbb{R} \to \mathbb{R}$ given by $g(x) = x^5 + 5$.
(iii) $h : (0, \infty) \to \mathbb{R}$ given by $h(x) = 4 \ln x$.
(iv) $p : [0, \infty) \to [0, \infty)$ given by $p(x) = \sqrt[3]{x + 1} - 1$.
(v) $q : \mathbb{R} \to \mathbb{Z}$ given by $q(x) = \lfloor x \rfloor$

D. Which of the functions in C are injective? Prove or disprove injectivity for each.