1. (a) Continuous on $\mathbb{R}$,  
(b) Continuous for $x \geq 0$,  
(c) Continuous for $x \neq 0$,  
(d) Continuous on $\mathbb{R}$.

2. Use 5.2.1(a) and Induction; or, use 5.2.8 with $g(x) := x^n$.

3. Let $f$ be the Dirichlet discontinuous function (Example 5.1.6(g)) and let $g(x) := 1 - f(x)$.

4. Continuous at every noninteger.

6. Given $\varepsilon > 0$, there exists $\delta_1 > 0$ such that if $|y - b| < \delta_1$, then $|g(y) - g(b)| < \varepsilon$. Further, there exists $\delta > 0$ such that if $0 < |x - c| < \delta$, then $|f(x) - b| < \delta_1$. Hence, if $0 < |x - c| < \delta$, then we have $|(g \circ f)(x) - g(b)| < \varepsilon$, so that $\lim_{x \to c} (g \circ f)(x) = g(b)$.

9. Show that an arbitrary real number is the limit of a sequence of numbers of the form $m/2^n$, where $m \in \mathbb{Z}$, $n \in \mathbb{N}$.