$b_i \neq a_{ii}$, 0, or 9.

We see that b is not one of the numbers with two representations (because b does not end with a tail of zeros or 9's) and b is not on the list of all numbers from $(0,1)$ (because $b_i \neq a_{ii}$ so $b \neq a_i$ for any i).

We have produced $b \in (0,1)$ with b not in the list of all numbers from $(0,1)$. This is a contradiction. Our original supposition must be false. Thus $(0,1)$ is uncountable.

6 (a) Suppose $f(a_1) = f(a_2)$ for some a_1 and $a_2 \in A$

Apply g to get $gf(a_1) = gf(a_2)$

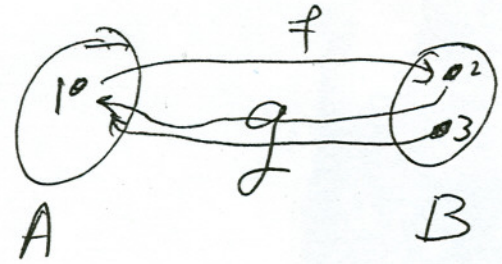
But $gf(a_1) = a_1$ and $gf(a_2) = a_2$. Thus $a_1 = a_2$

and f is 1-1

(b) Take $a \in A$. We are told $a = g(f(a))$.

Thus g is onto

(c)



$A = \{1\}$

$B = \{1, 2\}$

$f(1) = 1$

$g(1) = g(2) = 1$

(7) Given $\varepsilon > 0$, we see

$$|(a+b) - (a_n + b_n)| = |(a - a_n) + (b - b_n)| \underset{\Delta \text{ ineq}}{\leq} |a - a_n| + |b - b_n|.$$

The sequence $\{a_n\}$ converges to a so $\exists\, n_0$ s.t. $n \geq n_0 \Rightarrow |a - a_n| < \frac{\varepsilon}{2}$

The sequence $\{b_n\}$ converges to b so $\exists\, n_1$ s.t. $n > n_1 \Rightarrow |b - b_n| < \frac{\varepsilon}{2}$