Problem 1

This can be solved using contradiction to check if there are bijections or none. If there is then it is countable, if not then it is not countable

a)

give n to be number of natural numbers then greater than zero and then use p as power set of N

$T \in p(2)|T > 0$

So a) countable

b)

Assuming s is subset of the power of natural number and S is the finite set

p(N)=0,1,4,9,...

$P = \{S \in \wp(N)| \text{ S is a finite set}\}$

So b) countable

Problem 2

Any real number $a \le b$

$set[a,b] = \{x \in R \mid a \le x \le b\}$

$[-1,2] = \{-1,0,1,2\}$ $|[-1,2]| = 4$

$[0,1] = \{0,1/3,2/3,1\}$ $|[0,1]| = 4$

Problem 3

$n \in N$

Substitute 1 in the number in set when it is even or 0 if the number is odd

Problem 4

a)higher(Google,Yahoo)
b)higher(Google,Yahoo) $\wedge$ higher(Google,Facebook)
c)$\exists x(\neg link(x,x))$
d)$\forall x(link(x,Google) \vee (link(x,Yahoo)) \rightarrow link(x,Facebook)$
e)$\forall x(link(x,Google))$

Problem 5

a)

1)parent(John,Mary)	pre
2)parent(Mary,Tom)	pre
3)$\forall x.\forall y.(parent(x, y) \rightarrow child(y, x))$	pre
Assuming x as Mary	
Assuming y as Tom	
4)parent(Mary, Tom) $\rightarrow$ child(Tom, Mary)	$\forall$E,3
5)child(Tom, Mary)	$\rightarrow$E,2,4
6)$\exists x.child(x,Mary)$	$\exists$I,4

b)

1)on(a, b)	pre
2)on(b, c)	pre
3)red(a)	pre
4)blue(c)	pre
5)$\forall x.\neg(red(x) \wedge blue(x))$	pre
Assuming x as a	
6)$\neg(red(a) \wedge blue(a))$	$\forall$E,5
7)red(a) $\wedge$ blue(a)	$\neg$E,6
8)red(a) $\wedge$ $\neg$red(a)	7
9)$\exists x.\exists y.(on(x, y) \wedge red(x) \wedge \neg red(y))$	$\exists$I,1,8