1.

p	q	P -> q	P -> \neg q	Final (OR)
0	0	T	T	T
0	1	T	T	T
1	0	F	T	T
1	1	T	F	T

Answer: It's valid

2.

p	q	r	(NOT p) OR q	q -> (NOT r) AND (NOT p)	p OR r	Final (AND)
0	0	0	T	T	F	F
0	**0**	**1**	**T**	**T**	**T**	**T**
0	1	0	T	T	F	F
0	1	1	T	F	T	F
1	0	0	F	T	T	F
1	0	1	F	T	T	F
1	1	0	T	F	T	F
1	1	1	T	F	T	F

Answer: satisfiable: p = 0, q = 0, r = 1

3.
Red: Freedom is behind this door
Blue: Freedom is not behind this door
Green: Freedom is not behind the blue door

Constraints:
1. At least 1 statement is True and at least 1 is False.
2. Only 1 is the door to freedom

Solution:
Step 1: check if Red is true (incorrect, why?)
Step 2: Red is false. Check if Blue is true (correct).
Step 3: Red is false. Check is Blue is false (incorrect, why?).
No more cases.

Answer: red is false, blue is also false, green is true -> freedom is behind the green door.

4.
a) Forall x: K(x, Son Goku)
b) Forall x: Exists y: K(x,y)
c) Exists y: Forall x: K(x,y)
d) Exists y: \NOT K(Son Goku, y)

e) Exists y: Forall x: \Not K(x,y)

5.

5) a) $\forall x,y \in \mathbb{N}, \exists z \in \mathbb{N} : x > z > y$

b) Try $x=1, y=2$, $z=?$

No z exists, $\therefore$ False.

6.

6) a) i $\neg \forall x \in \mathbb{Z} : p(x) \vee r(x)$

or, $\exists x \in \mathbb{Z} : \neg p(x) \wedge \neg r(x)$ (via Demorgans)

ii $\forall x \in \mathbb{Z} : q(x) \wedge s(x) \Rightarrow r(x)$

Switch

b) i True, e.g. 1

ii False, e.g. 6

7.

7) a) $\{ x \in \mathbb{Z} : x^2 \leq 200 \}$

b) $\{ x \in \mathbb{N} : n \bmod 3 = 0 \wedge n \in \mathbb{N} \}$

Many solutions to these!