1. There are several sentences. Here are some examples:
7. P given 1 and AND-ELIMINATION RULES
8. Z given 1 and AND-ELIMINATION RULES
9. (~R v ~P) given 2 and distributive law of V on ^ and AND-ELIMINATION RULES
10. (~W v ~P) given 2 and distributive law of V on ^ and AND-ELIMINATION
11. ~R given 9 and RESOLUTION
12. ~W given 10 and RESOLUTION
13. Q given 12 and 4 and RESOLUTION
14. A v P given 13 and 5 and MODUS PONENS
15 A v R given 7, 13, and 6 and MODUS PONENS
etc…

2. There can be several solutions depending on how the predicates are defined.
i. Smart(Joe) ^ ~Smart(Jim)
ii. ∀ x Fish(x) => ~Walk(x)
iii. ∀ x Red(x) ^ Mushroom(x) => Poisonous(x)
iv. ∀ x PC(x) => Big(x) v Ugly(x)
v. ∀ x Student(x) ^ (∀ y AttendedLecture(y, x)) => FindExam(Easy, x)

3.
~P(x) v ~P(y) v P(f(x,y))

~P(z) v Q(z,g(z))

~P(w) v ~P(g(w))

4a.
1. (∀ x) S(x) v M(x)

2. ~(Ex) M(x) ^ L(x, Rain)

3. (∀ x) S(x) => L(x, Snow)

4. (∀ y) L(Ellen, y) <=> ~L(Tony, y)

5. L(Tony, Rain)

6. L(Tony, Snow)

7. Query: (Ex) M(x) ^ ~S(x)

8. Negation of the Query: ~(Ex) M(x) ^ ~S(x)

4b.

1. S(x1) v M(x1)
2. ~M(x2) v ~L(x2, Rain)
3. ~S(x3) v L(x3, Snow)
4. ~L(Tony, x4) v ~L(Ellen, x4)
5. L(Tony, x5) v L(Ellen, x5)
6. L(Tony, Rain)
7. L(Tony, Snow)
8. Negation of the Query: ~M(x7) v S(x7)

4c.Clause 1	Clause 2	Resolvent	MGU
8	1	9. S(x1)	{x7/x1}
9	3	10. L(x1, Snow)	{x3/x1}
10	4	11.~L(Tony, Snow)	{x4/Snow,x1/Ellen}
11	7	False	{}

answer: Ellen

5. a. Yes, Prolog will find Fly(Tweety) is true.
- bird(X) will unify with bird(tweety) X/tweety
- ostrich(tweety) will fail because it is not found in the kb
- so NOT ostrich(tweety) is true
- then fly(tweety) will be true.

b. a/A, c/A, d/A, b/B

c. Entailment is given one sentence another sentence is necessarily true
Inference is the procedure to determine entailment (like modus ponens or resolution)
Implicature is a natural language sentence that implies information that may not be entailed.

d. Many examples, see paper or discussion/lecture videos.

6. 1.B, 2. C, 3. B 4. A, 5. A, 6. A or C, 7. B, 8. A, 9. C 10. A