1. Any regular language is finite.  
Justify: $L = a^*$ is finite \[ n \]

2. For any language $L$ there is a deterministic automata $M$, such that $L = L(M)$.  
Justify: language must be regular \[ n \]

3. Given $L_1, L_2$ regular languages over $\Sigma$, then $(L_1 \cap (\Sigma^* - L_1))L_2$ is not regular.  
Justify: Regular languages are closed under intersection and complement \[ n \]

4. There is an algorithm that for any finite automata $M$ computes a regular expression $r$, such that $L(M) = r$.  
Justify: defined in the proof of Main Theorem \[ n \]

5. For any $M$, $L(M) = \bigcup \{ R(1, j, n) : q_j \in F \}$, where $R(1, j, n)$ is the set of all strings in $\Sigma^*$ that may drive $M$ from state initial state to state $q_j$ without passing through any intermediate state numbered $n + 1$ or greater, where $n$ is the number of states of $M$.  
Justify: only when $M$ is a finite automaton \[ n \]

6. Pumping Lemma says that we can always prove that a language is regular.  
Justify: it gives certain characterization of infinite regular languages and can be used for proving that a language is not regular. \[ n \]

7. $L = \{a^{2n} : n \geq 0\}$ is regular.  
Justify: $L = (aa)^*$ \[ y \]

8. $L = \{a^n : n \geq 0\}$ is not regular.  
Justify: $L = a^*$ \[ n \]

9. $L = \{b^n a^n : n \geq 0\}$ is not regular.  
Justify: proved using Pumping Lemma \[ y \]

10. Let $L$ be a regular language. The language $L^R = \{w^R : w \in L\}$ is regular.  
Justify: $L^R$ is accepted by a finite automata $M^R = (K \cup s', \Sigma, \Delta', s', F = \{s\})$, where $K$ is the set of states of $M$ accepting $L$, $s' \notin K$, $s$ the initial state of $M$, $F$ is the set of final states of $M$ and  
$$ \Delta' = \{(r, \sigma, p) : (p, \sigma, r) \in \Delta\} \cup \{(s', e, q) : q \in F\}, $$  
where $\Delta$ is the set of transitions of $M$. \[ y \]

11. Any subset of a regular language is a regular language.  
Justify: $L_1 = \{b^n a^n : n \geq 0\} \subseteq L = b^* a^*$ and $L$ is regular, and $L_1$ is not regular \[ n \]
QUESTION 1 Use the constructions defined in the proof of theorem

A language is regular iff it is accepted by a finite automata

construct a finite automata $M$ such that $L(M) = a(ab \cup aab)^*b$ and

$$M = M_a(M_{ab} \cup M_{aab})^*M_b$$

Solution - follow DIRECTLY book definitions!