1. Using the Pumping Theorem, show that the language a^mb^m where m is a perfect cube, is not regular.
For if A is a regular language then A has a pumping length such that there is a string where x >= y can fulfill the 3 equations below

1. $|y| > 0$
2. $|xy| <= p$
3. $xy^*z \in L$

One of a case that can be a^mb^m is L = {aaaabbbb} where x is aaa, y is ab, and z is bbb. This does not comply with the last rule xy*z, therefore the language a^mb^m cannot be a regular

2. Show that the language {na(w)!= nb(w)|w ∈ (a+b)*} is not regular.
For if A is a regular language then A has a pumping length such that there is a string where x >= y can fulfill the 3 equations below

1. $|y| > 0$
2. $|xy| <= p$
3. $xy^*z \in L$

One case of {na(w)!= nb(w)|w ∈ (a+b)*} is that of aaba where aa be x b be y and a be z but when y^3 this becomes aabbba this violates na(w)!= nb(w) there for, is not a regular language

3. Show that the language {a^mb^n} where m/n is a positive integer is not regular.
For if A is a regular language then A has a pumping length such that there is a string where x >= y can fulfill the 3 equations below

1. $|y| > 0$
2. $|xy| <= p$
3. $xy^*z \in L$

Where possible L is a aaaabb and let x be aaa, y be ab and z be b, when I is more then 1, L becomes aaaababb where this does not comply with {a^mb^n} rule set.

4. Show that the language {a^(2^n)|n>0} is not regular.

For if A is a regular language then A has a pumping length such that there is a string where x >= y can fulfill the 3 equations below

1. $|y| > 0$
2. $|xy| <= p$
3. $xy^*z \in L$

let n = 1, a^2^n = aaaa where a is x aa is y and a is z, xy^iz can be any number of a's that have more then aa, there for not complient with the rule set {a^(2^n)|n>0}