



## ★ Conditionals and Biconditionals

### Definitions:

- 1) Conditional Statement:
  - hypothesis
  - conclusion



Statement: All residents of Texas live south of the Mason-Dixon line.

If-then form: If he is a resident of Texas, then he lives south of the Mason-Dixon line.

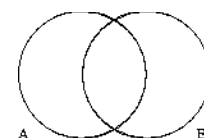
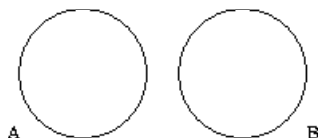
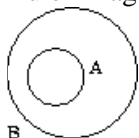
- 2) Inverse:
- 3) Converse:
- 4) Contrapositive
- 5) Biconditional Statement:

**Problem 5:** Given  $p =$  *If you show up for work Monday* and  $q =$  *You will get the job.* write each of the following using symbols, then write the statement in words.

- a) The conditional statement                      If  $p$ , then  $q$ .                       $p \rightarrow q$
- b) The converse of the statement:                      If  $q$ , then  $p$ .                       $q \rightarrow p$
- c) The inverse of the statement:                      If not  $p$ , then not  $q$ .
- d) The contrapositive of the statement;                      If not  $q$ , then not  $p$ .

## ★ Validity of Statements

- 1) Euler Diagrams



- 2) Law of Detachment: *If the statement “if p, then q” is true, and p is true, then q must be true.*  
uses direct reasoning
- 3) Modus Tollens: *If the statement “if p, then q” is true, and q is false, then p must be false.*  
uses indirect reasoning
- 4) Chain Rule: *If the statements “if p, then q” and “if q, then r” are true, then “if p, then r” is true.*

**Problem 6:** Use an Euler diagram to check the validity of the following statements.

*All roses are red.  
This flower is a rose.  
Therefore this flower is red.*

**Problem 7:** Determine whether the following argument is valid.

*If you eat spinach, then you will be strong.  
You eat spinach, therefore you will be strong.*

**Problem 8:** Determine conclusions for the following true statements.

- a) *If a person lives in Boston, then the person lives in Massachusetts.  
Jessica does not live in Massachusetts.*
- b) *If  $x = 3$ , then  $2x \neq 7$ . We know that  $2x = 7$ .*
- c) *If a triangle is equilateral, then it is isosceles.  
If a triangle is isosceles, then it has at least two congruent sides.*
- d) *If you pay your taxes, then you are a good citizen. People who do not pay their taxes did not receive a tax bill. If it is April, then you will receive a tax bill. It is April.*

**Truth Tables:**

<b>p</b>	<b>q</b>	<b><math>p \vee q</math></b>	<b><math>p \wedge q</math></b>	<b><math>p \rightarrow q</math></b>