

## Section 9.3 Negation and Conjunction

**Definition:** Negation  $\sim$  A negation gives the opposite truth value of a statement. So if a proposition is true then the negation will be false. If the proposition is false then the negation is true. In symbols the negation of  $P$  is denoted as  $\neg P$

**Example:** Determine the negation of the following statements and the truth value of the negation.

- a) School starts at 7:40.

School does not start at 7:40

False

- b) There are 30 days in the month of February.

There are not 30 days in the month of February

True

**Example:** Determine the solution set of the given statement. Then give the negation of the statement and its solution set.

- a)  $2x \leq 10$

Solution set of given statement:  $\{x: x \in \mathbb{R}, x \leq 5\}$

Negation of statement:  $2x > 10$

Solution set of the negation:  $\{x: x \in \mathbb{R}, x > 5\}$

Notice that the solution sets of negations are complements.

**Definition:** Conjunction  $\sim$  A conjunction is formed by combining two proposition with the word “and” . A conjunction is only true when both P and Q (called the conjuncts) are true. In symbolic form the conjunction of P and Q is denoted as  $P \wedge Q$ .

**Example:** Translate the  $(P \wedge Q) \Rightarrow R$  into words and then give its truth value:

P: The temperature is in the 90's

Q: It is sunny

R: We are going swimming

Answer:

If the temperature is in the 90's and it is sunny, then we are going swimming.

**Examples:** Let p represent a true statement and q represent false statements. Find the truth value of each compound statement.

1.  $p \wedge q$

Answer:  $T \wedge F = F$

2.  $\neg p \wedge \neg q$

Answer:  $F \wedge T = F$

3.  $p \wedge \neg q$

Answer:  $T \wedge T = T$

4.  $p \Leftrightarrow q$

Answer:  $T \Leftrightarrow F = F$

5.  $p \Leftrightarrow \neg q$

Answer:  $T \Leftrightarrow T = T$