Remember:

Statements are represented by the letters: ***p, q, r***

Connectives used in this section are: ***and, or, not***

In this section we will find the truth values, ***T*** or ***F***, for compound statements (two or more statements put together by a connective). First let’s use ordinary language and statements to create the rules for finding truth values. Then we will write the rule in symbol form.

**1.** ***AND***

Find the truth value, ***T*** or ***F***, of compound statements using the connective, ***and***.

***and*** (**∧**) is a connective that implies \_\_\_\_\_\_\_\_\_\_.

**EXAMPLE:** “I want to go to dinner and a movie.” This statement implies doing both activities.

**Compound statement: Last night, we went to dinner and a movie.**

***p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AND ***q*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is ***p*** true? \_\_\_\_\_\_\_\_\_ Is ***q*** true? \_\_\_\_\_\_\_\_\_

Is the compound statement ***p and q*** true? \_\_\_\_\_\_\_\_\_

**Compound statement: Last night, we went to dinner and did not go to a movie.**

***p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ AND ***q*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is ***p*** true? \_\_\_\_\_\_\_\_\_ Is ***q*** true? \_\_\_\_\_\_\_\_\_

Is the compound statement ***p and q*** true? \_\_\_\_\_\_\_\_\_

Create a truth value table of all the possible values for compound statements using, ***and***:

Truth Table Rule for ***AND***

|  |  |
| --- | --- |
| p q | p ∧ q |
|  |  |

**2.** ***OR***

Find the truth value, ***T*** or ***F***, of compound statements using the connective, ***or***.

***or*** (**∨**) is a connective that implies \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**EXAMPLE:** “I will help you paint, so I will paint the walls or the ceiling.” This statement implies doing one of the activities or maybe both.

**Compound statement: I painted your walls. I painted your ceiling.**

***p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ OR ***q*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is ***p*** true? \_\_\_\_\_\_\_\_\_ Is ***q*** true? \_\_\_\_\_\_\_\_\_

Is the compound statement ***p or q*** true? \_\_\_\_\_\_\_\_\_

**Compound statement: I painted your walls. I did not paint your ceiling.**

***p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ OR ***q*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Is ***p*** true? \_\_\_\_\_\_\_\_\_ Is ***q*** true? \_\_\_\_\_\_\_\_\_

Is the compound statement ***p or q*** true? \_\_\_\_\_\_\_\_\_

Create a truth value table of all the possible values for compound statements using, ***or***:

Truth Table Rule for ***OR***

|  |  |
| --- | --- |
| p q | p ∨ q |
|  |  |

**3.** ***NOT***

Find the truth value, ***T*** or ***F***, of statements using ***not***.

***not*** (~) is a negation that implies \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**EXAMPLE:** The United States has a president.

**Statement: Obama was the President of the United States.**

Is ***p*** true? \_\_\_\_\_\_\_\_\_

What is **~*p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Statement: Jimmy Fallon, of The Tonight Show, is the President of the United States.**

Is ***p*** true? \_\_\_\_\_\_\_\_\_

What is **~*p*** = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Create a truth value table of all the possible values for using, ***not***:

Truth Table Rule for ***NOT***

|  |  |
| --- | --- |
| p | ~p |
|  |  |

**4.** **DeMorgan’s Law:** The complement (negation) of compound statements.

The complement of *p or q*: ~ (p ∨ q) =

The compliment of *p and q*: ~ (p ∧ q) =

**EXAMPLE:** use DeMorgan’s law to negate the statements.

Statement: I got an A or I got a B on my test.

Negation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Statement: It is summer and there is no snow.

Negation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**TRUTH VALUE EXAMPLES:** If ***p* is a false** statement and ***q* is a true** statement, find the truth value for the given compound statements.

1. ~p =
2. p ∨ q =
3. ~p ∧ q =
4. p ∨ ~q =

**5. TRUTH TABLES:**

1. Draw a basic table
2. *p* and *q* are the statements and go on the left side of the table.

🞽 You need to know how many basic combinations of TRUE and FALSE will be in your truth table (left side/column). In other words, how many rows are in the truth table? Use the same formula from Chapter 2, when we looked for the number of subsets created from one given set: 2n where n was the number of elements in a set. Now n will be the number of statements.

The formula: \_\_\_\_\_\_\_\_\_\_\_\_\_ How many rows? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. In many mathematical problems, sometimes you have several steps to get to the final answer. Create a column for each step, the last column being your final answer.
2. We solve math problems using Order of Operations, so you must fill in truth tables in a particular order, too:

Parentheses

Not

And, Or

1. Refer back the basic truth table rules to follow the pattern and find your answers.

**EXAMPLE:** construct a truth table for the given compound statements. Use this page or your own notebook paper.

1. ~ (p ∧ q)
2. ~p ∨ ~q
3. ~q ∧ (~p ∨ q)
4. (~p ∧ q) ∧ r