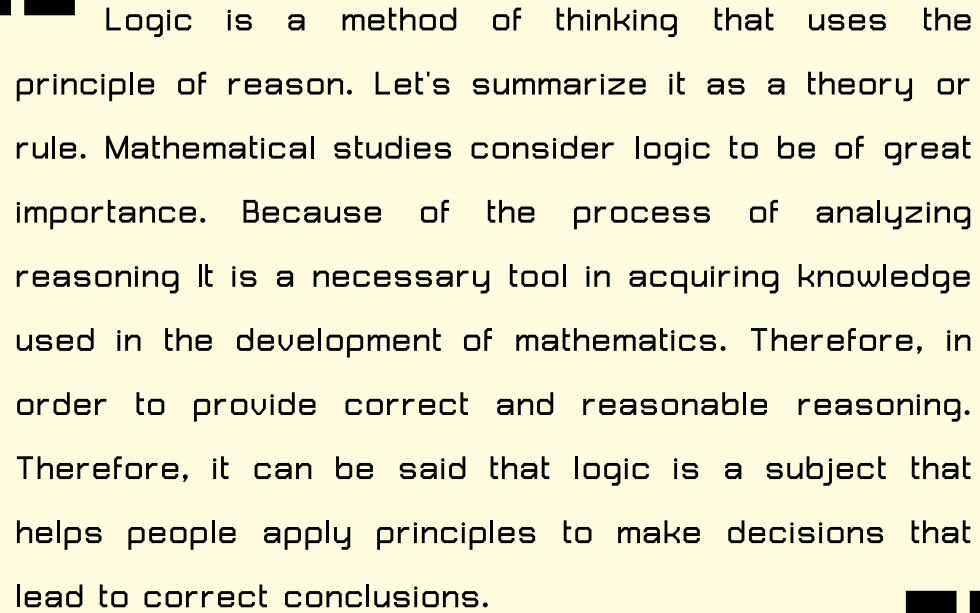# Chapter 9

logic

learning content

1. Propositions and propositional connections

2. Finding the truth value of a proposition

3. Truth value table

> Logic is a method of thinking that uses the principle of reason. Let's summarize it as a theory or rule. Mathematical studies consider logic to be of great importance. Because of the process of analyzing reasoning It is a necessary tool in acquiring knowledge used in the development of mathematics. Therefore, in order to provide correct and reasonable reasoning. Therefore, it can be said that logic is a subject that helps people apply principles to make decisions that lead to correct conclusions.

1. Proposition

Proposition or Statement is a sentence or statement that is in the form of a declarative sentence. or negative sentence that can be said to have truth value Is it only true or false? only alone Propositions are generally written with the English letters p, q, r, ... Propositions must be true (True) or false (False) only. which we call the truth value of the proposition, where

– The truth value is true, represented by T (True).
– The truth value is false, represented by F (False).

example

Consider the truth value of the following propositions.

1) Tak is a province in the northern part of Thailand.

2) Office of the Vocational Education Commission under the Ministry of Education

3) 3) Thailand has 75 provinces.

4) 4) 7 + 2 = 10

summarize

From 1), 2) has a truth value of True and 3), 4) has a truth value of False.

⚡ Observations

Sentences or statements that are questions, commands, prohibitions, requests, pleas, exclamations, proverbs, aphorisms, expressing wishes. or sentences whose truth value is not known for sure considered non-propositional, for example:

- Did the students do their homework today? (Question)

- Everyone open the book (command)

- Don't go swimming when it rains (forbidden).

- Jai Pla Siw (idiom)

- Please throw the trash in your hand "into the bin" (please).

In logic, the symbols p, q, r, ... are used to represent subordinate propositions.1) If the subordinate proposition has 1 proposition, namely p, for example, p represents Praewa, a good-looking woman. truth value There are two possible cases: true or false.2) If the subproposition has 2 propositions, p and q, there are 4 possible truth values. Consider using a tree diagram as follows.
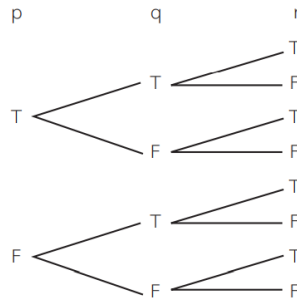
p	q
T	T
T	F
F	T
F	F

or
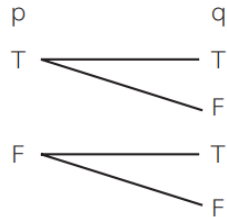
3) If there are 3 subpropositions: p, q, and r, there are 8 possible truth values. Consider using the Tree Diagram as follows:

p	q	r
T	T	T
T	T	F
T	F	T
T	F	F
F	T	T
F	T	F
F	F	T
F	F	F

Tree diagram (p, q, r):

p = T:
- q = T: r = T, r = F
- q = F: r = T, r = F

p = F:
- q = T: r = T, r = F
- q = F: r = T, r = F

or

4) If the subproposition has n propositions, all possible truth values are $2^{(n)}$ cases. For example, if the subproposition has 1 proposition, there are $2^{n} = 2$ possible truth values.

1. The truth value of a proposition that has only one connector.

1

1) ตารางค่าความจริงของ p ∧ q คือ

p	q	p ∧ q
T	T	T
T	F	F
F	T	F
F	F	F

2

2) ตารางค่าความจริงของ p ∨ q คือ

p	q	p ∨ q
T	T	T
T	F	T
F	T	T
F	F	F

3 ตารางค่าความจริง

3

3) ตารางค่าความจริงของ p → q คือ

p	q	p → q
T	T	T
T	F	F
F	T	T
F	F	T

4

4) ตารางค่าความจริงของ p ↔ q คือ

p	q	p ↔ q
T	T	T
T	F	F
F	T	F
F	F	T

Negation of a proposition

If p is a proposition, the negation of p is the proposition that has the opposite truth value to p. The negation of p is written as ~p. The truth value table ~p is

p	~p
T	F
F	T

2. The truth value of a proposition that has two or more connectors.

ในการหาค่าความจริงของประพจน์ที่มีตัวเชื่อมตั้งแต่ 2 ตัวขึ้นไป มีลำดับขั้นตอนดังนี้

1) หาค่าความจริงของประพจน์ที่อยู่ในวงเล็บก่อน

2) ถ้าไม่ใส่วงเล็บให้หาค่าความจริงของนิเสธ (~) ก่อน แล้วตามด้วยตัวเชื่อม $\wedge$, $\vee$, $\rightarrow$ และ $\leftrightarrow$ ตามลำดับ แบ่งออกเป็น 2 กรณี คือ

2. The truth value of a proposition that has two or more connectors.

Case 1: In the case where the truth value of any subproposition or some propositions is given. Enter the truth value corresponding to each proposition given by the problem. Then find the truth value of the proposition formed by the connector. By connecting the propositions from the truth values studied above.

➕

Case 2: In the case where the problem does not provide the truth value of any sub-proposition, finding the truth value in this manner All possible truth values must be considered in every case. By creating a truth value table, then if a subproposition has n propositions, the possible truth values will be in all 2^n cases.

summarize

A proposition means a statement or negative sentence that can be said to be true or false. one or the other alone

Propositions are joined with connectors such as "and," "or," "if...then," "...if..." and "not." For convenience, we use the letters p, q, r, ... to represent propositions. Where the truth value is true, represented by T (True), and the truth value is false, represented by F (False).