Propositions or Statement: Proposition is a declarative sentence that is either true or false, but not both.

For example: (i) 5 is an integer.
Example 1:
(ii) $\sqrt{5}$ is an integer.
(iii) New Delhi is the Capital of India
(iv) Toranto is the Capital of Canada. → ottawa

Each of above statement is a declarative sentence. As Sentence (i) & (iii) are true, whereas (ii) & (iv) are false.

* Typically lowercase letters with or without supscripts are used to denote propositions. For example, we might write

p: 4 is an integer
q: 5 is an even integer
r: $\sqrt{5}$ is an irrational number.

Here p, q, and r denotes the proposotions.

Example 2: Consider the following sentences:

p: What are you doing?
q: Enjoy the lovely weather!

Here p and q are not declarative sentences, so these are not propositions.

e 3: (i) $x+1=2$

(ii) $x+y=z$

Equation (i) & (ii) are not propositions because they are neither true nor false.

But it is noted here, that these equations can be turned into propositions by assigning particular values to x, y & z.

* We use letters to denote propositional variables (or statement variables). The conventional letters used for propositional variables are $p, q, r, s, \ldots$

If The truth value of proposition is <u>True</u>, it is denoted by <u>T</u>.
If the truth value of proposition is <u>False</u>, it is denoted by <u>F</u>.

* The area of logic that deals with propositions is called the propositional calculus or propositional logic. It was first developed by the Greek philosopher Aristole.

<u>Compound Propositions</u>: Propositions formed from existing propositions using logical operators.

<u>Negation</u>: Let p be a proposition. The negation of p, denoted by $\sim p$ (also written as $\bar{p}$), is the statement:
"It is not the case that p"

proposition $\sim p$ is read as "not p".

e truth value of the negation of p, "$\sim p$" is opposite of the truth value of p.

Formation

* Typically, if p is a statement, then its negation is formed by writing "it is not the case that p".

For example, if

p: 2 is positive, then

$\sim p$: It is not the case that 2 is positive.

OR $\sim p$: 2 is not positive (In simple English).

Example 2:

Find the negation of the proposition "Today is Friday" Express in simple English.

: The negation is "It is not the case that today is Friday".

In Simple English "Today is not Friday".

Truth Table for negation of p

p	$\sim p$
T	F
F	T

Logical Operators: That are used to form new propositions from two or more existing propositions. These logical operators are also called Connectives

Compound Proposition: When one or more propositions are connected through various connectives are called Compound proposition

Primitive proposition: A proposition is said to be primitive if it Cannot be brokeen into simpler propositions.

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Connectives: Logical operators that are used to form new propositions from two or more existing propositions. These logical operators are called <u>connectives</u>.

Def. 2:
<u>Conjuction</u>: Let p and q be propositions. The conjuction of p and q, denoted by $p \wedge q$ is the proposition "p and q".

The conjuction $p \wedge q$ is true if both p and q are true and is false otherwise.

Truth table for conjuction of two proposition p & q is given by

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

<u>Example 1</u>: Let

p: 2 divides 4

q: 3 is greater than 5. , then

$p \wedge q$: 2 divides 4 and 3 is greater than 5.

Because p is T &

q is F ; #

$\therefore$ $p \wedge q$ is F.

* The symbol $\wedge$ is called "and".
* In logic the word "but" can be used instead of "and".

<u>For Example</u>: "The sun is shining and it is raining," can also be written as "The sun is shining but it is raining".