Let us recall some of the theorems/conjectures:

1. There are infinitely many primes.
2. There are infinitely many twin primes. ⟷ TWIN PRIME CONJECTURE
3. Every even positive integer, greater than 2, is the sum of two primes.
4. Let G be a graph. If each vertex has degree 2 or more then G has a cycle.

Each of these is either TRUE or FALSE (BUT NOT BOTH).

A **proposition** is a statement that is either TRUE or FALSE (but NOT both).

Examples of Propositions:

1. 17 is a prime. T
2. 24 is a prime. F
3. 19 is NOT a prime. F
4. 19 is a prime. T
5. 17 & 19 are twin primes. T
6. 19 & 21 are twin primes. F
7. Each vertex of  has degree 2 or more. F
8.  has a cycle. T

For example: the Twin Prime Conjecture is either TRUE or FALSE. However, humans have NOT (yet!) figured out whether it is TRUE or FALSE.

Let us consider the following proposition:

(Let G be a graph.)

If $\boxed{\text{G is Eulerian AND connected}}$

then $\boxed{\text{either each vertex of G has even degree or G has precisely two vertices of odd degree}}$

Let us "dissect" the above proposition:

↓

(break into smaller propositions to understand better)

$\boxed{\text{G is Eulerian}}$ AND $\boxed{\text{G is connected}}$

$\boxed{\text{Each vertex of G has even degree}}$

OR

$\boxed{\text{G has precisely two vertices of odd degree}}$

Let us apply these to specific graphs and get some propositions:

G_1 () is Eulerian. T

G_2 () is Eulerian. T

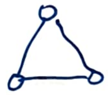
G_1 () is connected. T

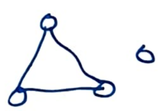
G_2 () is connected. F

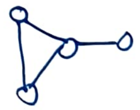
Let us combine these using AND:

G_1 () is Eulerian AND G_1 is connected. T

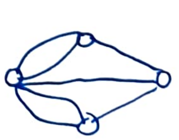
G_2 () is Eulerian AND G_2 is connected. F

G_1 

G_2 

G_3 

G_4



Using AND ($\wedge$) to combine propositions:

P, Q: Propositions

$P \wedge Q$ (read: P AND Q) is TRUE

whenever P is TRUE & Q is TRUE;

otherwise $P \wedge Q$ is FALSE.

This can be represented briefly using a "truth table":

P	Q	$P \wedge Q$
T	T	T
T	F	F
F	T	F
F	F	F

all 4 possibilities for P & Q

result of $P \wedge Q$ in each of the 4 possibilities

Observe that $\wedge$ (symbol for AND) is "similar" to $\cap$ (symbol for intersection of 2 sets).

This is NOT a coincidence..

DIY: Define intersection of two sets S & T using $\wedge$.

Let us do the same exercise for OR:

G_3  has precisely two vertices of odd degree. T

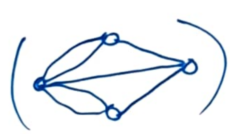
G_4  has precisely two vertices of odd degree. F

Each vertex of G_3 has even degree. F

Each vertex of G_4 has even degree. F

Let us combine these using OR:

G_3  has precisely two vertices of odd degree OR each vertex of G_3 has even degree. T

G_4  has precisely two vertices of odd degree OR each vertex of G_4 has even degree. F

Using OR ($\vee$) to combine propositions:

P, Q: Propositions

$P \vee Q$ (read: P OR Q) is TRUE whenever at least one of P & Q is TRUE; otherwise $P \vee Q$ is FALSE.

P	Q	$P \vee Q$
T	T	T
T	F	T
F	T	T
F	F	F

all 4 possibilities for P, Q

result of $P \vee Q$ in each case

DIY: Define ~~the~~ union of two sets ($S \cup T$) S & T using $\vee$.