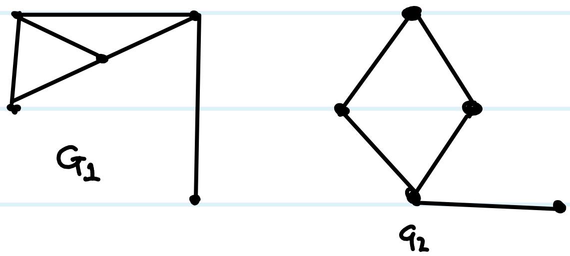
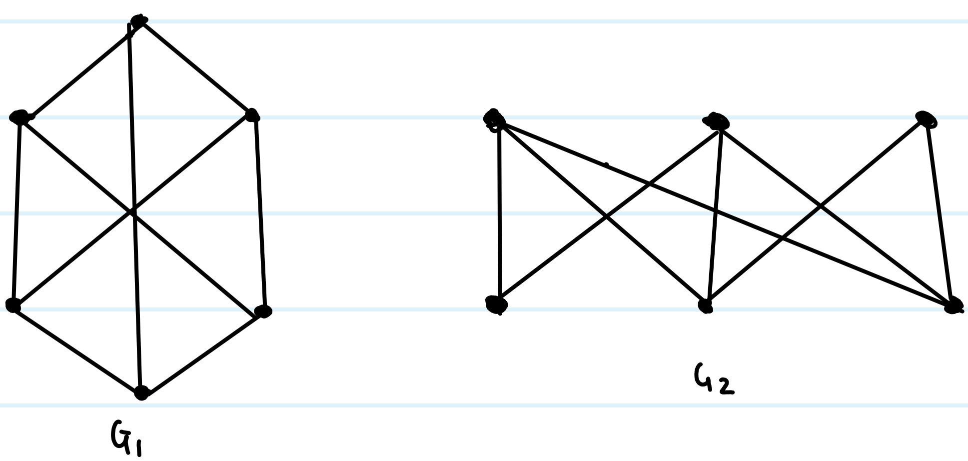
* Isomorphic Graph



→	Graph G_1	Graph G_2
No. of vertices	5	5
No. of edges	6	5

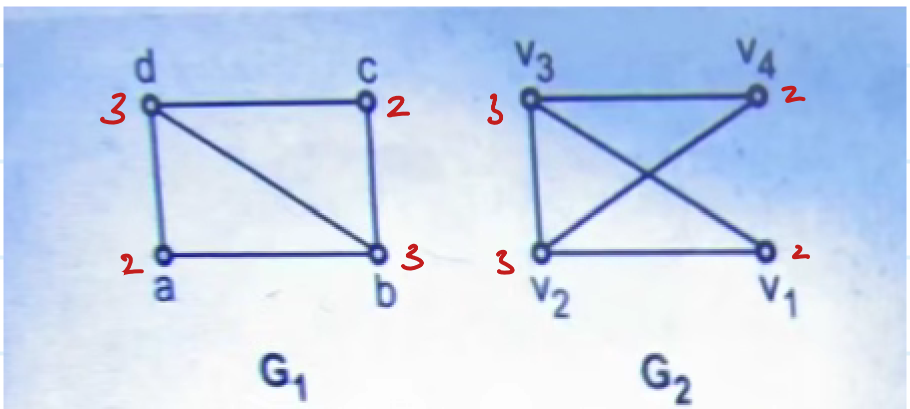
Both Graph G_1 & G_2 having diff no. of edges

Q]



	G_1	G_2
No. of V	6	6
No. of E	9	8

Q)



	G_1	G_2
No. of V	4	4
No. of E	5	5
Degree Seq.	3, 2, 3, 2	3, 2, 2, 3

1 to 1 corresponce of V & E

$a \to V_1$

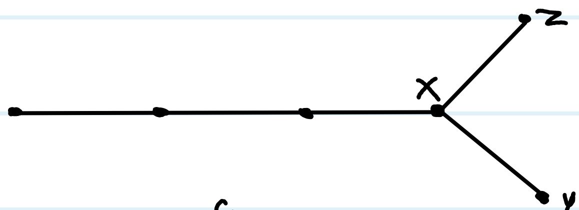
$b \to V_2$

$c \to V_4$

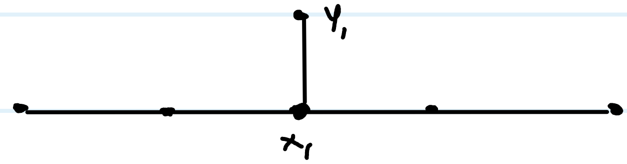
$d \to V_3$

Graph is isomorphic

Q)



G_1



G_2

	G_1	G_2
V	6	6
E	5	5
D	1, 2, 2, 3, 1, 1	1, 2, 3, 2, 1, 1

For graph G_1, Degree 3 connected to Deg (1), Deg (1), Deg (2)
For graph G_2, Degree 3 connected to Deg (2), Deg (2), Deg (1)

MisMatch

* Eulerian Graph & Hamiltonian Graph

Eulerian Path : Every edges of graph appears exactly once in the path

→ 0 or 2 vertices of odd degree

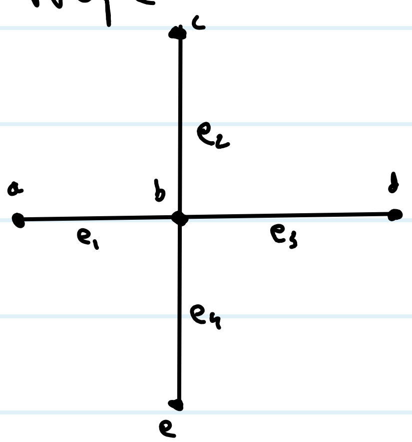
Eulerian Circuit : The circuit which contains every edge of the graph exactly once

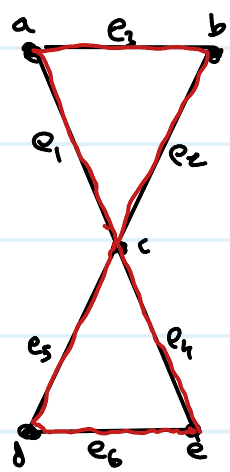
Starting & Ending Point should be same

→ Each vertices must be even degree.

Eulerian Graph : A graph which has an Eulerian Circuit

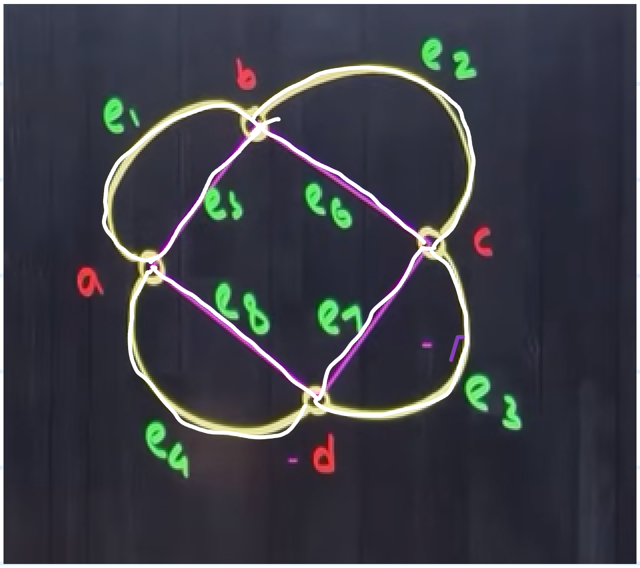
Nope





$e e_6\ d e_5\ c e_2\ b e_3\ a e_1\ c e_4$

Check whether the graph has Euler circuit, path justify:



Degree of each vertex is even

∴ Eulerian circuit

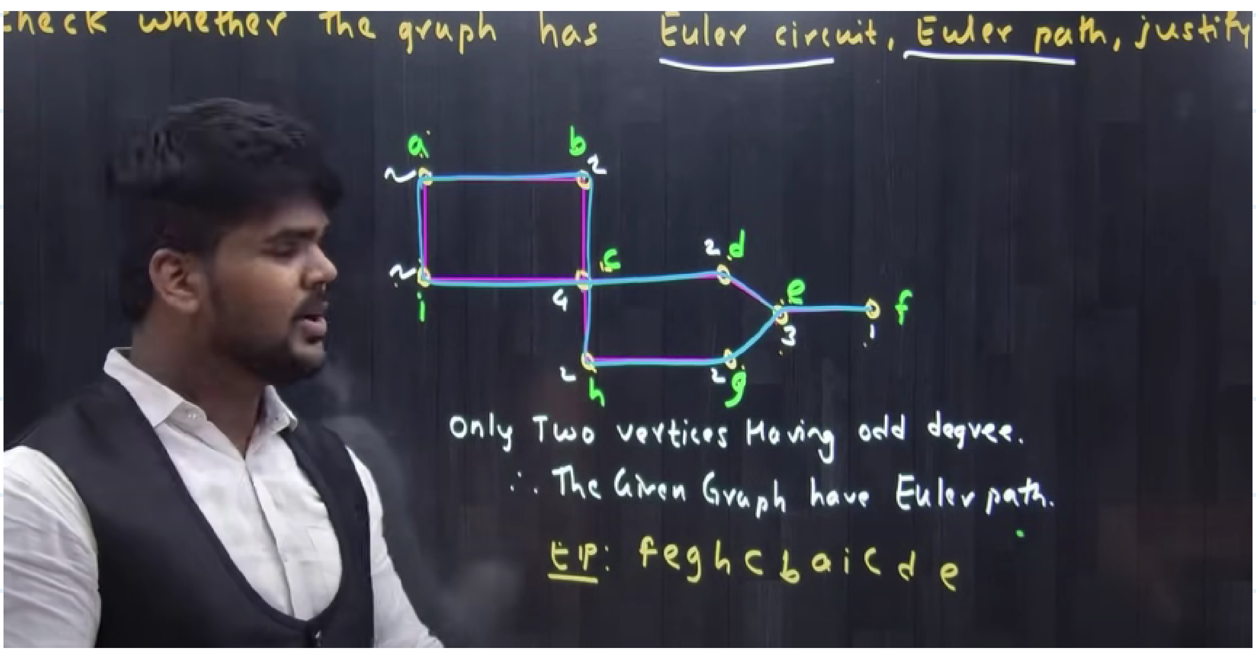
Here zero vertex has odd degree

∴ Eulerian Path

E.P: $ae_1, be_2, ce_3, de_4, ae_5, be_6, ce_7, de_8$

E.C: $ae_1, be_2, ce_3, de_4, ae_5, be_6, ce_7, de_8, a$

2)



No E.C. → Not all vertices even degree.

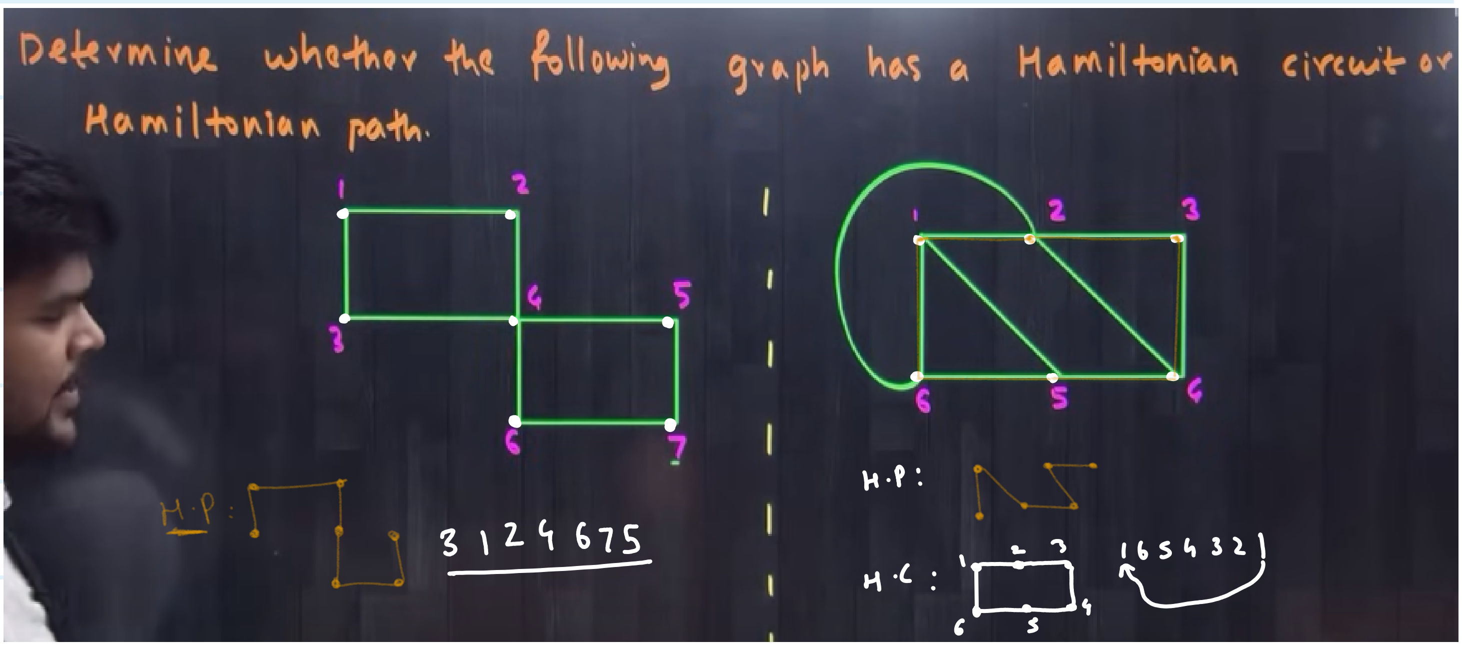
* Hamiltonian Graph

Hamitonian Path : Every vertex of Graph appears exactly once in path

Hamiltonian Circuit : The circuit which contains every vertex of graph exactly once.

Hamitonian Graph : A Graph which has an Hamiltonian circuit

Q]



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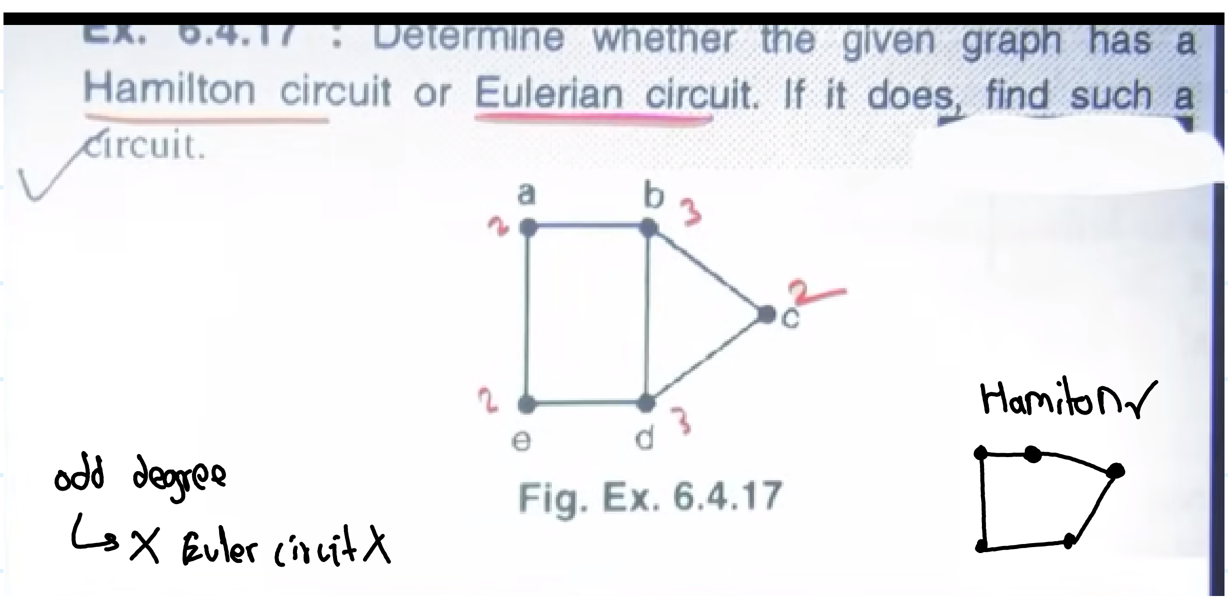
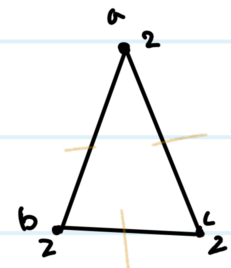


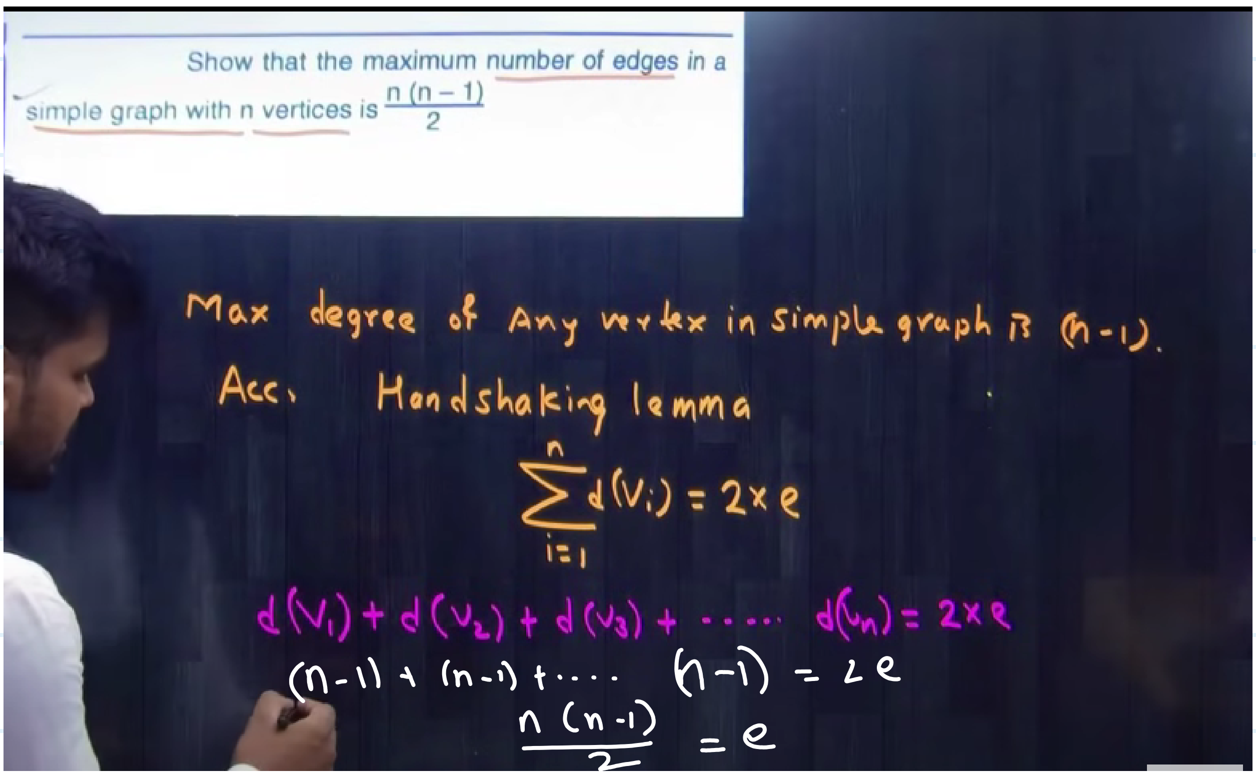
* Handshaking Lemma

$$\boxed{\sum_{i=1}^{n} d(v_i) = 2e}$$



$\therefore\ 3 \times 2 = 6$

Max degree of any vertex in a simple graph with n vertices is $(n-1)$



Determine the number of edges in a graph with 6 nodes, 2 of degree 4 and 4 of degree 2. Draw two such graphs.

$d(V_1) = 4$ $\quad d(V_3) = d(V_4) = d(V_5) = d(V_6) = 2$

$d(V_2) = 4$

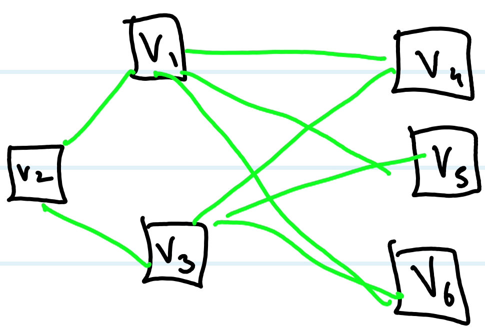
Handshaking lemma

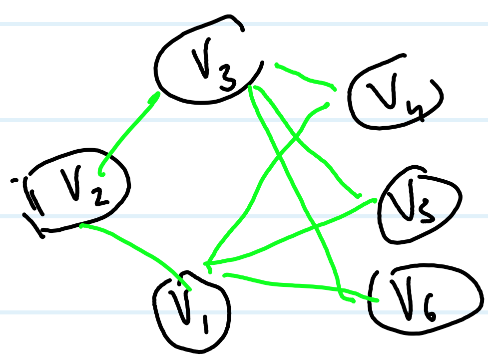
$$\sum_{i=1}^{6} d(V_i) = 2e$$

$$d(V_1) + d(V_2) + d(V_3) + d(V_4) + d(V_5) + d(V_6) = 2 \times e$$

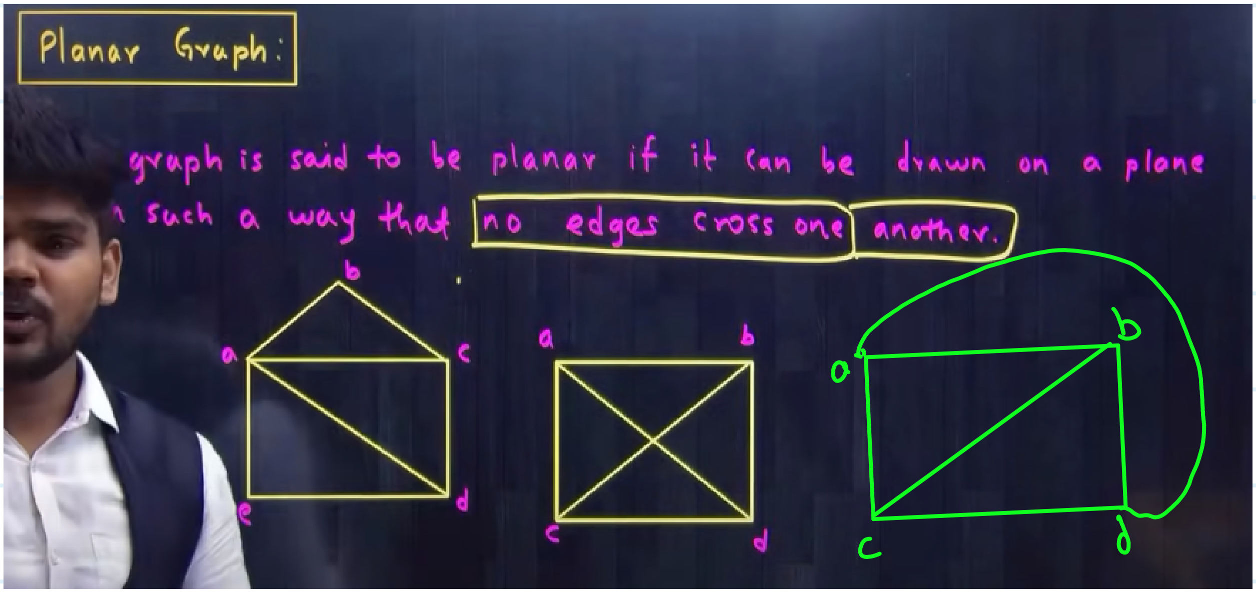
$\therefore \quad 4+4+2+2+2+2 = 2e$

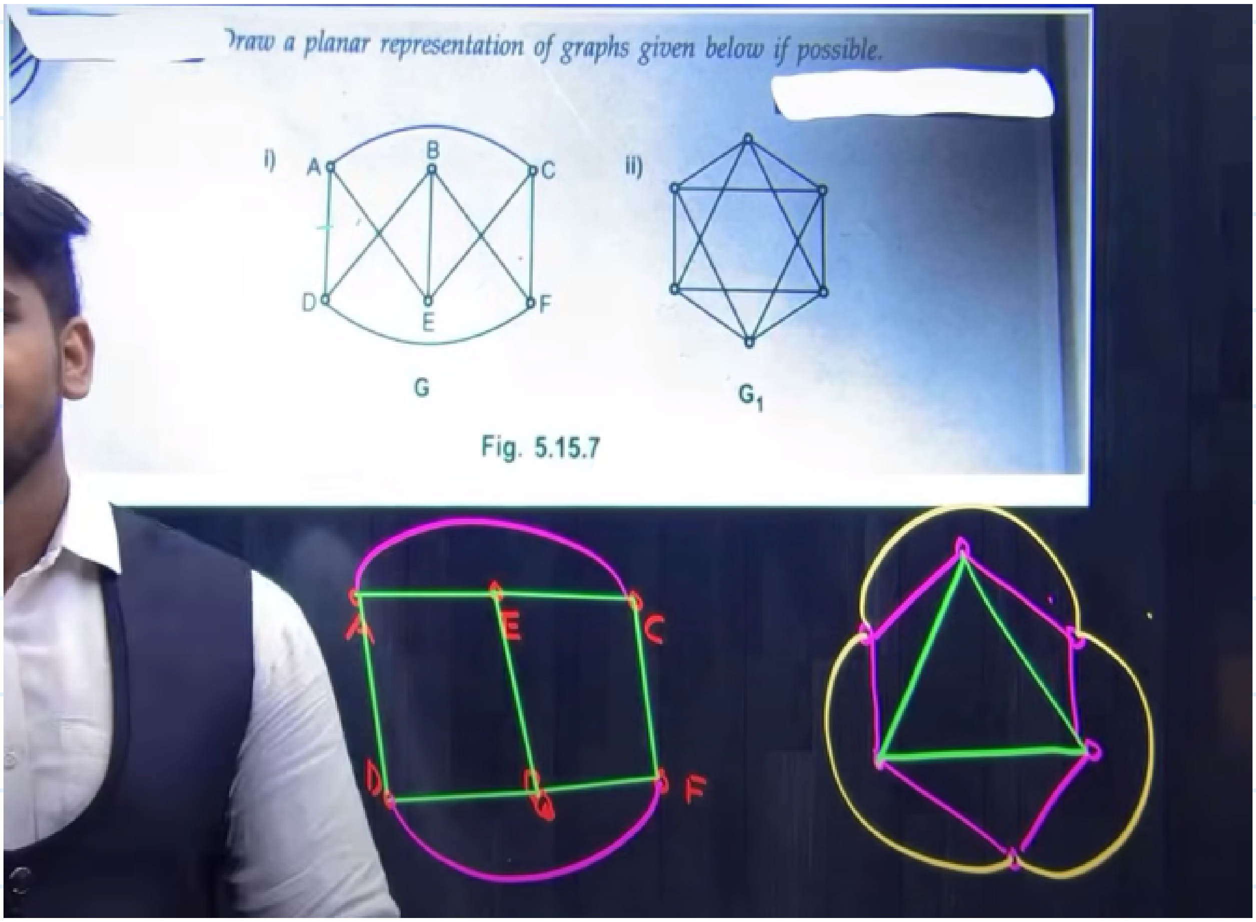
$\therefore \quad e = 8$





* Planar Graph





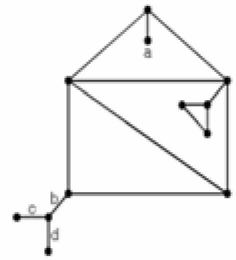
- **Theorem :** *Euler's connected planar graph theorem*

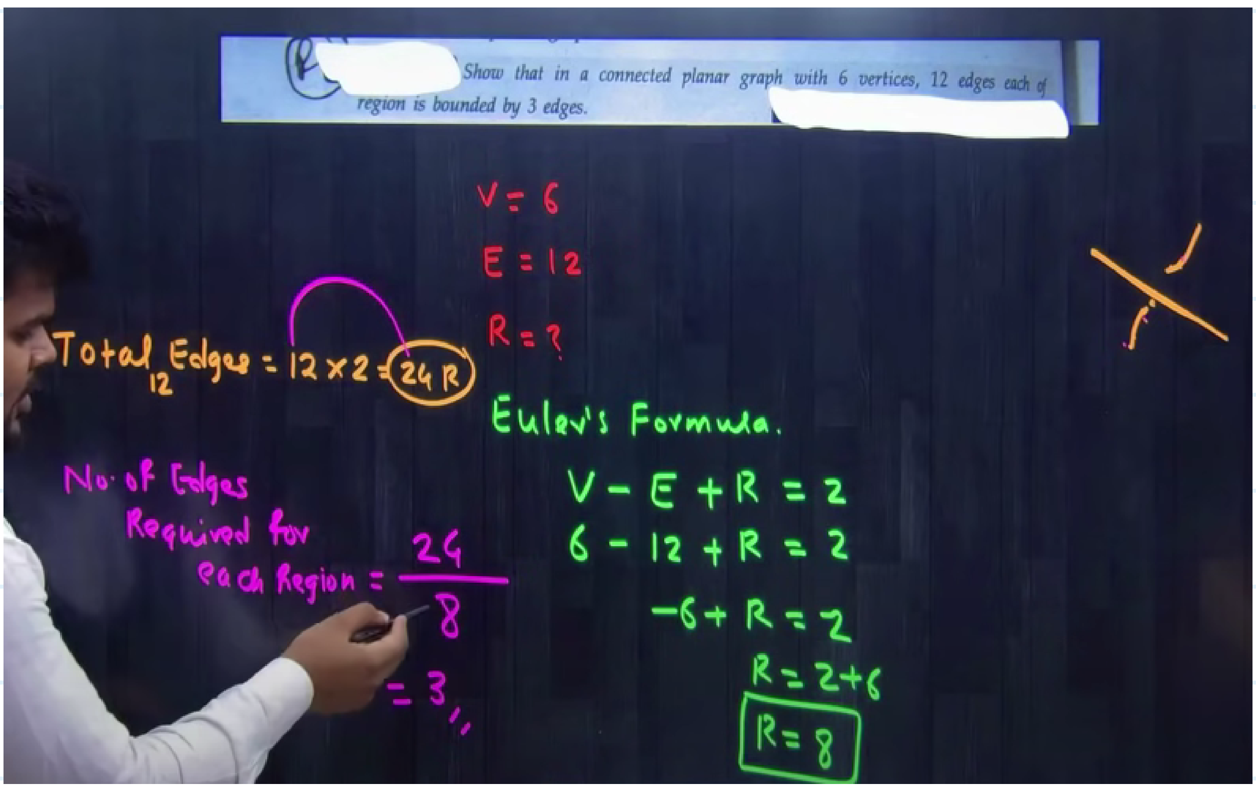
$$v - e + r = 2$$

v → number of vertices

e → number of edges

r → number of regions





For Subgraphs → Refer Notes