5.3 Test

CONTOUREDUCATION

VCE Specialist Mathematics ½
Graph Theory I [5.3]
Test

20 Marks. 1 Minute Reading. 16 Minutes Writing.

Results:

Test Questions	_____ / 20

## Section A: Test Questions (20 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. A graph consists of a set of objects called **vertices** together with a set of unordered pairs of vertices, called **edges**.	✓	
b. The number of edges that are directly connected to a particular vertex is the "degree" of the vertex and is generally denoted as deg(V), where V is the vertex.	✓	
c. A **simple graph** is one in which pairs of vertices are always connected by one edge.	✗	✓
d. A **connected** graph is a graph where it is possible to reach all vertices by moving along edges.	✓	
e. A **complete** graph is a simple graph in which each vertex is connected to every other vertex.	✓	
f. The number of edges in a complete graph K_n is given by the formula: $\frac{n(n+1)}{2}$.		✓
g. In graph theory, an isomorphism is where the corresponding vertices in both graphs are connected by the same edges.	✓	
h. A subgraph is a graph whose vertices and edges are all contained within the original graph.	✓	

Space for Personal Notes

Question 2 (2 marks)
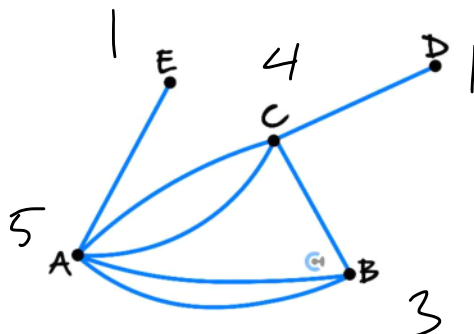
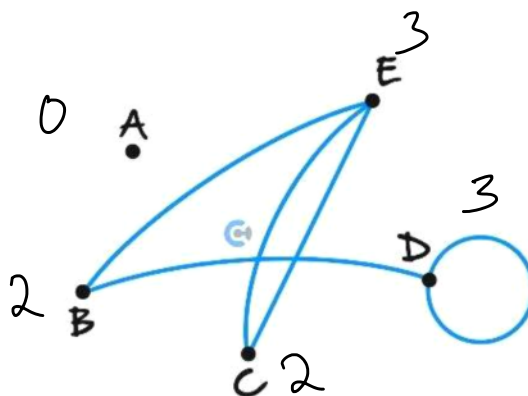Write the vertex sets and edge sets for the graph below.

V set = { A, B, C, D }

E set = { AB, CD
AD, BC }

_____

_____

_____

_____
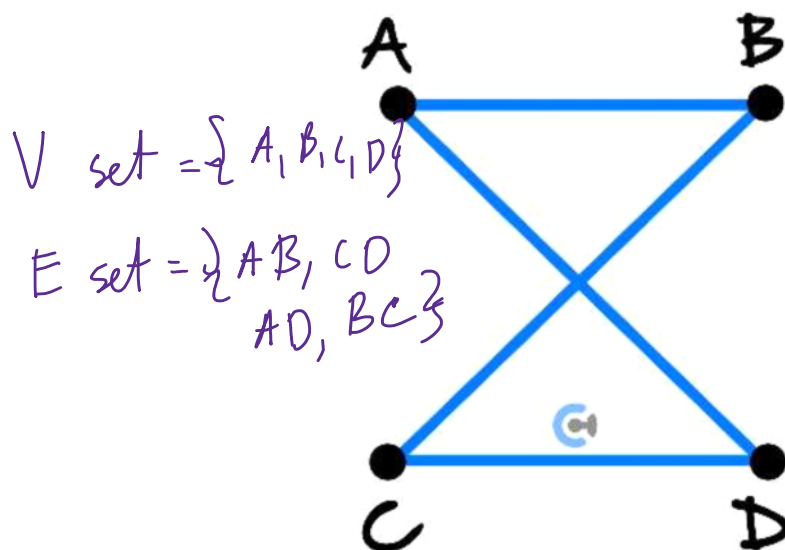
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Question 3 (4 marks)

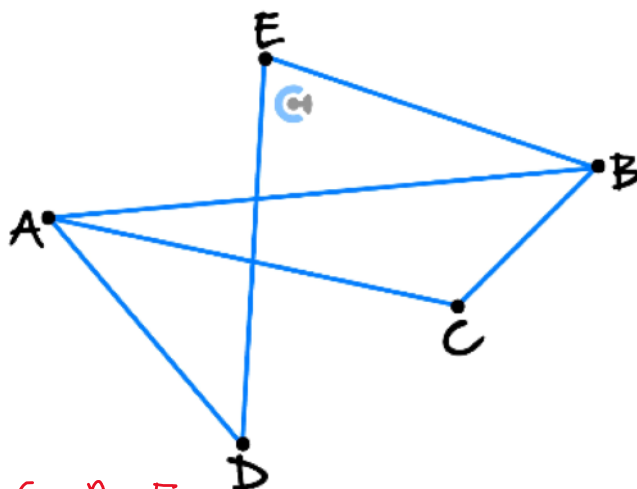Identify the degree of each vertex in the following graphs.

a. (2 marks)

_____

_____

_____

_____

b. (2 marks)

_____

_____

_____

_____

Question 4 (2 marks)

Construct the adjacency matrix for the given graph.

$$
\begin{array}{c|ccccc}
 & A & B & C & D & E \\
\hline
A & 0 & 1 & 1 & 1 & 0 \\
B & 1 & 0 & 1 & 0 & 1 \\
C & 1 & 1 & 0 & 0 & 0 \\
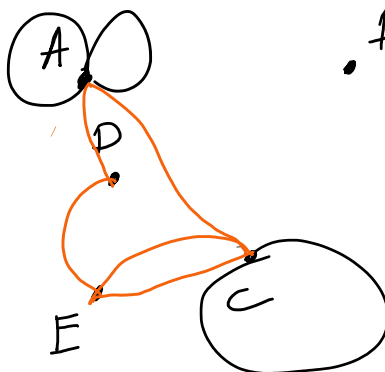D & 1 & 0 & 0 & 0 & 1 \\
E & 0 & 1 & 0 & 1 & 0 \\
\end{array}
$$

Space for Personal Notes

Question 5 (3 marks)

Draw graphs to represent the following adjacency matrices.

$$
\begin{array}{c c}
& \begin{matrix} A & B & C & D & E \end{matrix} \\
\begin{matrix} A \\ B \\ C \\ D \\ E \end{matrix} &
\begin{bmatrix}
2 & 0 & 1 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 2 \\
1 & 0 & 0 & 0 & 1 \\
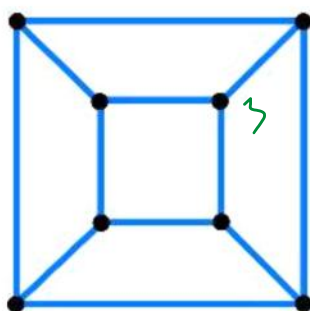0 & 0 & 2 & 1 & 0
\end{bmatrix}
\end{array}
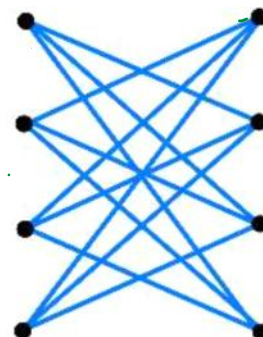$$

B is isolated

Space for Personal Notes

Question 6 (2 marks)

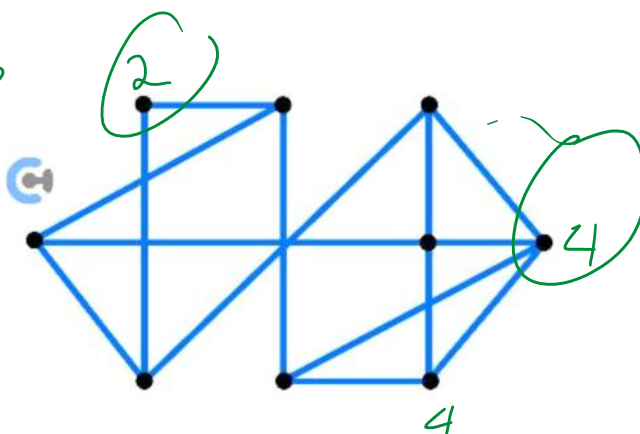For each of the following pairs of graphs, determine whether the graphs are isomorphic.
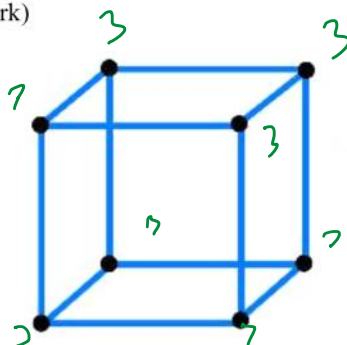
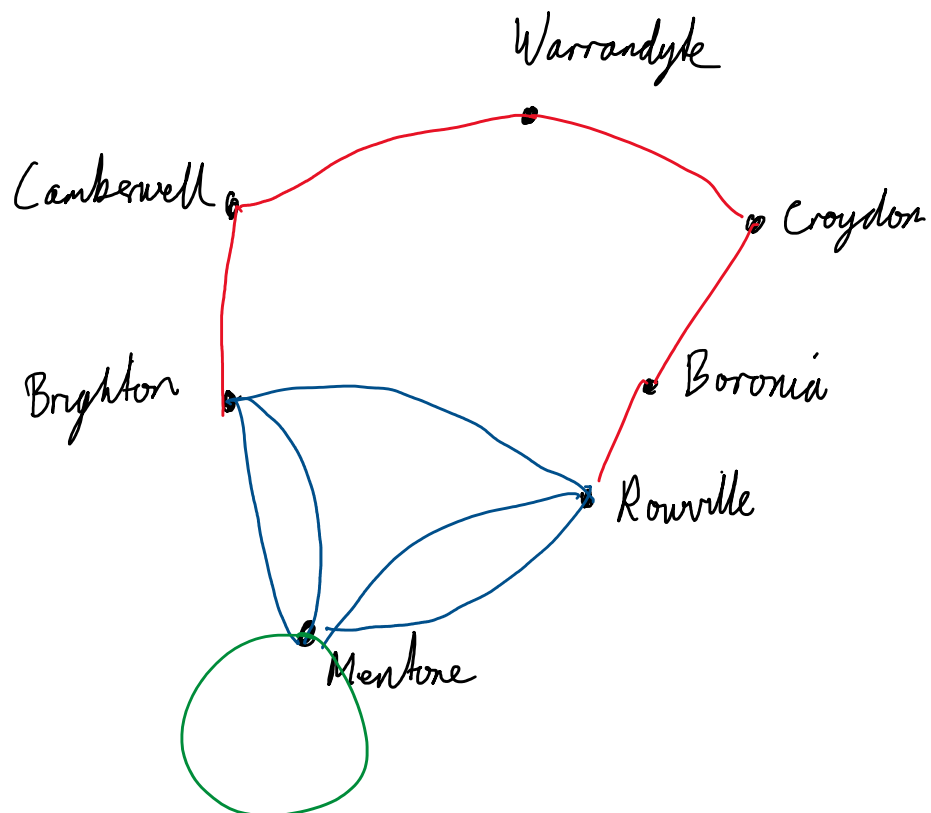**a.** (1 mark)

3-regular, 8 vertices, connected

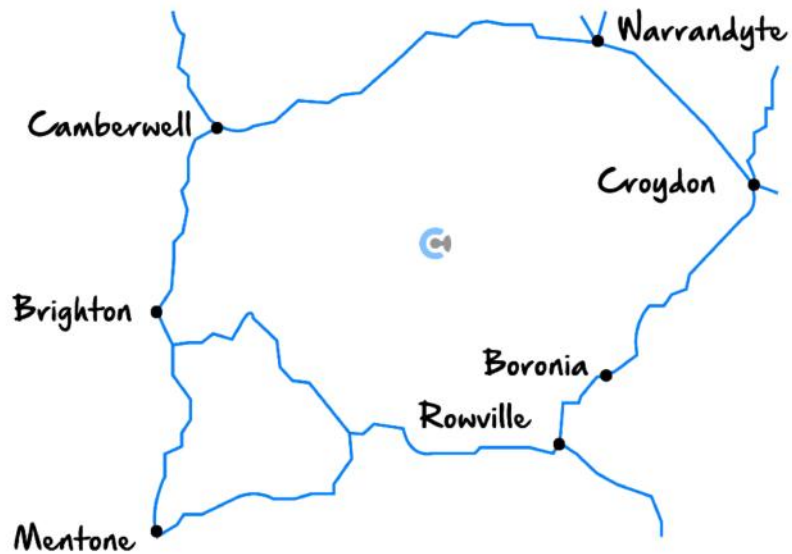*Isomorphic*

_____

_____

b. (1 mark)

Not isomorphic

_____

_____

Space for Personal Notes

Question 7 (3 marks)

Using the map below, represent the paths between the towns as a graph.

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