

Q1 What is a graph?

4 Points

Answer the following questions, given that we have an undirected graph $G = (V, E)$.

Q1.1 What is V

1 Point

V is the set of vertices.

☒ True

☐ False

Explanation

By definition.

Q1.2 What is E

1 Point

E is a set of unordered pairs from $V \times V$.

☒ True

☐ False

Explanation

By definition.

Q1.3 Inequality on V and E

1 Point

$|V| \text{ ? } |E|$ for all graphs.

☐ $>$

☐ $<$

☐ $\geq$

☐ $\leq$

☒ None of the others

Explanation

For an arbitrary graph, the number of edges could be greater than, less than or equal to the number of vertices.

Q1.4 What is a connected component

1 Point

$|E|$ is the number of connected components.

☐ True

☒ False

Explanation

The definition of a connected component is a maximal set of vertices where all pairs of vertices are connected. A pair of vertices is connected if there is a path between the vertices. A path between u and v is a sequence of vertices $u = v_0, \dots, v_k = v$ where $\{v_i, v_{i+1}\} \in E$.

Q2 Example

3 Points

Consider an example graph $G = (V, E)$, with $V = \{A, B, C, D\}$ and $E = \{\{A, B\}\}$.

Q2.1 Counting connected components

1 Point

How many connected components does G have?

- ☐ 1
- ☐ 2
- ☒ 3
- ☐ 4

Explanation

The connected components are $\{A, B\}$, $\{C\}$, $\{D\}$. A and B are connected by a path, therefore they form one connected component. C and D are isolated, as such they are each individual connected components.

Q2.2 Maximum degree

1 Point

What is the maximum degree of any vertex in G ?

- ☐ 0
- ☒ 1
- ☐ 2

Explanation

A and B both have degree one, as the only edge in G connects them.

Q2.3 Incident

1 Point

What vertices are incident to edge (A, B) ?

☐ B, C

☒ A, B

☐ C, D

☐ A, C

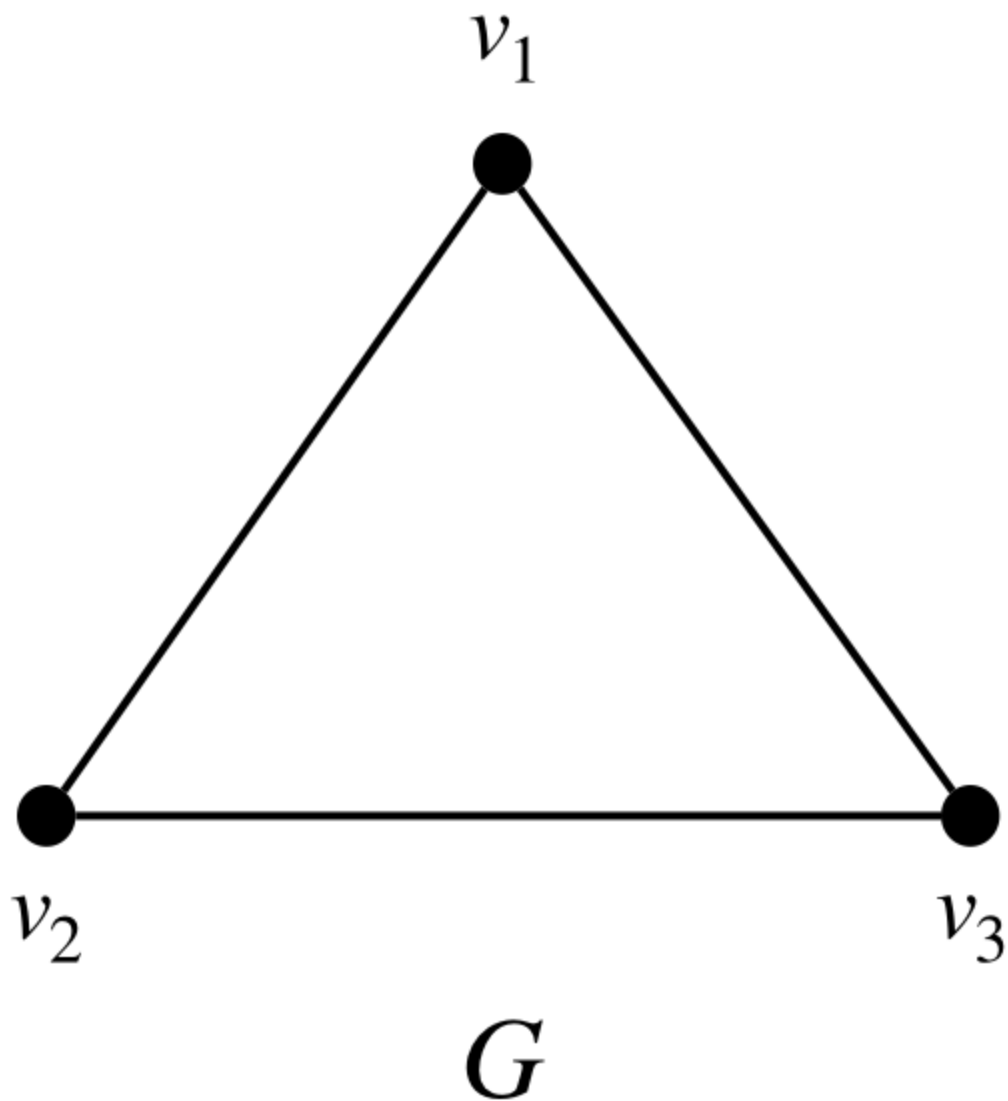
Explanation

The definition of an edge being incident to a vertex is that the ordered pair contains that vertex.

Q3 Paths, Walks, and Cycles

2 Points

Consider the graph G below and the walk $\{v_2, v_3\}, \{v_3, v_1\}, \{v_1, v_2\}$ in G .



Q3.1 Path?

1 Point

The walk described above is a simple path.

☐ True

☒ False

Explanation

The walk above repeats the vertex v_2 , so it is not a simple path.

Q3.2 Cycle?

1 Point

The walk described above is a cycle.

☒ True

☐ False

Explanation

The walk starts and ends at v_2 . Besides v_2 , it has no repeat vertices, and it has no repeat edges.