

CHAPTER RESOURCE: VOCABULARY LIST

Term	Definition
Graph / Network	Shows connections between people, places, or objects—not a coordinate-plane graph.
Vertex	A point in a graph; also called a node.
Edge	Connects two vertices; also called an arc or link.
Loop	An edge from a vertex to itself (counts as 2 for degree).
Adjacent (vertices)	Two vertices connected by an edge.
Equivalent graph	Same connections; shape and placement may differ.
Parallel edges	Two or more edges between the same pair of vertices.
Degree	Number of edges at a vertex (a loop adds 2).
Even vertex / Odd vertex	Even: even degree. Odd: odd degree.
Order	The number of vertices in the graph.
Path	A sequence of adjacent vertices and connecting edges.
Circuit	A closed path; same start and end vertex.
Bridge (cut edge)	An edge whose removal disconnects the graph; not a physical bridge on a map.
Euler path	Uses every edge in the graph exactly once.
Euler circuit	An Euler path that starts and ends at the same vertex.
Hamilton path	Visits every vertex exactly once.
Hamilton circuit	A Hamilton path that starts and ends at the same vertex.
Weight (of a route)	Sum of edge weights along a path or circuit.
Component	A connected piece of a graph.

CHAPTER RESOURCE: TYPES OF GRAPHS

Graph Type	Definition	Example
Connected	You can travel from any vertex to any other along edges ("one piece").	A single network with no isolated parts
Disconnected	Not connected; the graph has two or more components.	Two separate graphs drawn with no shared vertices
Tree	A connected graph with no circuits.	A connected graph with 5 vertices and 4 edges, no loops
Complete	Every vertex is directly connected to every other vertex.	K4 — four vertices, each pair joined by one edge
Weighted	Edges have numbers (weights) representing cost, distance, or time.	A road map with mile labels on each segment

TOPIC: INTRO TO GRAPH THEORY

Intro to Graph Theory



◆ A **graph (network)**, shows _____ between people, places, or objects (NOT x - y coordinate plane).

► Graphs are made up of _____, called **vertices**, joined by straight or curved _____ called **edges**.
(nodes) (arcs)

New

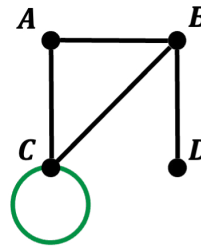
Graph Theory

Vertices:
singular = vertex

Edges:

Adjacent Vertices: share an edge
► Ex: M is adjacent to $[C | N | P]$

◆ In graph theory, a **loop** is an edge from one vertex to itself.

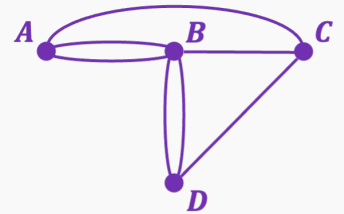


TOPIC: INTRO TO GRAPH THEORY

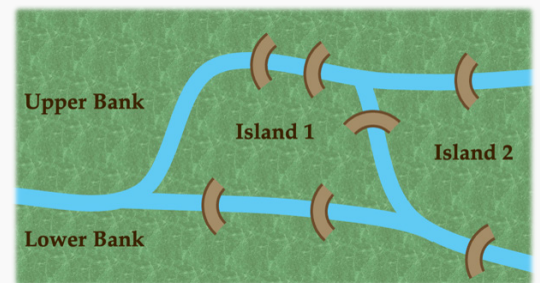
PRACTICE

The graph below represents a map of Königsberg, where vertices are land masses and edges are the bridges that connect them. Use the graph to answer the questions below.

(A) Find the number of bridges (edges).



(B) What is the order of this graph? (*order = number of vertices*)



(C) Are landmasses *B* & *C* connected (*adjacent*)?

(D) Are landmasses *A* & *D* connected (*adjacent*)?

TOPIC: INTRO TO GRAPH THEORY

EXAMPLE

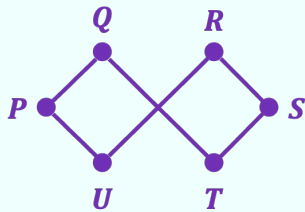
Draw the graph with the following properties:

Vertices: P, Q, R, S, T, U ; Edges: PQ, QR, QS, QT, ST, SU

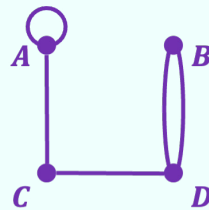
EXAMPLE

For each graph shown, draw an *equivalent* graph, meaning it has the same vertices & same edges.

(A)



(B)



TOPIC: INTRO TO GRAPH THEORY

Drawing Graphs to Model Situations

- ◆ To draw a graph that models a real situation, first identify what **vertices** and **edges** represent.
 - ▶ Then, draw a **point** for each **vertex** and a **line** for each _____ (*shape & scale don't matter*).

EXAMPLE

Draw a graph to represent the connections between people.

💡 *Hint: Use vertices = people, edges = shared clubs.*

- ▶ Callie and Colleen are in book club together.
- ▶ Jenn and Callie play volleyball on the weekends.
- ▶ Jenn, Colleen, and Nick play board games on Wednesdays.

EXAMPLE

The table shows the schedule for an upcoming hockey tournament including the Penguins, the Polar Bears, The Elk, the Wolves, the Moose, and the Seals. Draw a graph to represent team matchups.

💡 *Hint: Use vertices = teams, edges = games scheduled.*

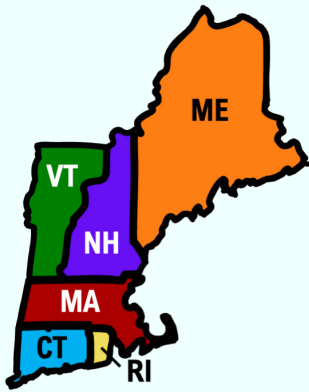
Team 1	Team 2	Team 3	Team 4
Penguins	Wolves	Friday	8:00 a.m.
Polar Bears	Elk	Friday	12:00 p.m.
Moose	Seals	Friday	4:00 p.m.
Seals	Elk	Saturday	8:00 a.m.
Wolves	Moose	Saturday	12:00 p.m.
Polar Bears	Penguins	Saturday	4:00 p.m.

TOPIC: INTRO TO GRAPH THEORY

EXAMPLE

Draw the graph to represent the map of US States:

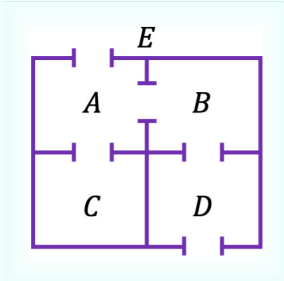
💡 *Hint: Use vertices = states, edges = shared borders.*



EXAMPLE

Draw the graph to represent the floor plan:

💡 *Hint: Use vertices = rooms/outside, edges = doorways.*



EXAMPLE

Draw the graph to represent the neighborhood in the map.

💡 *Hint: Use vertices = corners & intersections, edges = streets.*



TOPIC: INTRO TO GRAPH THEORY

PRACTICE

Select the graph that best represents the following train routes between major European cities.

- ▶ Barcelona has trains that go to Paris and Milan.
- ▶ Paris has trains that go to Barcelona, Milan, and Amsterdam.
- ▶ Amsterdam has trains that go to Paris, Milan, and Berlin.
- ▶ Milan has trains that go to Barcelona, Paris, Amsterdam, Rome, and Vienna.
- ▶ Rome has a train that goes to Milan.
- ▶ Berlin has trains that go to Amsterdam and Vienna.
- ▶ Vienna has trains that go to Milan and Berlin.

