



Arizona's College and Career Ready Standards – Mathematics – HS Contemporary Mathematics Placemat

HS Conceptual Category: Contemporary Mathematics

Domains	Discrete Mathematics			
Clusters	Understand and apply vertex-edge graph topics			
Mathematical Practices	1. Make sense of problems and persevere in solving them.	2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others.	4. Model with mathematics.
			5. Use appropriate tools strategically.	6. Attend to precision.
				7. Look for and make use of structure.
				8. Look for and express regularity in repeated reasoning.

Discrete mathematics is contemporary mathematics. This area of mathematics is very relevant in today's technologically advanced society. Discrete mathematics provides the underpinnings for many features of the Internet, from encryption of credit card numbers to decompression and compression of photographs, music, and video. It also informs the efficiency of our communication and transportation systems, such as determining the shortest path through a network or identifying the most cost effective design of airline or bus routes. The power of discrete mathematics is exemplified through the motivational impact on students. They are not only immersed in interesting mathematics but are actively engaged in the "doing" of mathematics. Mathematics is not a bystander sport.

Discrete mathematics topics, particularly vertex-edge graphs, afford students the opportunity to access problem solving in a meaningful context. Students strengthen their skills in problem solving, reasoning, conjecturing, communication, analysis, and proof. They apply the Standards for Mathematical Practice as they solve discrete mathematics problems. Discrete mathematics courses play an increasingly important role in the high school curriculum as possible pathways for those students who seek meaningful 4th credit courses that connect to technology and the needs of the 21st century learner.

Graph theory is the formal study of vertex-edge graphs. Unlike graphs used in data analysis, vertex-edge graphs are used to visually represent problem situations. Vertex-edge graphs are used to model and solve problems related to paths, circuits, or the relationship among a set of objects.

Connections to Modeling. Mathematical modeling occurs when students follow a multistep process of solving problems and represent the key ideas through a visual representation. These visual representations allow students multiple entry points for solving a problem, ensuring material that is both engaging and accessible. Examples of real word situations that could be modeled using a vertex-edge graph are 1) planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player or 2) engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.

Discrete Mathematics (CM-DM)★

Understand and apply vertex-edge graph topics

AZ.HS.CM-DM.1. Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices.

AZ.HS.CM-DM.2. Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.

AZ.HS.CM-DM.3. Devise, analyze, and apply algorithms for solving vertex-edge graph problems.

AZ.HS.CM-DM.4. Extend work with adjacency matrices for graphs, such as interpreting row sums and using the n th power of the adjacency matrix to count paths of length n in a graph.