Summary

HL- Networks and graph theory

Subject	Year	Start date	Duration
Mathematics: applications and interpretation	IB2	Week 4, November	6 weeks

Course Part

Description

In this unit you will learn how to use a network to maximise profits, minimise costs, find long-term conditions and many more logistical situations.

Inquiry & Purpose

Inquiry / Higher Order Questions

Type	Inquiry Questions
Content-based	How do you think navigation works in relation to a network problem?
Skills-based	What circumstances might you have consider when using a network to model a cities traffic system?

Curriculum

Aims

Develop logical and creative thinking, and patience and persistence in problem solving to instil confidence in using mathematics

Objectives

Reasoning: Construct mathematical arguments through use of precise statements, logical deduction and inference and by the manipulation of mathematical expressions.

Inquiry approaches: Investigate unfamiliar situations, both abstract and from the real world, involving organizing and analyzing information, making conjectures, drawing conclusions, and testing their validity.

Syllabus Content

Topic 3: Geometry and trigonometry

AHL Content

AHL 3.14

Graph theory: Graphs, vertices, edges, adjacent vertices, adjacent edges. Degree of a vertex.

Simple graphs; complete graphs; weighted graphs.

Directed graphs; in degree and out degree of a directed graph.

Subgraphs; trees.

AHL 3.15

Adjacency matrices. Walks.

Number of k-length walks (or less than k-length walks) between two vertices.

Weighted adjacency tables.

Construction of the transition matrix for a strongly- connected, undirected or directed graph.

AHL 3.16

Tree and cycle algorithms with undirected graphs.

Walks, trails, paths, circuits, cycles.

Eulerian trails and circuits. Hamiltonian paths and cycles.

Minimum spanning tree (MST) graph algorithms:

Kruskal's and Prim's algorithms for finding minimum spanning trees.

Chinese postman problem and algorithm for solution, to determine the shortest route around a weighted graph with up to four odd vertices, going along each edge at least once.

Travelling salesman problem to determine the Hamiltonian cycle of least weight in a weighted complete graph.

Nearest neighbour algorithm for determining an upper bound for the travelling salesman problem.

Deleted vertex algorithm for determining a lower bound for the travelling salesman problem.

ATL Skills

Approaches to Learning

Thinking

Developing IB Learners

Learner Profile

Inquirers

Knowledgeable

Thinkers