Hamiltonian paths and cycles

Year 11
General Mathematics

www.maffsguru.com

Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Unit 1 and 2 General Mathematics course.

- Know what a Hamiltonian Path is
- Know what a Hamiltonian Cycle is

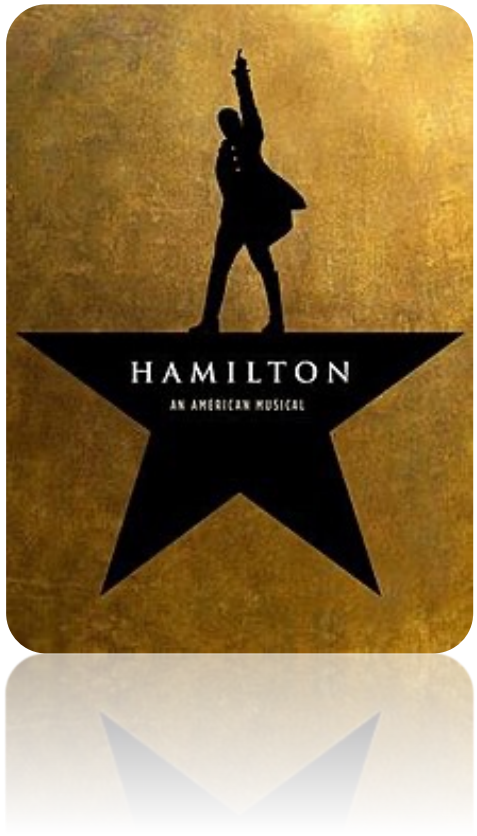
Recap

Last lesson we built on the following keywords by looking at Eulerian Cycles and Eulerian Paths.

- Walk
- Trial
- Path
- Circuit
- Cycle

Not to be out done, Hamilton wanted to have a piece of the action.

"I'm not throwin' away my shot"



Wrong Hamilton

Sigh. Not everything is about musical theatre!

It's important to note that Hamilton came at things from a **vertices** point of view.

This is different from Euler as he looked at **edges**.

So, Hamilton said that for it to have a **Hamiltonian Path** you must pass through every vertex in a connected graph. It may, or may not, involve all of the edges in the graph.

He went on to say that a **Hamiltonian Cycle** is a Hamiltonian Path which starts and ends at the same vertex.

Why would we need to know this?

I'm planning a holiday!

No theme parks this time, just a gentle walk in the county … so, I've decided I want to visit the following places. I don't want to get there more than once, so I need to find the best way.

- Bendigo,
- Halls Gap,
- Horsham,
- Stawell, and
- Ouyen

This is an example of a Hamiltonian Path.

Why would we need to know this?

I'm quitting teaching and I'm going to work for DHL.

They have given me a lot of packages many of which have to be taken to the same places.

I don't want to keep going backwards and forwards, so I'm going to group all the packages in one place and then deliver them. This means I'm not going to visit each place more than once.

As I need to return the van to the depot, I need to start and end at the same place.

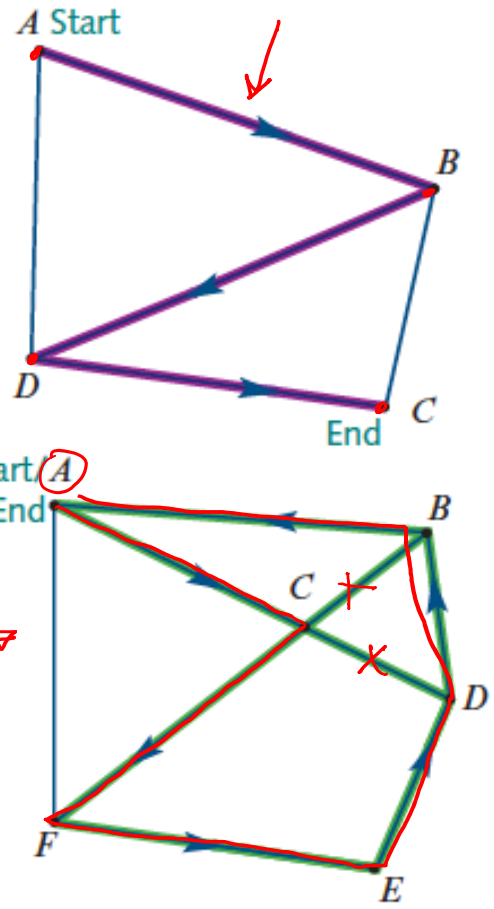
This is an example of a **Hamiltonian Cycle**.

Important information

Remember, it's all about the nuances!

A Hamiltonian Path involves all the vertices but not necessarily all the edges. This is also true of a Hamiltonian Cycle.

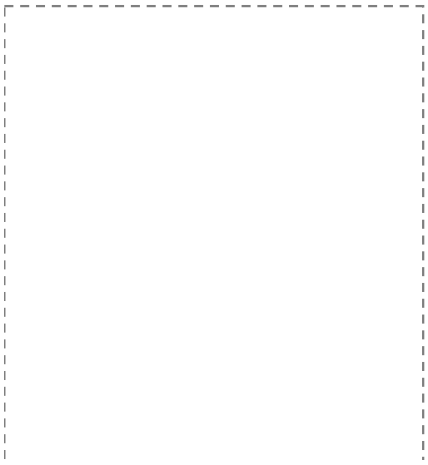
The examples shows a **Hamiltonian Path** and **Hamiltonian Cycle**.



Could there be rules to help us with this?

Nope.
Sorry.
Not for this one.

You simply have to use trial and error to see if it is a Hamiltonian Path or Cycle.



Work to be completed

The following represents the minimum work which should be completed.

The more questions you answer from each exercise, chapter review and Checkpoints the better you chance of gaining an excellent study score in November.

General Mathematics Units 1 and 2 Textbook

Chapter 9
Exercise 9H Hamiltonian paths and cycles
Questions: All