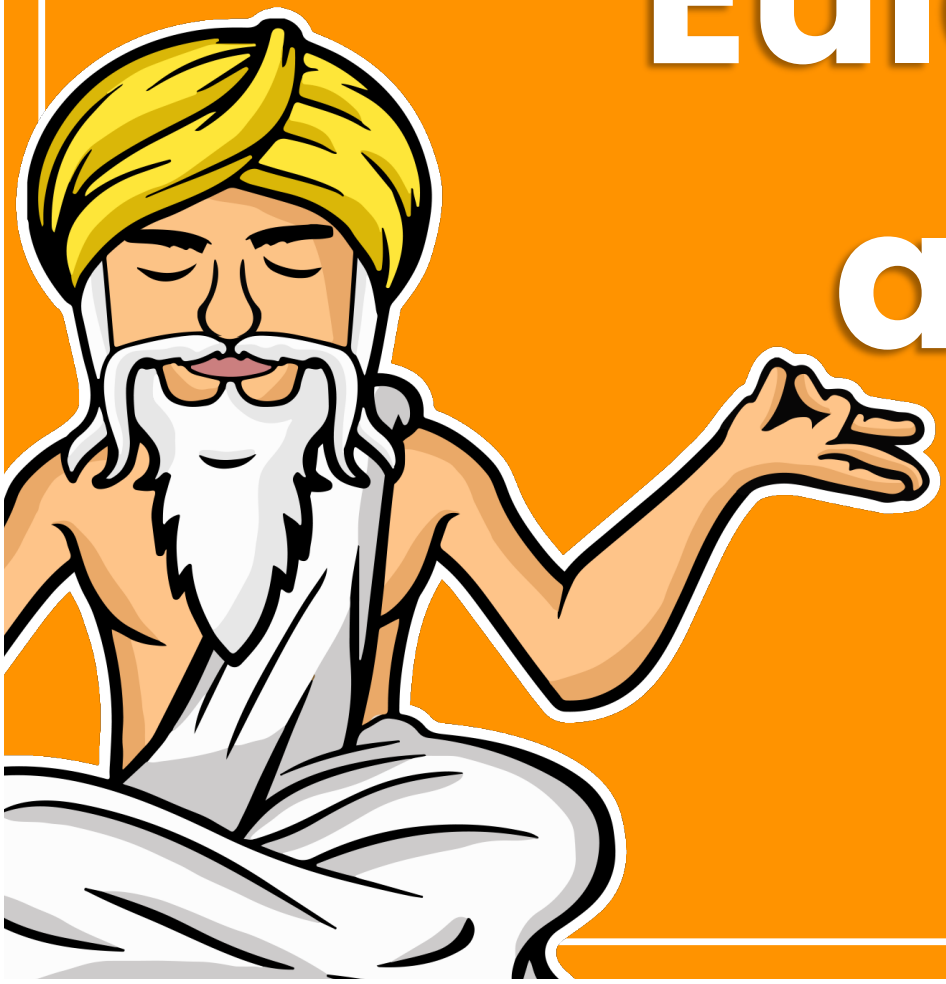
Eulerian trails and circuits



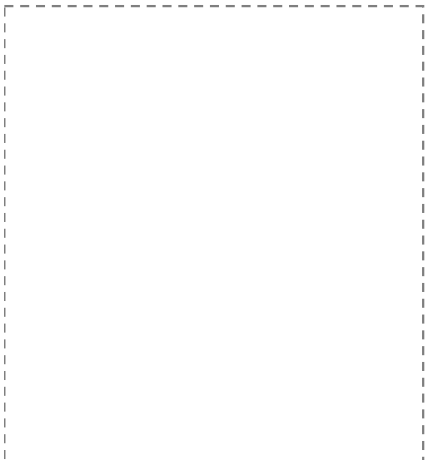
Year 11
General Mathematics

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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 an Eulerian Trail is
- Know what an Eulerian Circuit is



Recap

As if we didn't already have a summary book filled with useful (useless?!) information, we have even more to contend with.

It's important to understand the difference between the following terms and, if possible, memorise them!

- Walk
- Trial
- Path
- Circuit
- Cycle

Last lesson we looked at how we can tell is something is traversable. Now, we are back to our old friend Euler who has two things named after him!

Why do we need this stuff?

Imagine, one day, you become a postman.

You want to protect your tired old feet, so you want to make sure that the route you choose, only had you going down each street once.



Why do we need this stuff?

I love, love, love, love theme parks.

One of my favourite rides was the “Duelling Dragons” at Islands of Adventure in Orlando.

One ride I did NOT like was X^2 at Six Flags Magic Mountain.

OH MY GOD …

When I went to the theme park, I would always map out my route to make it the most efficient. This ensured I did not recover ground and I got to visit every ride.

The stuff we are looking at is a real world and practical application of this stuff.



Eulerian Trail

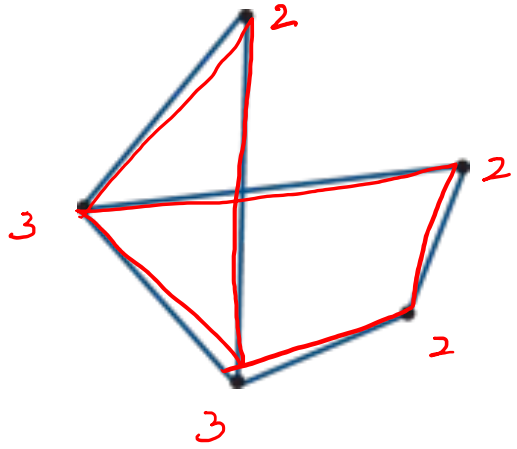
OK, so, from memory (he says reading the textbook) a trail is:

A trail is a walk with no repeated edges.

With a walk being:

A walk is a sequence of edges, linking successive vertices, that connects two different vertices in a graph.

So, an **Eulerian Trail** is a trail which includes every edge in a graph.



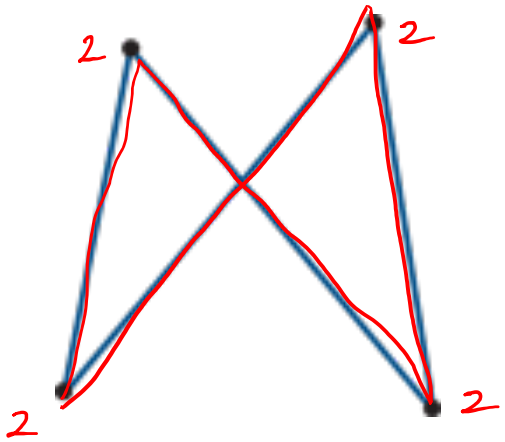
Eulerian Circuit

Not content with having lots of things named after him, he wanted even more! He didn't know when to stop.

An **Eulerian circuit** is a circuit that includes every edge in a graph.

Remember:

A circuit is a walk that has no repeated edges and starts and ends at the same vertex.



Could there be rules to help us with this?

Of course! This is Mathematics …

Eulerian Trials:

- The graph must be connected
- Must have two odd degree vertices which will start at one ~~off~~ odd vertex and finish at the other.

Eulerian Circuit:

- The graph must be connected
- Must have all vertices with an even degree which will start and end at the same vertex.

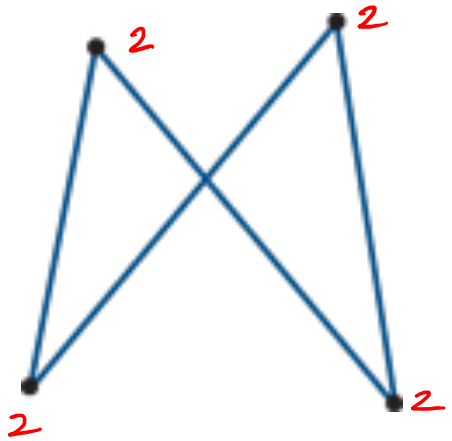
Note: A graph with more than two odd degree vertices is not traversable. As a consequence, it does not have an Eulerian trail or an Eulerian circuit.

Example: Identifying Eulerian Trails and Circuits

For each graph:

- Determine whether the graph has an Eulerian trail, an Eulerian circuit or neither, and state why.
- If the graph has an Eulerian trail or an Eulerian circuit, show one example.

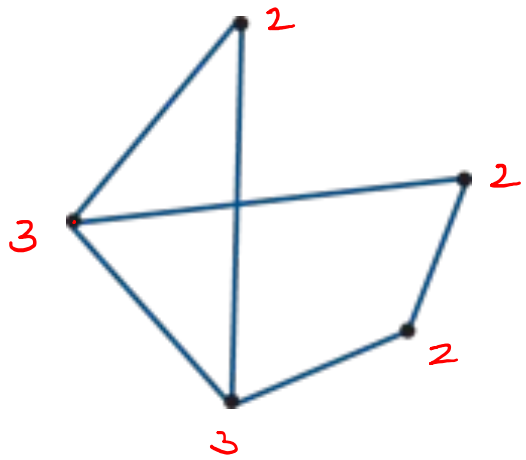
Eulerian Circuit



Example: Identifying Eulerian Trails and Circuits

For each graph:

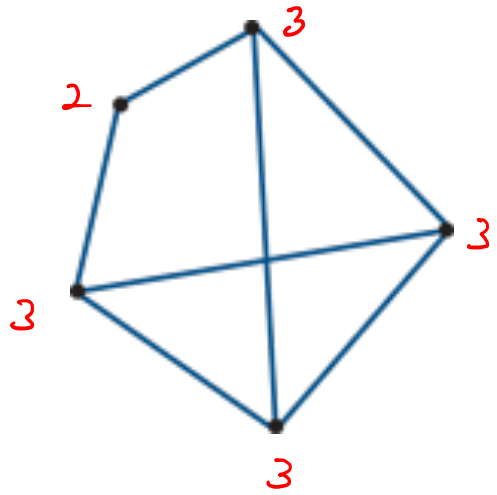
- Determine whether the graph has an Eulerian trail, an Eulerian circuit or neither, and state why.
- If the graph has an Eulerian trail or an Eulerian circuit, show one example.



Example: Identifying Eulerian Trails and Circuits

For each graph:

- Determine whether the graph has an Eulerian trail, an Eulerian circuit or neither, and state why.
- If the graph has an Eulerian trail or an Eulerian circuit, show one example.



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 9G Eulerian trails and circuits
Questions: All