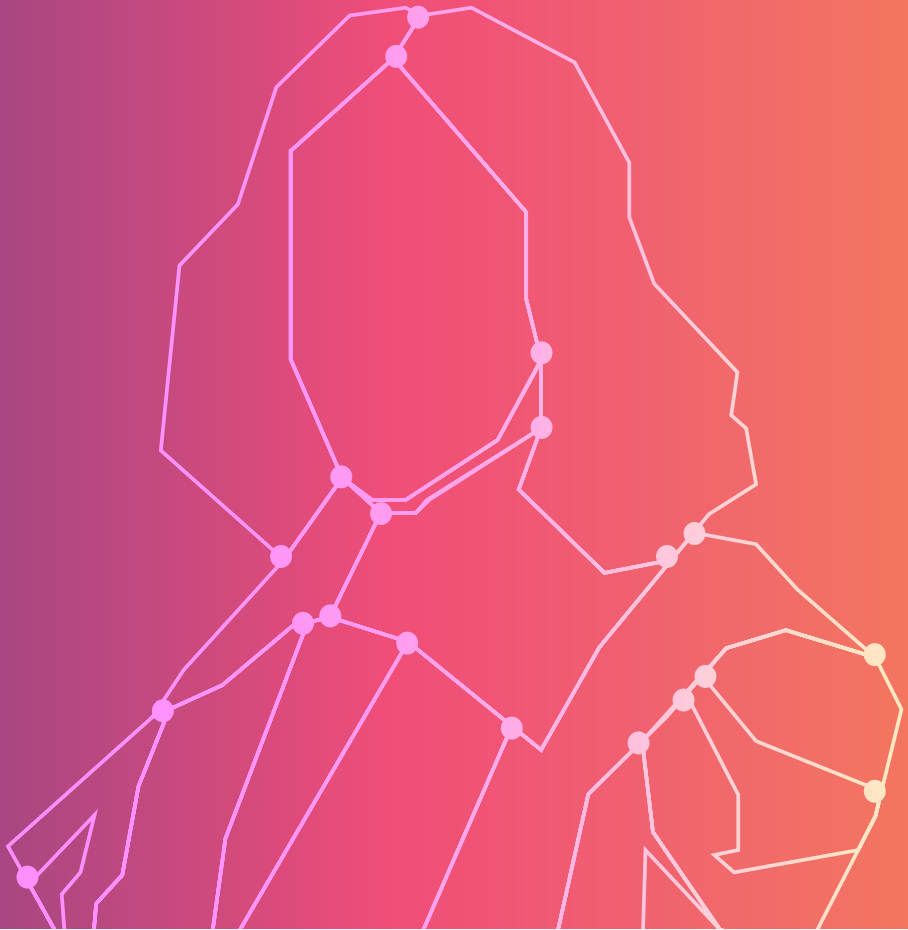


01



The four Colour Theorem

Topic: Graph theory

Theme: Discovery of the notion of graph

Abilities: Knowledge of EU countries

Material: Felt-tipped pens

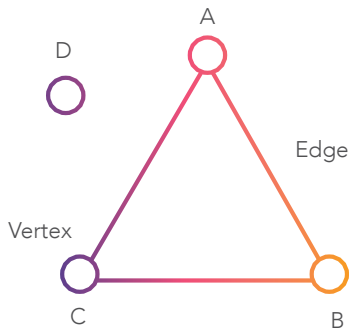
Level France: Age 14/18



What is a graph ?

In mathematics, and more specifically in graph theory, a graph is a schema containing points called vertex, connected or not by segments called edges.

A is a vertex, the segment $[AB]$ is an edge connecting A to B.
D is an isolated vertex, not connected to another vertex.



Graphs are the basic subject studied by graph theory. Many problems and theorems in graph theory have to do with various ways of colouring graphs.

Typically, one is interested in colouring a graph so that two adjacent vertex would not be the same colour, or with other similar restrictions.

One of the most famous theorems is the four colour theorem :

In 1852, Francis Guthrie, an English cartographer, discovered that it only took four colours to colour the map of the cantons of England so that two neighbouring cantons would not be the same colour.

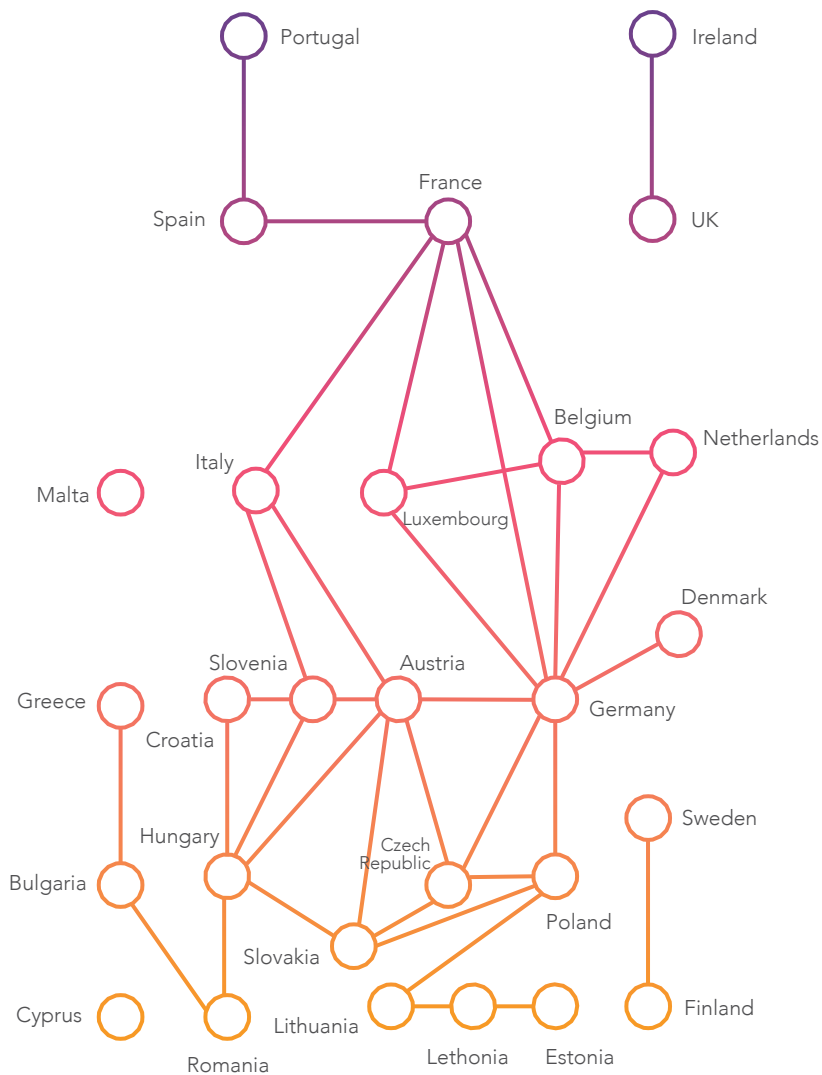
After many episodes, and more than 120 years later, two American mathematicians provided a mathematical proof thanks to the

demonstration of the 4-colour theorem which states «whatever the complexity of a geographical map, four colours are sufficient to colour it without two border regions being the same colour». For the first time, a computer was used to complete a demonstration.

1

We drew the map of the member countries of the European Union in 2019 using a graph. Colour each vertex of the graph with a colour, 2 vertex connected by an edge must be of a different colour.

4 different colours are enough!



2

Colour the map of Europe with 4 different colours.
Bordering territories must not be the same colour.
Follow the resolution of the graph!

