[Graph theory terminology]

In the mathematical field of Graph Theory, we are interested in properties and results pertaining to relationships and connections between objects. The terminology is confusing – but we're no longer talking about Graphs as charts with axes and variables, but rather structures like this, comprised of nodes or vertices, edges, and sometimes additional information.

The edges usually represent the existence of relationships or connections between the nodes. For example, if we use a graph to represent the bridge problem, each edge represents a bridge, each node a land mass; however we could also representa social network in this way, where each node represents a person and each edge indicates the two people follow each other or are friends.

In general, each edge only runs between two nodes and so If we see two edges cross, that doesn't allow new connections to form. (although we can also have an edge that goes from a node to itself),

In some circumstances, we can also have directed graphs, which might indicate a one-way street, or in social media, you can follow someone without them following you. So we can already see that what is "allowed" will often depend on the situation.

Later on, we'll also look at situations where you can assign cost or distance to these edges, for example, if the graph represents a train network and we want to indicate the time between any two stations.

Now a key idea that makes graph theory very different from geometry, is that often the actual position of a node, or the length of an arc is meaningless. For example, in solving the Königsburg problem, it doesn't matter whether we represent the bridge like this, or like this, or like this – all that matters is whether or not to nodes are connected, and how many times they are connected.

So for the terminology, we have nodes/vertices, edges/arcs, then we refer to the 'degree' of a vertex as the number of arcs going in or out – and if a node is connecting to itself, this counts as 2. We can also count faces – as long the graph is drawn so that none of the edges cross over one another. Then any region enclosed by edges and vertices is a face, and we also count the outside area as a face. These terms should all be familiar to you if you've studied polyhedrons, and in fact a number of properties about graphs can be derived from properties of polyhedrons.