Concept – Euler's Formula

A planar graph ____

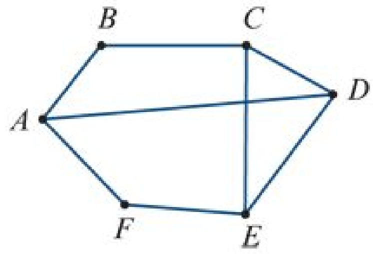
except at a _______________________

Once you have a planar graph you can count it's faces. The faces of a graph are

____

Euler was a mathematician who thought deeply about networks. He made a formula which is always true for connected planar graphs.

$$v - e + f = 2$$



How to

To redraw a graph so that it is planar;

1. Identify the edges which cross, making the graph not planar.
2. Draw the graph again without these edges.
3. Add the final edges (which were crossing originally) to the graph in a way so that they don't cross). You may need to move the position of a vertex.
4. The graph you made should be

   __________________ with the original.

To show that a graph satisfies Euler's formula you need to;

1. Check that it is both connected and planar.
   If it is not planar you must redraw it so that it is.
2. Count all the vertices, edges and faces.
3. Substitute these into Euler's formula and show that you get an answer of 2.

$f =$

To find a missing value using Euler's formula;

1. Write down all the values that you know (there should be 2).
2. Substitute these values into Euler's formula.
3. Solve for the unknown (you can use CAS if you would like)

Eg: A connected planar graph is drawn with 6 vertices and 11 edges. How many faces will it have?

Worked Example

Find an example where you are given two values from Euler's formula and show how to calculate the third. Then draw a connected planar graph which meets the criteria in your example and label all of the faces.

Concept – Travelling Graphs

Often once we have drawn a network we need to imagine travelling through it. There are a number of different ways that this can be done.

A walk ____

A trail ____

A path ____

A circuit ____

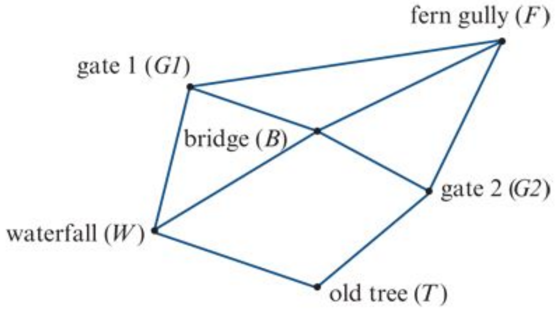
A cycle ____

There is a lot of terminology above, which can be summarised in the table below.

Type of route	Can you repeat edges?	Can you repeat vertices?
Walk		
Trail		
Path		
Circuit		
Cycle		

How to

The graph shown here is of a small section of state park containing two gates and some mountain biking tracks.



1. Identify a walk from gate 1 to the old tree.

   ____

2. Identify a trail which starts at gate 1, visits the old tree and finishes at the bridge.

   ____

3. Identify a circuit starting at gate 1

   ____

4. It is possible to complete a cycle of this state park? Explain your answer.

   ____

Worked Example

Draw a network and clearly identify on this examples of a walk, a path, a trail, a circuit and a cycle.