









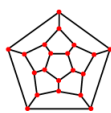


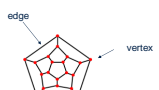


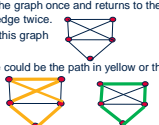



<p>Slide 1</p>	  <p>3 colour dodecahedron</p> <p>Instructions to make a 3 colour dodecahedron</p>	
<p>Slide 2</p>	  <p>3 colour dodecahedron</p> <ul style="list-style-type: none"> You only need to do this step if you want to colour your dodecahedron with 3 colours with 3 different colours at each vertex. To be able to achieve this, we need to be able to draw the dodecahedron. To do this we will represent the dodecahedron using its graph, or projection. 	
<p>Slide 3</p>	  <p>Graph Theory</p> <ul style="list-style-type: none"> A graph is a way of showing how things are connected, for example roads connecting towns, tube lines connecting stations or servers connecting computers. Here are some examples  <ul style="list-style-type: none"> This is a graph of a dodecahedron, where the red dots are the vertices, the black lines are the edges and the faces are enclosed.  <p><small>Graph by Tommaso Engel, Princeton, CC BY-SA 4.0. https://commons.wikimedia.org/wiki/File:Graph_of_dodecahedron.png</small></p>	<p>Emphasise that the word Graph has a different meaning in mathematics than in normal life. Graph theory has many connections to real problems, from mapping neuron transmissions in the brain to the interconnected nature of Facebook.</p>
<p>Slide 4</p>	  <p>Graph of a dodecahedron</p> <ul style="list-style-type: none"> Can you count the faces? What's missing? How is it represented on the graph? 	<p>The 12th face is the pentagon on the outside. You can imagine lifting the 5 outside vertices off the paper and pulling the shape up to make a dodecahedron. Emphasise that the angles in the pentagon, or the irregularity of the pentagons is not important, the fact that they have 5 vertices and 5 edges with each vertex having 3 edges leading in to it is the important part. We can describe each vertex as having degree 3.</p>
<p>Slide 5</p>	  <p>Graph Theory</p> <ul style="list-style-type: none"> To colour the graph, we need some vocabulary  <p>Path = travelling along the edges between the vertices Cycle = travelling along the edges between the vertices and return to the start</p>	
<p>Slide 6</p>	  <p>Hamiltonian Cycle</p> <ul style="list-style-type: none"> A Hamiltonian cycle is one that goes along the edges through every vertex of the graph once and returns to the start, without going over any edge twice. For example, in this graph  <p>a Hamiltonian cycle could be the path in yellow or the path in green</p>	

<p>Slide 7</p>	  <p>Colouring the edges</p> <ul style="list-style-type: none"> Find a Hamiltonian path in the graph of the dodecahedron On the Hamiltonian path, take two different colours and colour each edge in alternate colours – for example  <p>would become</p>  <ul style="list-style-type: none"> This is now your guide to the colours for your dodecahedron – each vertex will have the 3 different colours (with your edges not in the Hamiltonian cycle as the final colour) 	
<p>Slide 8</p>	  <p>A possible solution</p> 	