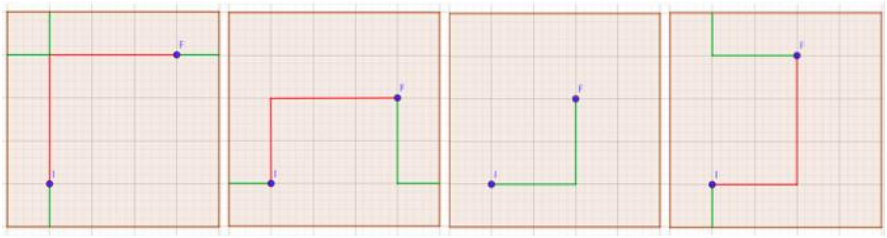
Pacman in a Torus	
Problem wording	The problem is based on the classic videogame, Pacman, represented on an N*N grid where the nodes represent Pacman's possible positions. Since in this game the characters can 'disappear' across one edge and 'reappear' at the opposite edge, the interior nodes are the only positions that Pacman can occupy on the grid. In this topology, for every j=0, 1, 2. … N, point (0,j) is identified with (N,j) and point (i,0) with (i,N) for i, j=0,…N. The distance between any two points on the grid is defined as the shortest route connecting the two points, i.e., the number of horizontal and/or vertical segments connecting them, given the topology as established. The example below depicts different routes to get from point I to point F. In the first drawing, the red route comprises six segments and the green four. The distance between I and F in the first drawing is therefore 4 (the smallest number of segments). The other drawings depict other possible routes, with the shortest shown in green.  The problem posed consists in determining the two points, excluding the ones around the edges, that are farthest apart on the grid and the associated maximum distance, and relating that distance to the value of N.
Purpose	• To find the functional relationship that determines the maximum distance in each grid depending on the size of the sides of the square. • To set out empirical arguments and formalise reasoning.
Suggestions for classroom delivery	Start with square whose sides measure 4 segments and discuss with students the possible routes between any two points. Gradually, the number of segments should be increased, distinguishing whether the property found meets the above criterion. The teacher should explain the distinction between odd and even cases. The teacher should discuss the unicity of the solution and the point positions that maximise the distance.