Totally Magic Graphs

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A total labeling of a graph with $v$ vertices and $e$ edges is defined as a one-to-one map taking the vertices and edges onto the integers $1, 2, \ldots, v + e$. Such a labeling is vertex magic if the sum of the label on a vertex and the labels on its incident edges is a constant independent of the choice of vertex, and edge magic if the sum of an edge label and the labels of the endpoints of the edge is constant.

We shall examine graphs possessing a labeling that is simultaneously vertex magic and edge magic — called totally magic graphs. Such graphs appear to be rare.

We then look at totally magic injections, one-to-one maps taking the vertices and edges into the positive integers, such that the magic properties of vertices and of edges hold.

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