

1086-VN-2385      **Dimitri J. Plessas\*** ([dimitri.plessas@umontana.edu](mailto:dimitri.plessas@umontana.edu)), Department of Mathematical Sciences,  
32 Campus Drive, Missoula, MT 59812. *Topos Axioms and the Categories of Graphs.*

In the usual Category of Graphs, the graphs allow only one edge to be incident to any two vertices, not necessarily distinct. The usual graph morphisms must map edges to edges and vertices to vertices while preserving incidence. We refer to these morphisms as strict morphisms. We relax the condition on the graphs allowing any number of edges to be incident to any two vertices, as well as relaxing the condition on graph morphisms by allowing edges to be mapped to vertices, provided that incidence is still preserved. We call this broader graph category the Category of Conceptual Graphs, and define three other graph categories created by combinations of restrictions of the graph morphisms as well as restrictions on the allowed graphs. These categories have finite limits and colimits (the first of the three topos axioms). We explore the other two topos axioms: the existence of exponentiation with evaluation and/or a subobject classifier. It is known that the usual Category of Graphs is cartesian closed but lacks a subobject classifier. We show there is another category of graphs that is also cartesian closed but lacks a subobject classifier. We also show that the remaining three categories lack exponentiation with evaluation, but do have subobject classifiers. (Received September 25, 2012)