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James R Henderson* (hen_14120@yahoo.com), 306 N. Franklin Street, Titusville, PA 16354.

What Does It Mean for One Problem to Reduce to Another? Preliminary report.

In "Argumentations and Logic," John Corcoran says that one of the jobs of deduction is to reduce new, unsolved problems to old, solved ones, but what does it mean for one problem to reduce to another? This can happen in a number of ways. First, it might be that one problem immediately reduces to another. For example, "No square number is twice another square number" (A) straightaway becomes a demonstration of the irrationality of the square root of two (B). Here B clearly implies A. In a more complicated second case, several lemmas may need to be demonstrated before the sought-after theorem may be deduced. For instance, assume to show result C, preliminary results 1, 2, and 3 are needed. The relationship between C and 1, 2, and 3 may be thought of in two ways: Either "1, 2, and 3 imply C" (just a more detailed version of the simple case) or, for instance, "Given 1 and 2, 3 implies C." Both cases will be examined. Another complication is that a result may be demonstrated non-trivially in more than one way. Further, the meaning of 'implies' must be made clear. Obvious candidates include material implication, logical implication, and formal implication. Each of these, and others, will be considered. (Received July 23, 2007)