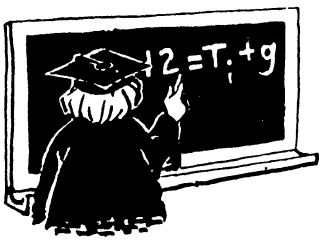

# CLASSROOM CAPSULES

*Edited by*
*Warren Page*

*Classroom Capsules serves to convey new insights on familiar topics and to enhance pedagogy through shared teaching experiences. Its format consists primarily of readily understood mathematics capsules which make their impact quickly and effectively. Such tidbits should be nurtured, cultivated, and presented for the benefit of your colleagues elsewhere. Queries, when available, will round out the column and serve to open further dialog on specific items of reader concern.*

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## The Change of Base Formula for Logarithms

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The change of base formula for logarithms is usually expressed in the following form:

$$\log_d(c) = \frac{\log_a(c)}{\log_a(d)}.$$

It can also be written in the equivalent form:

$$\log_a(b)\log_c(d) = \log_a(d)\log_c(b).$$

Once this formula is seen, it is not easy to forget. It simply states that when logarithms are multiplied, the bases (or the arguments) may be interchanged. Since any permutation of bases $(b_1, b_2, \ldots, b_n) \to (b_1', b_2', \ldots, b_n')$ may be achieved by interchanges, it follows that

$$\log_{b_1}(a_1)\log_{b_2}(a_2)\cdots\log_{b_n}(a_n) = \log_{b_1'}(a_1)\log_{b_2'}(a_2)\cdots\log_{b_n'}(a_n).$$

This provides a quick method of solving certain precalculus exercises. For example, simplify

$$\log_2(27)\log_5(8)\log_3(1/5).$$

Rearranging, we get

$$\log_2(8)\log_5(1/5)\log_3(27) = -9.$$