

## THE CALCULUS IN OUR COLLEGES AND TECHNICAL SCHOOLS.

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THE history of the race is frequently suggestive, in educational matters, of a wise course for the training of the individual. If we turn to the problems to which the calculus owes its origin, we find that not merely, not even primarily, geometry, but every other branch of mathematical physics—astronomy, mechanics, hydrodynamics, elasticity, gravitation, and later electricity and magnetism—in its fundamental concepts and basal laws contributed to its development and that the new science became the direct product of these influences.

Not until recent times have the analytic methods of the calculus been securely established. But at last the method of rates and that of infinitesimal constants have given place to the method of limits as being the only method known to us on which the calculus can be satisfactorily founded, satisfactorily, not merely from a logical point of view; it is important that the methods be in close touch with the physical concepts with which the calculus deals.

What is the bearing of these facts on instruction in the calculus in our colleges and technical schools? I wish to deal with some of the phases of this question.

### § 1. *Object of the Study of the Calculus.*

Let us first make clear to ourselves what some of the chief aims of the study of the calculus are. A view that has been widely accepted, to judge from the text-books that have had the largest sale, is that the first course should deal almost solely with the formal side. Just as the school boy learns to manipulate algebraic expressions with skill and accuracy, so the student shall first be drilled in differentiation and integration, the applications being chiefly to geometry and consisting in computing by formulas deduced in the text-book or class-room.