EASY LESSONS IN THE DIFFERENTIAL CALCULUS: INDICATING FROM THE OUTSET THE UTILITY OF THE PROCESSES CALLED DIFFERENTIATION AND INTEGRATION

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Easy Lessons in the Differential Calculus: Indicating from the Outset the Utility of the Processes Called Differentiation and Integration by Richard A. Proctor

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RICHARD A. PROCTOR

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Trieste

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BY

RICHARD A. PROCTOR.

'Most excellent differences.'—*Shakespeare.*

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PREFACE.

I FIRST took interest in algebra when I found that problems in Single and Double Position could be solved much more readily by algebra than by the rather absurd rules given for such problems in books on arithmetic. In like manner, I could find no interest in the Differential Calculus till, after wading through two hundred pages of matter having no apparent use (and for the most part really useless), I found the calculus available for the ready solution of problems in Maxima and Minima. This little work has been planned with direct reference to my own experience at school and college. The usual method of teaching the Differential and Integral Calculus seems to me almost as absurd (quite as absurd it could scarcely be) as the plan by which children, instead of being taught how to speak—whether their own language or another—are made to learn by rote rules relating to the philosophy of language such as not one grammarian in ten thousand ever thinks about in after life.

I have striven in this little work (reprinted here from the pages of KNOWLEDGE) to show at once how and why we want a method of calculation dealing with quantities which vary in value under various conditions, and how such a method of calculation is to be used in practice.

The Integral Calculus I have treated as simply a department of the Differential Calculus, dealing with it in the same practical manner.

It may interest learners to know that, chancing when at Cambridge to be my own master, with freedom to choose what I would learn, I took up for my degree rather less of the Differential Calculus than is presented for beginners here. What I have had occasion to study since respecting the Differential Calculus, the Calculus of Variations and higher matter, I have dealt with as occasion required—the only really effective way of studying mathematics.

RICHARD A. PROCTOR.

ST. JOSEPH MO.:
May 1887.

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EASY LESSONS

IN THE

DIFFERENTIAL CALCULUS.

LESSON I.

PURPOSE OF THE DIFFERENTIAL CALCULUS.

THE Differential Calculus is the science which deals with the rate at which variable quantities increase or diminish. When we say that a quantity is variable, we imply that it varies as some other quantity changes. For example, the velocity of a train is variable. It varies with the *time* which has elapsed since the train started—it varies with the *distance traversed*—with the *steam power* employed—with the *state of the rails*—and so on. But the differential calculus deals only with those quantities which vary according to some definite law.

For example, when a body is let fall from rest the distance it traverses varies, according to a known law, with the time elapsed since the fall began. The differential calculus is able to deal with such a case as this. Again, the sine of an angle varies according