

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

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649508211

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

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

RICHARD A. PROCTOR

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

EASY LESSONS
IN THE
DIFFERENTIAL CALCULUS:

INDICATING FROM THE OUTSET THE UTILITY OF
THE PROCESSES CALLED
DIFFERENTIATION AND INTEGRATION.

BY
RICHARD A. PROCTOR.

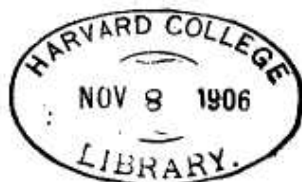
Most excellent differences.—*Shakespeare.*

SIXTH EDITION.

LONGMANS, GREEN, AND CO.
LONDON, NEW YORK, AND BOMBAY.
1897.

All rights reserved.

Math 2008, 97.13



Bowditch fund.

Entered according to Act of Congress, in the year 1887,
by Richard A. Proctor,
in the office of the Librarian of Congress, at Washington.

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.

CONTENTS.

| LESSON | PAGE |
|---|------|
| I. PURPOSE OF THE DIFFERENTIAL CALCULUS | 1 |
| II. " " INTEGRAL " | 9 |
| III. ILLUSTRATIONS OF THE USE OF THE CALCULUS | 17 |
| IV. DIFFERENTIATING SIMPLE FUNCTIONS | 21 |
| V. " " " (continued) | 28 |
| VI. DIFFERENTIATING COMPOSITE FUNCTIONS | 39 |
| VII. ILLUSTRATIONS: MAXIMA AND MINIMA | 45 |
| VIII. FURTHER EXAMPLES OF MAXIMA AND MINIMA | 50 |
| IX. DIFFERENTIATING LOGARITHMIC FUNCTIONS | 55 |
| X. OTHER EXAMPLES: MAXIMA AND MINIMA | 59 |
| XI. " VANISHING FRACTIONS | 66 |
| XII. " TANGENTS TO CURVES | 70 |
| XIII. " AREAS OF CURVES | 74 |
| XIV. USE OF THE INTEGRAL CALCULUS | 80 |
| XV. DIRECT INTEGRATION | 84 |
| XVI. INTEGRATION BY SUBSTITUTION | 87 |
| XVII. INTEGRATION BY PARTS | 91 |
| XVIII. USEFUL INTEGRALS | 94 |
| XIX. ELLIPTIC AND HYPERBOLIC INTEGRALS | 100 |
| XX. SUBSIDIARY INTEGRALS | 106 |
| XXI. " " (continued) | 110 |

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for ensuring transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods and techniques used to collect and analyze data. It highlights the need for consistent and reliable data collection processes to ensure the validity of the results.

3. The third part of the document describes the different types of data that are collected and analyzed. It includes information on both quantitative and qualitative data, as well as the various sources and methods used to obtain this information.

4. The fourth part of the document discusses the various statistical methods and techniques used to analyze the data. It covers topics such as hypothesis testing, regression analysis, and correlation analysis, and provides examples of how these methods are applied in practice.

5. The fifth part of the document discusses the various ways in which the results of the analysis can be presented and communicated. It includes information on the use of tables, graphs, and charts, as well as the importance of clear and concise communication in reporting the findings.

6. The sixth part of the document discusses the various factors that can affect the accuracy and reliability of the data and the results of the analysis. It includes information on the importance of controlling for confounding variables and the need for careful interpretation of the results.

7. The seventh part of the document discusses the various ethical considerations that must be taken into account when conducting research. It includes information on the importance of informed consent, confidentiality, and the protection of human subjects.

8. The eighth part of the document discusses the various ways in which the results of the analysis can be used to inform decision-making and policy-making. It includes information on the importance of clear communication and the need for careful interpretation of the results.

9. The ninth part of the document discusses the various ways in which the results of the analysis can be used to improve the quality of services and programs. It includes information on the importance of ongoing evaluation and the need for continuous improvement.

10. The tenth part of the document discusses the various ways in which the results of the analysis can be used to inform the public and the media. It includes information on the importance of clear communication and the need for careful interpretation of the results.

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