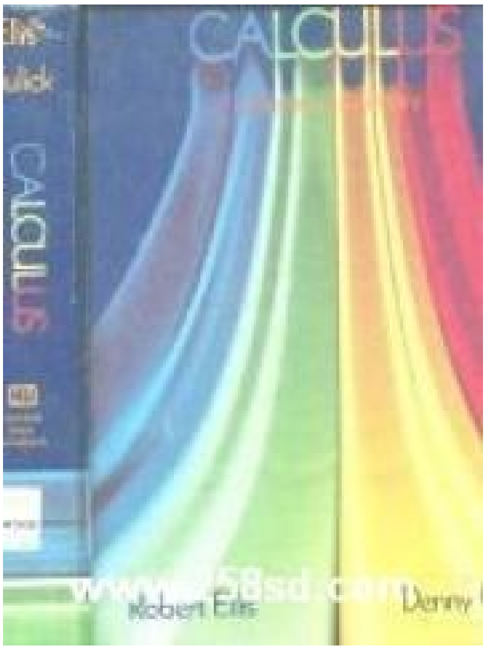
Calculus with analytic geometry



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 ~hen you begin to study calculusï¼Œ you will find that you have enconn-
 tered many of its concepts and techniques before. Calculus makes extensive
 use of plane geometry and algebraï¼Œ two branches of mathematics with which
 you are already familiar. Howeverï¼Œ added to these is a third ingredientï¼Œ
 which may be new to you: the notion of limit and of limiting processes.
 From the idea of limit arise tile two principal concepts that form tile
 nucleus of calculus; these are the derivative and the integral.
 Tile derivative can be thought of as a rate of changeï¼Œ and this interpreta-
 tion has many applications. For exampleï¼Œ we may use tile derivative to
 find the velocity of an objectï¼Œ such as a rocketï¼Œ or to determine tbe
 maximum and minimum values of a function. In factï¼Œ the derivative provides
 so much information about the behavior of functions that it greatly simplifies
 graphing them. Because of its broad applicabilityï¼Œ tile derivative is as
 important in such disciplines as physicsï¼Œ engineeringï¼Œ economicsï¼Œ and
 biology as it is in pure mathematics.
 The definition of tile integral is motivated by the familiar notion of area.
 Although the methods of plane geometry enable us to calculate tile areas
 of polygonsï¼Œ they do not provide ways of finding the areas of plane regions
 whose boundaries are curves other than circles. By means of the integral
 we can find the areas of many such regions. We will also use it to
 calculate volumesï¼Œ centers of gravityï¼Œ lengths of curvesï¼Œ workï¼Œ and hydro-
 static force.
 The derivative and the integral have found many diverse uses. The
 following listï¼Œ taken from the examples and exercises in tiffs bookï¼Œ illustrates
 tile variety of the fields in which these powerful concepts are employed.

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