Rentals amounting to $2,367,000 will go to the university under the terms of a lease arranged by Levi L. Barbour, the Detroit manufacturer, with the stipulation that the money shall be used for educating women of the Far East.

Cornell University has received a gift of $100,000 for a new dormitory, to be named for the donors' parents, from W. G. Mennen and his sister, Mrs. Emma Mennon Williams, of Detroit.

Bates College is to receive $500,000 from the fund to be raised by the Northern Baptist Convention.

On recommendation of the medical faculty of Cornell University, women who are students in medicine may hereafter take the first year's work at the Medical College in New York City.

Professor Walter Edward McCourt, head of the department of geology of Washington University, has been appointed dean of the schools of engineering and architecture of Cornell University. He will assume the duties of his new position at once. The appointment was made to fill the vacancy caused by the resignation of Professor A. S. Langsdorf.

Professor E. T. Bartholomew, of the department of botany of the University of Wisconsin has accepted a research professorship in the Graduate School of Tropical Agriculture at Riverside, Cal., in connection with the University of California. His special work will be the investigation of the diseases of lemons and other citrus fruits.

Sir Archibald E. Garrod has been appointed to be regius professor of medicine in the University of Oxford in succession to the late Sir William Osler.

DISCUSSION AND CORRESPONDENCE

MODERN INTERPRETATION OF DIFFERENTIALS

To the Editor of Science: Without attempting to discuss the historical questions involved, I wish to point out that the theory of "differentials" given by Professor A. S. Hathaway in Science for February 13, 1920, would prove highly misleading to the modern student.

Professor Hathaway defines $\Delta' y$ as $N\Delta y$, where N is some multiplier and Δy a simple increment, and then defines dy as the limit of $\Delta' y$ as Δy approaches zero. The inevitable consequence of such a definition is that $dy = 0$, which is obviously futile.

In view of the continual recrudescence of such fallacies (with or without a historical background), it may be worth while to repeat here the modern interpretation of the differential, though this may be found correctly stated in any good text-book of calculus.

Consider the graph of a function $y = f(x)$, with the tangent line drawn at the point $x = x_1$, $y = y_1$. Give x an arbitrary increment

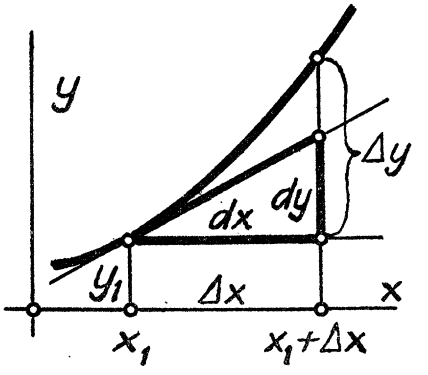

Fig. 1.

which, since x is the independent variable, may be denoted indifferently by Δx or dx. Corresponding to any such increment in x we have the *increment* of y, called Δy, extending up to the curve, and the *differential* of y, called dy, extending up to the tangent. Now when Δx (or dx) is made to approach zero, the ratio dy/dx remains constant, being the slope of the tangent line, while the ratio $\Delta y/\Delta x$ is a variable, approaching the slope of the tangent as a limit. *But the limit of Δy taken by itself is zero, and the limit of dy taken by itself is also zero.*

There are thus two very good reasons why

we can not say that "dy is the limit of Δy." First, dy is a variable and therefore can not be the limit of anything; secondly, zero is the limit of Δy, and therefore nothing else can be.

A list of similar fallacies, which still persist in some books (and, apparently, in some classrooms also), may be found in a paper by the present writer on "The proper use of the differential in calculus." [1]

The word *derivative* means, of course, the ratio dy/dx.

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WEIGHT AND CENTRIPETAL ACCELERATION

TO THE EDITOR OF SCIENCE: Mr. Carl Hering's suggestion for a new form of dynamic compass[1] ought to be challenged before some one organizes a company to work the idea out on a commercial basis. The fact is, of course, that the change in weight which Mr. Hering refers to occurs only when the motion is *in a circle having its center in the earth's axis.* Mr. Hering's disk is a plane tangent to the earth's surface and motion in this plane does not, on the basis of Newtonian mechanics, affect the weight of a body. It is understood of course, that the disk is not forced to remain tangent to the earth as the earth rotates. This would complicate the situation by introducing the gyroscopic effect. If the disk is mounted in gimbals so that the earth in turning does not force a change in direction of the shaft there would, as stated above, be no tendency of the shaft to set itself parallel with the earth's axis.

The suggestion that the light disk with equal weights at extremities of a diameter would rotate in balance when in a north and south plane, but out of balance in an east and west plane is equally mistaken. Any change in the weight of a body on the basis of Newtonian mechanics must be due to an acceleration of the body, part of the gravitational force being used to produce the acceleration. We may, therefore, examine the accelerations of these bodies to see whether they could produce the effect described. Each of the weights on the light disk has an acceleration composed of two components.[2] One of these components is directed toward the center of the disk. This component is due to the rotation of the disk, and may be called the *disk component.* Since the two weights are at opposite extremities of a diameter the disk components of their acceleration are equal in magnitude and opposite in direction, and their only effect is to produce the well-known centrifugal stress in the disk. The other component of acceleration is common to the two weights. It is the acceleration of the center of the disk due to the earth's motion. It is altogether independent of the rotation of the disk. This acceleration will affect the weights of the two bodies, but the effect will be the same for both bodies in all positions of the disk, and cannot therefore, produce unbalanced rotation.

Curiously enough there is another cause that would produce a minute unbalance in a disk of the sort just considered when rotating in any vertical plane at any point on the earth's surface. When the line of the weights is in a horizontal position let the weight of each be represented by w. Then neglecting the weight of the disk and shaft the downward pressure on the bearings is $2\ w$. When the line of the weights has turned through 90° to a vertical position one of the bodies has approached the earth and consequently its weight is increased. The other has receded from the earth but its weight has decreased less than the other increased since the attraction varies as the inverse *square* of the distance. Consequently the pressure on the bearings is greater when it is horizontal. This would produce a minute effect of unbalance which, however, would be just as great when the disk rotates slowly as when it rotates at high speed.

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[1] Society for the Promotion of Engineering Education: *Bulletin,* Vol. 4, pp. 19–28, 1914, or *Proceedings,* Vol. 22, pp. 115–124, 1915.

[1] SCIENCE, Vol. LI., p. 46.

[2] Gimbal mounting is assumed again to eliminate gyroscopic effect.