finite terms several most important partial differential equations of the second order, including the equation of continuity in a homogeneous incompressible fluid; and the chapters in which these equations are discussed are by far the most important and interesting in the work. Mr. Earnshaw is already known for his able treatment of the equation for the motion of a sound wave in the Philosophical Transactions for 1860, and no one can doubt the importance of the subjects suggested for consideration by this and other equations. The question is discussed whether there must necessarily exist an integral of every partial differential equation that can be proposed, and on this part of the subject we wish the author had extended his remarks. The real question considered seems however rather to be the possibility of the existence of a continuous function expressible in finite terms as an integral. With regard to the considerations having reference to certain physical problems, we should not expect to learn very much from the discussion of such questions, as the differential equation might admit of a solution incapable of satisfying the physical conditions.

We must notice one singular error made by Mr. Earnshaw. He concludes that the well-known partial differential equation of the second order of surfaces having their principal radii of curvature equal and of opposite signs at all points, admits of no integral, because the form of a surface possessing this property would be such as could not exist; but it is well known that the surface formed by the revolution of a catenary round its directrix does possess the property in question, and it is easy to see that this arises simply from the fact that the normal and radius of curvature in the catenary are equal and of opposite signs; the form of the surface is quite easy to conceive. A particular integral of the equation obtained by Poisson's method is also given in Boole's Differential Equations, chapter xv. Even admitting Mr. Earnshaw's reasoning, it would only establish the non-existence of a real surface possessing the required property. The integrals of the equation of continuity in three dimensions, and of one or two other equally important equations, we do not remember to have seen before, and they are perhaps the most general finite solutions the equations admit of. Of the value and power of the method it is impossible to speak at present; but we heartily commend Mr. Earnshaw's book to the reader as one containing much matter of great interest systematically and clearly developed and treated by a novel method. It is remarkable that the subject of partial differential equations has not attracted more attention than it has in recent years, as an advance in this quarter is more immediately felt in physics than an advance in any other pure mathematical subject. The present work will help to bring the matter prominently forward; and as the analysis is nowhere of a very difficult nature, it will probably come under the notice of many readers not accustomed to study mathematical memoirs on their appearance.

If the work had been intended to be a Treatise on the subject, we should have had good reason to object to the total omission of all reference to the usual methods, but the title and preface explain that this was not contemplated; it is one of the few English books containing original mathematics.

J. W. L. G.

OUR BOOK SHELF

Three and Four Place Tables of Logarithmic and Trigonometric Functions. By James Mills Peirce. 16 pp. (Boston: Ginn Brothers, 1871.)

PERHAPS the best way of treating this work, which does not contain a single word of explanation, will be to give a summary of the tables contained in it. First we have proportional parts of all numbers up to 100; then on one page three-place logarithms of numbers and of the six trigonometric functions, natural and logarithmic. On pages 4 and 5 we find four-place logarithms of numbers, then logarithms of sums and differences (Gaussian logarithms) also to four places, then follow tables of logarithmic trigonometric functions, inverse trigonometric functions (a new table, to which attention is specially invited, for finding angles from the logarithms of their trigonometric functions), traverse table, the correction of the middle latitude (in an improved form), and meridional parts.

In a prospectus issued by the publishers, it is stated as a result of experiment that it has been found that the times occupied, in regular computation, in doing one piece of work by tables of 4, 5, 6, and 7 places, are proportional to the numbers 1, 2, 3, and 4; hence it is that the author has drawn up the majority of the tables under review to 4 places as sufficient for ensuring the degree of accuracy usually required in computations of common surveying, engineering, &c.

The type employed is very clear, the arrangement of the work is good, and the printer's part has been well done; the book requires only a few words of elucidatory matter. There is on the last page a useful Table of Constants with their logarithms, here we observe a few symbols which are new to us, and which are presented to our notice on the Title-page.

After all the value of such a work consists in its accuracy, and that can only be tested by practice, "the greatest pains have been taken both in preparing and printing to secure perfect accuracy." We commend the work to the notice of such as agree with old Burton (Anatomy of Melancholy, pt. II., sec. 2), "What so pleasing can there be . . . if a man be more mathematically given (as) to calculate or peruse Napier's logarithms, or those tables of artificial sines and tangents, not long since set out by . . . . Edmund Gunter, which will perform that by addition and subtraction only, which heretofore Regiomontanus' tables did by multiplication and division." But then the same quaint writer advises those who are melancholy to square a circle; does it follow that all circle-squarers are melancholy? R. T.

The Laws of the Winds prevailing in Western Europe. By W. Clement Ley. Part I. (Stanford, 1872.)

EVEN when we differ from an author's conclusions, the work of one who shows himself an honest and capable inquirer has a just claim to our attention. Mr. Ley evidently writes from practical knowledge of his subject, and his assiduity in collecting and charting observations must have entailed on him an amount of labour which only those who have been engaged in similar work can thoroughly understand. Unfortunately, as it appears to us, he has confined his investigations almost entirely to the limits set forth on his title-page; and the winds of Western Europe, though highly suggestive and subject to more exact observation than any others except those of the United States, are by no means to be taken as representative. Mr. Ley has taken them as such, and has thus laid down a series of general propositions, which may be briefly summed up in one—that revolving storms are caused by the barometric depression consequent on heavy rain over a large area. He brings forward some curious home instances in illustration of this; but looking farther afield, on the slopes of the Himalayas—to mention only one locality—a much heavier and longer continued pre-