the Board of Education, South Kensington. The two little books under notice have been written in the same spirit, and contain some sections from the previous volume, but the treatment is more elementary and many new exercises are given.

In Part i. the subjects dealt with belong to arithmetic, algebra and the mensuration of parallelograms, triangles and polygons. Prominence is given to contracted methods, use of decimals, and explanations of algebraical expressions. Scales, calipers, and other simple measuring instruments are described in the chapters dealing with mensuration, and their use is well exemplified. Part ii. is devoted to logarithms, the slide rule, mensuration of circles, ellipses and irregular plane figures, volumes and surfaces of solids, more difficult algebraic expressions than are given in Part i., and the graphic representation of varying quantities. Among noteworthy points in this part may be mentioned the clear account of uses to which a slide rule may be put, the descriptions of planimeters, and the ingenious uses made of squared paper in the section on graphic representation.

The books are full of exercises illustrating the applications to every-day problems of the principles described, and at the end of Part ii. a set of tables of logarithms and anti-logarithms is given, to enable the student to work out problems by logarithms when convenient. It would be too much to say that the books contain an ideal course of mathematics for technical students, but they may fairly claim to provide far more inspiring information and serviceable exercises than can usually be found in text-books designed for use in schools.

Exercises in Natural Philosophy, with Indications how to Answer them. By Prof. Magnus Maclean, D.Sc., F.R.S.E. Pp. x + 266. (London: Longmans, Green and Co., 1900.)

THE ability to deal with quantitative results is an essential qualification of a student of physical science. Laboratory work provides some material for the exercise of this faculty, but it is often necessary to use data obtained by others, and to work out problems other than those which are afforded by the student's own practical work. Dr. Maclean's book contains numerous exercises of this character, covering most of the subjects studied in courses of physical science, and many worked-out examples of typical cases suggesting methods of solution for those which follow. Wisely used, the book will provide teachers with useful exercises in mathematics applied to physics, and will make a convenient supplement to text-books in which such exercises are not given. Many text-books do contain questions upon the subjects dealt with, but even in these cases some good additional problems for solution could be selected from the book under notice.

Tables of useful data and physical constants are printed at the end of the volume.

Memoirs of the Countess Potocka. Edited by Casimir Stryienski. Authorised translation by Lionel Strachey. Pp. xxiv+253. (New York: Doubleday and McClure Company, 1900.)

THESE memoirs cover the period from the third partition of Poland to the incorporation of what was left of that country with the Russian Empire. They deal with episodes—more or less romantic and interesting—in Countess Potocka's career, referring to journeys, Court balls, and Napoleon I., between 1812 and 1820. The authoress died, at the age of ninety-one, in Paris, where her brilliant salon held no insignificant place in the gilded pleasures of the Second Empire. There is little of interest to scientific readers in the memoirs; but one or two incidents referring to astrologers are amusing.

LETTERS TO THE EDITOR.

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Inverse or "a posteriori" Probability

THE familiar formula of Inverse Probability may be stated as follows:—

Let the probabilities of a number of mutually exclusive causes or conditions $C_1\ C_2\ \ldots\ C_r$ be $P_1\ P_2\ \ldots\ P_r$ respectively, and the probabilities that if $C_1\ C_2$, &c., are realised, an effect or result E will happen be $p_1\ p_2\ \ldots\ p_r$ respectively; then if E happens, the probability that it happened as a result of C_r is

$$\frac{P_r p_r}{\Sigma P p}.$$

The current proofs of this are unsatisfactory, more especially one based on a theorem of James Bernoulli; for even if the ordinary statements of the principle of this theorem were correct, which must be disputed, the argument by which it is applied to Inverse Probability is demonstrably erroneous.

In consequence of the difficulty felt about the usual proofs, there seems to be a tendency to drop the subject, as unsound, out of mathematical theory.

Now it would not be hard to show that there is no essential difference of principle between problems of Inverse Probability and those of ordinary Probability, and therefore it can hardly be doubted that the former should admit of as accurate mathematical treatment as the latter.

The following is offered as a proof which can claim the same rigour as the theorems of ordinary Probability, and illustrates the identity of principle in both kinds of Probability:—

Let A and B be contingencies which are not independent, then by a known theorem

Prob. concurrence of A and B = Prob. A × Prob. of B if A happens.

Or, as it may be shortly expressed,

Prob. A with B = Prob. A × Prob. B if A.

Similarly

Prob. A with B = Prob. B × Prob. A if B.

∴ Prob. A × Prob. B if A = Prob. B × Prob. A if B.

$$\therefore \text{Prob. A if B} = \frac{\text{Prob. A} \times \text{Prob. B if A}}{\text{Prob. B}};$$

and this is really our theorem. For put $A = C_r$ and $B = E$.

$$\therefore \text{Prob. } C_r \text{ if E} = \frac{\text{Prob. } C_r \times \text{Prob. E if } C_r}{\text{Prob. E}}.$$

But Prob. $C_r = P_r$, Prob. E if $C_r = p_r$, and obviously Prob. E $= \Sigma P p$ by a known theorem.

$$\therefore \text{Prob. } C_r \text{ if E} = \frac{P_r p_r}{\Sigma P p}.$$

Another demonstration may be given which, though a little longer, is quite simple.

If the whole number of "equally likely" cases with reference to a given contingency E is b, and the number of these in favour of E is a, then the mathematical probability of E is, of course, $\frac{a}{b} = p$, suppose.

Considered as a fraction, $p = \frac{na}{nb}$, where n is any quantity whatever.

Suppose n an integer, as a fractional value does not here concern us. We may consider each of the original "equally likely" cases as including n "equally likely" sub-cases; and then we can interpret the fraction $\frac{na}{nb}$ as we interpreted $\frac{a}{b}$, and say that there are nb new cases equally likely, and of these na are in favour of E.

Obviously, if x is the total number of equally likely cases, the number in favour of the event or contingency is px. Again, if q is the probability that E happens if C happens, this means that q of the equally likely cases of C's happening are in favour of