MATHEMATICAL RECREATIONS.

Mathematical Recreations and Problems of Past and Present Times. By W. W. ROUSE BALL, Fellow and Lecturer of Trinity College, Cambridge; and of the Inner Temple, Barrister-at-Law. London: Macmillan and Co., 1892. 8vo, pp. xii. + 240.

PERHAPS "mathematical recreations" can be more or less sharply classified under two heads:

1. Particular problems treated by general mathematical theories and methods, but so that the layman may not recognize the general in the particular; as with those puzzles which really turn upon the solution of simple equations.

2. Theories or parts of theories, small and distinct enough for popular presentation, yet mathematical in the sense that, as with the Chinese rings or the tower of Hanoï, they deal with number, form and relation by consecutive reasoning whose methods, as far as independent of subject-matter, are essentially those of mathematics; perhaps mathematical too in the sense that, as with some topological studies useful toward function-theory, they are already auxiliary to larger doctrines recognized as main parts of the science, or that, as with some apparently disconnected properties of numbers, they bid fair to be included later in general theories.

Such "recreations," whether relating to pure or to applied mathematics, would naturally, as compared with most other mathematical studies, be more concrete, and would appeal rather less formally to the logical sense, and relatively more to imagination and ingenuity. But we must not forget Kirkman's caution, uttered in connection with his schoolgirl problem: "A solution . . . . , to be mathematical and not tentative, must inform us whether or no, and why, [so and so] will . . . . be suitable; and [this] before trial and examination of the [particular solution]"—or at least, *independently* of such trial. It is commonly all-important "to see the secret of the symmetry." *

These studies may be of more value than we realize: not only as pleasant introductions to existing theories, but yet more as leading the amateur by short paths to new fields where, not merely as a gleaner, he may experience the satisfaction of adding to our present knowledge something which is of interest in itself, is largely mathematical in spirit and method, and may some day conduce to the great generalizations of mathematics proper. As the world's leisure increases, a certain democracy in science may be essential to the right

* *Cambridge and Dublin Math. Journal*, vol. 5, 260.