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Review

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Source: *The Mathematical Gazette*, Vol. 1, No. 13 (Feb., 1898), p. 175

Published by: Mathematical Association

Stable URL: <http://www.jstor.org/stable/3602354>

Accessed: 01-12-2015 10:14 UTC

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as fascinating, and to provoke as many attempts at solution, as ever. Only within the last few weeks another hopeless attack on the problem has reached us, the writer submitting it in the confident expectation of winning a prize, which, he understands, has been offered in London for a solution! The third chapter of the book is devoted to showing what regular polygons can be constructed under the same restrictions as before; and this is followed by a complete construction of the regular 17-sided polygon.

The latter part of the book is on transcendental numbers, and is, if possible, still more interesting than the earlier part, since it deals with more general ideas. Numbers may be divided into two classes, viz., *algebraic* numbers, or all numbers which are roots of algebraic equations with integral coefficients, and *transcendental* numbers, or numbers which do not satisfy any algebraic equation. The fact of the existence of transcendental numbers has been recognized and proved for more than half a century. What is proved in the book on this subject is summed up (p. 76) in the concise and general theorem that *in an equation of the form*

$$a + be^k + ce^l + \dots = 0$$

*the exponents k, l ... and coefficients a, b, c ... cannot all be algebraic numbers.* As particular cases we may take the equations  $a - e = 0$ ,  $1 + e^{\pi} = 0$ ,  $y - e^x = 0$  or  $x = \log y$ , which show respectively that  $e$ ,  $\pi$ , and the logarithms of algebraic numbers are all transcendental. Similarly for the circular and inverse circular functions, etc., etc. We must, however, remark that the so-called elementary proof on p. 54 of the existence of transcendental numbers seems to us no proof at all, and so palpably fallacious as not to need refutation.

Two points touched upon in the book are of primary importance. One (p. 61) is the distinction between practical and theoretical convergence. The number  $10^{100}$ , for example, is so great as to be altogether beyond conception; but theoretically it is finite, and inconceivably small in comparison with other finite numbers. So again the divergence of the series  $1 + \frac{1}{2} + \frac{1}{3} + \dots$  is a fundamental fact in theory, yet if taken to  $10^{100}$  terms the sum is less than 231. The other point (pp. 50, 51) refers to the comparison of absolute infinities. "The proposition that the part is greater than the whole is not true for infinite masses." Absolute infinities cannot be compared in respect to magnitude. It is not correct to assume that the four infinite quadrants into which a plane is divided by two perpendicular lines are equal to one another. "The aggregate of real algebraic numbers and the aggregate of positive integers can be brought into a one-to-one correspondence," notwithstanding the fact that between any two successive integers an infinite number of real algebraic numbers exist. F. S. M.

**Elementary Geometrical Statics.** By W. J. DOBBS, M.A. (Macmillan, pp. 340.) This book is intended as an introduction to Graphic Statics, "preparing the way for such works as Clarke's *Graphic Statics* or Hoskin's *Elements of Graphic Statics*." It will undoubtedly be welcome to those at, or about to enter, the "shop," but meagre attention having been hitherto paid in the ordinary textbooks to what is so important to the engineer. The examples are numerous and well-selected; the majority seem to be original, and the residue to be from recent Woolwich papers. The space and force diagrams are beautifully drawn, and generally exhibited side by side. The chapters on systems of rods and stiff frameworks are extremely well done. To use a hackneyed expression, this volume certainly "fills a gap." W. J. G.

**Solutions of the Exercises in Taylor's Euclid.** Books VI., XI. By W. W. TAYLOR, M.A. (Cambridge University Press.) This book of solutions may prove useful to those who attack the harder exercises in the Pitt Press (Taylor's) Euclid. Besides the solutions the book contains some slight additions, such as the proof of the converse of Casey's theorem in regard to four circles which all touch the same fifth circle, and a construction for the centre of a given circle by using the compass only. F. S. M.