BULLETIN OF THE

AMERICAN MATHEMATICAL SOCIETY.

NOTE ON FERMAT'S NUMBERS.

BY DR. J. C. MOREHEAD AND MR. A. E. WESTERN.

(Read before the Chicago Section of the American Mathematical Society, April 9, 1909.)

In June, 1658, Fermat wrote to Sir Kenelm Digby a letter,* in which, after referring to certain theorems proved by him, which he might propose to Viscount Brouncker and John Wallis, in order to give them something to do, he said that, instead of these theorems, he would submit to them, as problems, some theorems which he admitted he could not prove, though he was convinced of their truth. The first of these problems was to prove that $2^{2^n} + 1$ is a prime, and he gave as examples the numbers corresponding to $n = 1, 2, 3, 4$, which in fact are primes. Fermat challenged his English friends to furnish a proof of this proposition, which was certainly very beautiful, and which he believed was true. He added that perhaps the proof would give the key to penetrate all the mystery of prime numbers.†

As is well known, the theorem is untrue for many values of n.‡ In 1905 Dr. Morehead read before the AMERICAN MATHEMATICAL SOCIETY a "Note on Fermat's numbers,"‡ which stated the result of a calculation proving that $F_7 = 2^{128} + 1$ is composite. Mr. Western had independently performed the same calculation, and communicated the result almost simul-

*Pierre de Fermat, Œuvres, Paris, 1896, vol. 2, p. 405 (in Latin); vol. 3, p. 315 (French translation).

†That Fermat attached great importance to this theorem is further evidenced by the fact that he referred to it in six other letters and papers written between 1640 and 1659. Cf. Œuvres, vol. 1, p. 131; vol. 2, pp. 206, 207, 212, 309, 434.

‡W. W. R. Ball, Mathematical Recreations and Problems, 2d ed., 1892, p. 26. *Proc. Lond. Math. Soc.*, Series 2, vol. 1 (1904), p. 175. BULLETIN, vol. 11, p. 543, and vol. 12, p. 449.