On the Convergence of the Reciprocals of Mersenne Primes

Cancel, Juan (School: CROEM HS)

Although the infinite sum of the reciprocals of Mersenne primes has already been approximated to 0.51645417894, that result has not been compared with (a) the infinite sum of the reciprocals of Mersenne numbers, and (b) the infinite sum of the reciprocals of Mersenne numbers with prime exponent. To do this, comparisons using Sigma notation and computer programs were used to approximate the values of (a) and (b) and consequently relate them to the infinite sum of the reciprocals of Mersenne primes. For (b), simple cases in which the exponent was not prime were excluded from the infinite sum to obtain a better approximation (for example, the cases in which the exponent is an even number bigger than 2). It was expected to find that the Mersenne primes contribute to a decent portion of the value of (a) the infinite sum of the reciprocals of the Mersenne numbers and (b) the Mersenne numbers with prime exponent. The infinite sum of the reciprocals of Mersenne numbers approximated to 1.60669515242, while the infinite sum of the reciprocals of Mersenne numbers with prime exponent approximated to 1.51890025137. It was found that the infinite sum of the reciprocals of Mersenne primes contributed to a 34% of the value of (b) the infinite sum of the reciprocals of the Mersenne numbers prime exponents and a 32% of the value of (a) the infinite sum of the reciprocals of the Mersenne numbers.

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