A Calculus Exam Misprint

Problem 99-005, *by* Michael Renardy (Virginia Tech, Blacksburg, VA) *and* Thomas Hagen (University of Wales, Aberystwyth, UK).

Does the series

$$\sum_{n=1}^{\infty} \frac{(2 + \sin n)^n}{3^n\, n}$$

converge?

This question was motivated by a misprint on a calculus exam.

Remark. It is quite possible that the question as stated cannot be answered with currently known methods. A more tractable version is to look at the sets of convergence and divergence of the more general series

$$\sum_{n=1}^{\infty} \frac{(2 + \sin(\alpha n))^n}{3^n\, n}.$$

Editorial note. Someone determined to solve the original problem might be interested in knowing as much as possible about rational approximations of π. We recommend J. M. Borwein, P. B. Borwein, and D. H. Bailey, *Ramanujan, modular equations, and approximations to pi, or How to compute one billion digits to pi*, Amer. Math. Monthly, 96 (1989), pp. 201–219, or online at http://www.cecm.sfu.ca/organics/papers/borwein/. In particular, section 2, "The state of our current ignorance" is appropriately cautionary.

Status. The problem as stated is unsolved. However, the authors do have results of the type alluded to in their remark.