

Putnam Calculus Problems

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2020 A3 Let $a_0 = \pi/2$, and let $a_n = \sin(a_{n-1})$ for $n \geq 1$. Determine whether

$$\sum_{n=1}^{\infty} a_n^2$$

converges.

2016 A2 Given a positive integer n , let $M(n)$ be the largest integer m such that

$$\binom{m}{n-1} > \binom{m-1}{n}.$$

Evaluate

$$\lim_{n \rightarrow \infty} \frac{M(n)}{n}.$$

2016 B1 Let x_0, x_1, x_2, \dots be the sequence such that $x_0 = 1$ and for $n \geq 0$,

$$x_{n+1} = \ln(e^{x_n} - x_n)$$

(as usual, the function \ln is the natural logarithm). Show that the infinite series

$$x_0 + x_1 + x_2 + \dots$$

converges and find its sum.

2014 A3 Let $a_0 = 5/2$ and $a_k = a_{k-1}^2 - 2$ for $k \geq 1$. Compute

$$\prod_{k=0}^{\infty} \left(1 - \frac{1}{a_k}\right)$$

in closed form.