Answer on Question #50129, Math, Complex Analysis

Given:

$$\sum_{n=2}^{\infty} \sqrt[2]{\sqrt[n]{\sqrt[n]{\sqrt[n]{\cos n + i \sin n}}}}$$

Decide:

if these series is convergent or divergent

Solution:

$$a_{n} = (\cos n + i \sin n)^{\frac{1}{2n^{3}}} = (e^{in})^{\frac{1}{2n^{3}}} = e^{i\frac{-\arg(e^{in}) + 2\pi k}{2n^{3}}} \qquad k \in \mathbb{Z}$$

$$\arg(e^{in}) = n$$

$$|a_{n}| = 1$$

we can use the fact

$$\lim_{n\to\infty} a_n = 0 \quad \Leftrightarrow \quad \lim_{n\to\infty} |a_n| = 0$$

we obtain

 $\lim_{n\to\infty} |a_n| = 1 \neq 0$ the necessary condition of convergence of series is not executed, so the series is divergent.

Answer: divergent

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