

$$a_{n+1}^2 = a_n^2 + 2 + \frac{1}{a_n^2} \Rightarrow a_n^2 = 1 + \sum_{q=1}^{n-1} \underbrace{(a_{q+1}^2 - a_q^2)}_{\geq 2} \geq 2n - 1 \Rightarrow a_n \geq \sqrt{2n - 2}$$