

The deviation is not worth it just in case:

$$2 + 2\delta + 2\delta^2 + \dots + 2\delta^{k-1} + 2\delta^k + \dots \geq 2 + 2\delta + 2\delta^2 + \dots + 2\delta^{k-1} + 3\delta^k \quad \text{iff}$$

$$2\delta^k + 2\delta^{k+1} + \dots \geq 3\delta^k \quad \text{iff}$$

$$2\delta + 2\delta^2 + \dots \geq 1 \quad \text{iff}$$

$$2\delta(1 + \delta + \dots) \geq 1 \quad \text{iff}$$

$$2\delta \cdot \frac{1}{1 - \delta} \geq 1 \quad \text{iff}$$

$$\delta \geq \frac{1}{3}.$$