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DIS 1C

## 1 Natural Induction on Inequality

Prove that if  $n \in \mathbb{N}$  and x > 0, then  $(1+x)^n \ge 1 + nx$ .

## 2 Strengthen Induction

Show by induction that  $\sum_{i=1}^{n} \frac{1}{i^3} \leq 2$ .

## 3 Binary Numbers

Prove that every positive integer n can be written in binary. In other words, prove that we can write

$$n = c_k \cdot 2^k + c_{k-1} \cdot 2^{k-1} + \dots + c_1 \cdot 2^1 + c_0 \cdot 2^0$$

where  $k \in \mathbb{N}$  and  $c_i \in \{0,1\}$  for all  $i \leq k$ .

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