

STEP II, 2015, Q1

- 1 (i) By use of calculus, show that $x - \ln(1 + x)$ is positive for all positive x . Use this result to show that

$$\sum_{k=1}^n \frac{1}{k} > \ln(n + 1).$$

- (ii) By considering $x + \ln(1 - x)$, show that

$$\sum_{k=1}^{\infty} \frac{1}{k^2} < 1 + \ln 2.$$



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