

STEP III, 2008 Q4

- 4 (i) Show, with the aid of a sketch, that $y > \tanh(y/2)$ for $y > 0$ and deduce that

$$\operatorname{arcosh} x > \frac{x-1}{\sqrt{x^2-1}} \quad \text{for } x > 1. \quad (*)$$

- (ii) By integrating (*), show that $\operatorname{arcosh} x > 2 \frac{x-1}{\sqrt{x^2-1}}$ for $x > 1$.

- (iii) Show that $\operatorname{arcosh} x > 3 \frac{\sqrt{x^2-1}}{x+2}$ for $x > 1$.

[**Note:** $\operatorname{arcosh} x$ is another notation for $\cosh^{-1} x$.]



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