

STEP III, 2006, Q7

- 7 (i) Solve the equation $u^2 + 2u \sinh x - 1 = 0$ giving u in terms of x .
Find the solution of the differential equation

$$\left(\frac{dy}{dx}\right)^2 + 2\frac{dy}{dx} \sinh x - 1 = 0$$

that satisfies $y = 0$ and $\frac{dy}{dx} > 0$ at $x = 0$.

- (ii) Find the solution, not identically zero, of the differential equation

$$\sinh y \left(\frac{dy}{dx}\right)^2 + 2\frac{dy}{dx} - \sinh y = 0$$

that satisfies $y = 0$ at $x = 0$, expressing your solution in the form $\cosh y = f(x)$. Show that the asymptotes to the solution curve are $y = \pm(-x + \ln 4)$.



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