Problem 1. Find the point of intersection of the lines

\[ L_1 : x(t) = 1 + 2t, \quad y(t) = 2 + 3t, \quad z(t) = 3 + 4t \]
\[ L_2 : x(s) = 2 + s, \quad y(s) = 4 + 2s, \quad z(s) = -1 - 4s, \]

and then find the plane determined by these lines.

Problem 2. Compute the distance from the origin to the plane \( M \) given by

\[ M : \quad 5x + 4y + 7z = 10 \]
Problem 3. Let $S$ be the domain of the function
\[ f : \mathbb{R}^2 \to \mathbb{R} \]
\[ (x, y) \mapsto f(x, y) = \sqrt{\ln x} - y + \sqrt{y} \]

i. Determine explicitly $S$ and sketch it. Find the Range of $f$.

ii. Determine whether $S$ is an open set. Find the boundary of $S$ ($\partial S$). Determine whether $S$ is a closed set. Determine whether $S$ is a bounded set.