

Problem 1.

Derive the Laplace equation in polar coordinates:

$$\frac{1}{r} \frac{\partial}{\partial r} \left(r \frac{\partial u}{\partial r} \right) + \frac{1}{r^2} \frac{\partial^2 u}{\partial \theta^2} = 0$$

from $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) u = 0$

$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$