2-D Wave Equation

$\frac{\tau}{\rho} = c^2$

τ = tension

$$\rho \frac{\partial^2 u}{\partial t^2} = \vec{\nabla} \cdot (\tau \vec{\nabla} u)$$

If τ & ρ are constant then we can divide them out...

$$\frac{\partial^2 u}{\partial t^2} = c^2 \vec{\nabla} \cdot (\vec{\nabla} u) = c^2 \nabla^2 u$$

↖ Laplacian

So $u_{tt} = c^2 u_{xx}$, where $u_{xx} = \nabla^2 u$

If in Rectangular Coordinates (x, y):

$$\nabla^2 u = u_{xx} + u_{yy}$$

$$= \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$$

2-D in Polar Coord:

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