This solution approaches infinity if nx is not an integer multiple of π for any non-zero value of y. The Cauchy problem for the Laplace equation is called ill-posed or not well-posed, since the solution does not continously depend on the data of the problem. Such ill-posed problem are not usually satisfactory for physical applications.

Word Problems

1. $u = e^{xyz}$, find $\frac{\partial^3 u}{\partial x \partial y \partial z}$

$$\frac{\partial^3 u}{\partial x \partial y \partial z} = \frac{\partial^2}{\partial x \partial y}\left(\frac{\partial u}{\partial z}\right)$$

Partially differentiating u with respect to z:

$$\Rightarrow \frac{\partial u}{\partial z} = \frac{\partial}{\partial z}(e^{xyz}) = xye^{xyz}$$

Now,

$$\frac{\partial^2}{\partial x \partial y}(xye^{xyz}) = \frac{\partial}{\partial x}\left[\frac{\partial}{\partial y}(xye^{xyz})\right]$$

$$= xe^{xyz} + xy.xze^{xyz}$$

$$= xe^{xyz} + x^2yze^{xyz}$$

Again,

$$\frac{\partial}{\partial x}(xe^{xyz} + x^2yze^{xyz}) = \frac{\partial}{\partial x}(xe^{xyz}) + \frac{\partial}{\partial x}(x^2yze^{xyz})$$