LA SOL GRAL DE ED en DP
puede ser no única.

$$\frac{\partial^2 u(x,y)}{\partial x^2} - 4\frac{\partial^2 u(x,y)}{\partial x \partial y} + 4\frac{\partial^2 u(x,y)}{\partial y^2} = 0$$

$$u(x,y) = f(mx+y)$$

$$\frac{\partial u}{\partial x} = m \cdot f' \qquad \frac{\partial u}{\partial y} = f'$$

$$\frac{\partial^2 u}{\partial x^2} = m^2 f'' \quad \frac{\partial^2 u}{\partial x \partial y} = m f'' \quad \frac{\partial^2 u}{\partial y^2} = f''$$

$$m^2 f'' - 4 m f'' + 4 f'' = 0$$

$$(m^2 - 4m + 4) f'' = 0 \qquad f'' = 0$$

$$m^2 - 4m + 4 = 0 \qquad (m-2)^2 = 0 \quad m_1 = m_2 = 2$$

$\underline{SG}$ no es única.
$$\left\{ \begin{array}{l} u(x,y) = f_1(2x+y) + x f_2(2x+y) \\ u(x,y) = f_1(2x+y) + y f_2(2x+y) \end{array} \right.$$

Método de Separación Variables

$$\frac{\partial^3 u(x,t)}{\partial t^3} = 4\,\frac{\partial^2 u(x,t)}{\partial x \partial t}$$

Hipótesis: $u(x,t) = F(x)\cdot G(t)$

$$\frac{\partial u}{\partial t} = F\cdot G' \quad \frac{\partial^2 u}{\partial t^2} = F\cdot G'' \quad \frac{\partial^3 u}{\partial t^3} = F\cdot G'''$$

$$\frac{\partial^2 u}{\partial x \partial t} = F'\cdot G'$$

$$F\cdot G''' = 4F'G'$$

$$\boxed{\frac{G'''}{4G'} = \frac{F'}{F}}$$

$$\frac{G'''}{4G'} = \alpha \qquad \frac{F'}{F} = \alpha$$

$$G''' = 4\alpha G' \qquad F' = \alpha F$$

$$\boxed{G''' - 4\alpha G' = 0} \qquad \boxed{F' - \alpha F = 0}$$

para $\alpha = 0$

$$G''' = 0 \quad G''(t) = C_1 \quad G'(t) = C_1\cdot t + C_2$$

$$F' = 0 \quad \boxed{F(x) = k_1} \qquad \boxed{G(t) = \frac{C_1}{2}\cdot t^2 + C_2\cdot t + C_3}$$

Solución general para $\alpha = 0$

$$u(x,t) = \left(\frac{C_1}{2}t^2 + C_2 t + C_3\right)k_1$$

$$\boxed{u(x,t)_{\alpha=0} = C_{10}t^2 + C_{20}t + C_{30}}$$

para $\alpha > 0 \quad \alpha = \beta^2 \ \forall \beta \neq 0$

$G''' - 4\beta^2 G' = 0 \qquad F' - F\beta^2 = 0$

$m^3 - 4\beta^2 m = 0 \qquad m - \beta^2 = 0$

$m(m^2 - 4\beta^2) = 0 \qquad m = \beta^2$

$m(m+2\beta)(m-2\beta) = 0$

$m_1 = 0$

$m_2 = -2\beta$

$m_3 = 2\beta$

$$\boxed{F(x) = k_1 e^{\beta^2 x}}$$

$$\boxed{G(t) = C_1 + C_2 e^{-2\beta t} + C_3 e^{2\beta t}}$$

para $\alpha > 0$

$$u(x,t) = k_1 e^{\beta^2 x}\left(C_1 + C_2 e^{-2\beta t} + C_3 e^{2\beta t}\right)$$

Sol. gral.

$$\boxed{u(x,t) = C_{10} e^{\beta^2 x} + C_{20} e^{\beta^2 x} e^{-2\beta t} + C_3 e^{\beta^2 x} e^{2\beta t}}$$

para $\alpha < 0$ $\quad \alpha = -\beta^2 \quad \forall \beta \neq 0$

$$G''' + 4\beta^2 G' = 0 \qquad F' + \beta^2 F = 0$$

$$m^3 + 4\beta^2 m = 0 \qquad m + \beta^2 = 0$$

$$m(m^2 + 4\beta^2) = 0 \qquad m = -\beta^2$$

$$\boxed{F(x) = k_1 e^{-\beta^2 x}}$$

$$m_1 = 0$$

$$m_2 = 2\beta i$$

$$m_3 = -2\beta i$$

$$\boxed{G(t) = C_1 + C_2 \cos(2\beta t) + C_3 \operatorname{Sen}(2\beta t)}$$

para $\alpha < 0$

$$u(x,t) = k_1 e^{-\beta^2 x}\left(C_1 + C_2 \cos(2\beta t) + C_3 \operatorname{Sen}(2\beta t)\right)$$

$$\boxed{u(x,t) = C_{10} e^{-\beta^2 x} + C_{20} e^{-\beta^2 x} \cos(2\beta t) + C_{30} e^{-\beta^2 x} \operatorname{Sen}(2\beta t)}$$

$$\frac{\partial^2 z(x,y)}{\partial x^2} + \frac{\partial^2 z(x,y)}{\partial x \partial y} - 3\frac{\partial z}{\partial y} = z.$$

H_0: $z(x,y) = F(x) \cdot G(y)$

$$\frac{\partial z}{\partial x} = F' \cdot G \qquad \frac{\partial^2 z}{\partial x^2} = F'' \cdot G$$

$$\frac{\partial^2 z}{\partial x \partial y} = F' \cdot G' \qquad \frac{\partial z}{\partial y} = F \cdot G'$$

$$F'' \cdot G + F' \cdot G' - 3F G' = F \cdot G$$

H_1: $z(x,y) = F + G$

$$\frac{\partial z}{\partial x} = F' \qquad \frac{\partial^2 z}{\partial x^2} = F''$$

$$\frac{\partial^2 z}{\partial x \partial y} = 0 \qquad \frac{\partial z}{\partial y} = G'$$

$$F'' + 0 - 3G' = F + G$$

$$F'' - F = 3G' + G.$$

H_0: $z(x,y) = F \cdot G$

H_1: $z(x,y) = F + G$

H_2: $z(x,y) = \frac{F}{G}$

H_3: $z(x,y) = F^y$

H_4: $z(x,y) = G^x$

H_5: $z(x,y) = \alpha F \cdot G$.

H_6: $z(x,y) = F \cdot \alpha G$