

```

> restart
> Ecua := y'' - 4·y' + 4·y = 6·exp(2 x)
      Ecua :=  $\frac{d^2}{dx^2} y(x) - 4 \left( \frac{d}{dx} y(x) \right) + 4 y(x) = 6 e^{2x}$  (1)
> EcuaHom := lhs(Ecua) = 0
      EcuaHom :=  $\frac{d^2}{dx^2} y(x) - 4 \left( \frac{d}{dx} y(x) \right) + 4 y(x) = 0$  (2)
> Q := rhs(Ecua)
      Q :=  $6 e^{2x}$  (3)
Vamos a resolver la homogenea asociada
> EcuaCarac := m2 - 4·m + 4 = 0
      EcuaCarac :=  $m^2 - 4 m + 4 = 0$  (4)
> Raiz := solve(EcuaCarac)
      Raiz := 2, 2 (5)
Estamos frente al caso II
> yy[1] := exp(Raiz[1]·x); yy[2] := x·exp(Raiz[1]·x)
      yy1 :=  $e^{2x}$ 
      yy2 :=  $x e^{2x}$  (6)
> SolGralHomAsociada := y(x) = _C1·yy[1] + _C2·yy[2]
      SolGralHomAsociada :=  $y(x) = _C1 e^{2x} + _C2 x e^{2x}$  (7)
Método de Parámetros Variables
> SolGralNoHom := y(x) = A(x)·yy[1] + B(x)·yy[2]
      SolGralNoHom :=  $y(x) = A(x) e^{2x} + B(x) x e^{2x}$  (8)
Resolver el sistema algebraico de ecuaciones
> with(linalg) :
> WW := wronskian([yy[1], yy[2]], x)
      WW :=  $\begin{bmatrix} e^{2x} & x e^{2x} \\ 2 e^{2x} & e^{2x} + 2 x e^{2x} \end{bmatrix}$  (9)
> BB := array([0, Q])
      BB :=  $\begin{bmatrix} 0 & 6 e^{2x} \end{bmatrix}$  (10)
> ParaVar := linsolve(WW, BB)
      ParaVar :=  $\begin{bmatrix} -6 x & 6 \end{bmatrix}$  (11)
> Aprima := ParaVar[1]
      Aprima :=  $-6 x$  (12)
> Bprima := ParaVar[2]
      Bprima :=  $6$  (13)
> A(x) := int(Aprima, x) + _C1
      A(x) :=  $-3 x^2 + _C1$  (14)
> B(x) := int(Bprima, x) + _C2

```

$$B(x) := 6x + _C2 \quad (15)$$

> *SolFinal* := simplify(*SolGralNoHom*)

$$SolFinal := y(x) = e^{2x} (_C2 x + 3 x^2 + _C1) \quad (16)$$

> restart

> *Ecua* := $y''' + y'' + y' + y = 2 \cdot x^2 \cdot \exp(x)$

$$Ecua := \frac{d^3}{dx^3} y(x) + \frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 2 x^2 e^x \quad (17)$$

> *EcuaHom* := lhs(*Ecua*) = 0

$$EcuaHom := \frac{d^3}{dx^3} y(x) + \frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 0 \quad (18)$$

> *Q* := rhs(*Ecua*)

$$Q := 2 x^2 e^x \quad (19)$$

> *EcuaCarac* := $m^3 + m^2 + m + 1 = 0$

$$EcuaCarac := m^3 + m^2 + m + 1 = 0 \quad (20)$$

> *Raiz* := solve(*EcuaCarac*)

$$Raiz := -1, I, -I \quad (21)$$

Caso I & Caso III

> *yy*[1] := exp(*Raiz*[1]·*x*)

$$yy_1 := e^{-x} \quad (22)$$

> *yy*[2] := cos(Im(*Raiz*[2])·*x*); *yy*[3] := sin(Im(*Raiz*[2])·*x*)

$$yy_2 := \cos(x)$$

$$yy_3 := \sin(x)$$

(23)

> *SolGralHom* := $y(x) = _C1 \cdot yy[1] + _C2 \cdot yy[2] + _C3 \cdot yy[3]$

$$SolGralHom := y(x) = _C1 e^{-x} + _C2 \cos(x) + _C3 \sin(x) \quad (24)$$

Método de Parámetros Variables

> *SolGralNoHom* := $y(x) = AA \cdot yy[1] + BB \cdot yy[2] + CC \cdot yy[3]$

$$SolGralNoHom := y(x) = AA e^{-x} + BB \cos(x) + CC \sin(x) \quad (25)$$

> with(linalg) :

> *WW* := wronskian([*yy*[1], *yy*[2], *yy*[3]], *x*)

$$WW := \begin{bmatrix} e^{-x} & \cos(x) & \sin(x) \\ -e^{-x} & -\sin(x) & \cos(x) \\ e^{-x} & -\cos(x) & -\sin(x) \end{bmatrix} \quad (26)$$

> *BB* := array([0, 0, *Q*])

$$BB := \begin{bmatrix} 0 & 0 & 2 x^2 e^x \end{bmatrix} \quad (27)$$

> *Para* := simplify(linsolve(*WW*, *BB*))

$$Para := \begin{bmatrix} e^{2x} x^2 & -(\cos(x) + \sin(x)) x^2 e^x & x^2 e^x (\cos(x) - \sin(x)) \end{bmatrix} \quad (28)$$

> *AAprima* := *Para*[1]

$$AAprima := e^{2x} x^2 \quad (29)$$

$$\begin{aligned}
& \text{BBprima} := \text{Para}[2] \\
& \text{BBprima} := -(\cos(x) + \sin(x)) x^2 e^x \quad (30) \\
& \text{CCprima} := \text{Para}[3] \\
& \text{CCprima} := x^2 e^x (\cos(x) - \sin(x)) \quad (31) \\
& \text{AA} := \text{int}(\text{AAprima}, x) + _C1 \\
& \text{AA} := \frac{1}{4} (2 x^2 - 2 x + 1) e^{2x} + _C1 \quad (32) \\
& \text{BB} := \text{simplify}(\text{int}(\text{BBprima}, x) + _C2) \\
& \text{BB} := -e^x \sin(x) x^2 - e^x \cos(x) x + e^x \sin(x) x + e^x \cos(x) + _C2 \quad (33) \\
& \text{CC} := \text{simplify}(\text{int}(\text{CCprima}, x) + _C3) \\
& \text{CC} := \cos(x) x^2 e^x - e^x \cos(x) x - e^x \sin(x) x + e^x \sin(x) + _C3 \quad (34) \\
& \text{SolFinal} := \text{simplify}(\text{SolGralNoHom}) \\
& \text{SolFinal} := y(x) = \frac{1}{2} x^2 e^x - \frac{3}{2} x e^x + \frac{5}{4} e^x + _C2 \cos(x) + _C1 e^{-x} + _C3 \sin(x) \quad (35) \\
& \text{Comprobar} := \text{simplify}(\text{eval}(\text{subs}(y(x) = \text{rhs}(\text{SolFinal}), \text{lhs}(\text{Ecua}) - \text{rhs}(\text{Ecua}) = 0))) \\
& \text{Comprobar} := 0 = 0 \quad (36) \\
& \text{Ecua} \\
& \frac{d^3}{dx^3} y(x) + \frac{d^2}{dx^2} y(x) + \frac{d}{dx} y(x) + y(x) = 2 x^2 e^x \quad (37) \\
& \text{Solucion} := \text{dsolve}(\text{Ecua}) \\
& \text{Solucion} := y(x) = \frac{1}{4} (2 x^2 - 6 x + 5) e^x + _C1 \cos(x) + _C2 \sin(x) + _C3 e^{-x} \quad (38) \\
& >
\end{aligned}$$