```
> restart
> SolucionUnoInicial := y(x) = C1·exp(-x) + C2·x·exp(-x)
```

$$SolucionUnoInicial := y(x) = C1\, e^{-x} + C2\, x\, e^{-x} \tag{1}$$

```
> EcuacionCaracUno := expand((m + 1)··2) = 0
```

$$EcuacionCaracUno := m^2 + 2\, m + 1 = 0 \tag{2}$$

```
> EcuacionUno := diff(y(x), x, x) + 2·diff(y(x), x) + y(x) = 0
```

$$EcuacionUno := \frac{d^2}{dx^2} y(x) + 2 \left(\frac{d}{dx} y(x) \right) + y(x) = 0 \tag{3}$$

```
> SolucionUnoFinal := dsolve(EcuacionUno)
```

$$SolucionUnoFinal := y(x) = \_C1\, e^{-x} + \_C2\, e^{-x} x \tag{4}$$

```
> restart
> SolucionDosInicial := y(x) = C1·exp(2·x)·cos(3·x) + C2·exp(2·x)·sin(3·x) + C3·x·exp(2
      ·x)·cos(3·x) + C4·x·exp(2·x)·sin(3·x)
```

$$SolucionDosInicial := y(x) = C1\, e^{2x} \cos(3\, x) + C2\, e^{2x} \sin(3\, x) + C3\, x\, e^{2x} \cos(3\, x) + C4\, x\, e^{2x} \sin(3\, x) \tag{5}$$

```
> EcuacionCaracDos := expand((m - 2 - 3 I)··2·(m - 2 + 3 I)··2) = 0
```

$$EcuacionCaracDos := m^4 - 8\, m^3 + 42\, m^2 - 104\, m + 169 = 0 \tag{6}$$

```
> EcuacionDos := diff(y(x), x$4) - 8·diff(y(x), x$3) + 42·diff(y(x), x$2) - 104·diff(y(x), x)
      + 169·y(x) = 0
```

$$EcuacionDos := \frac{d^4}{dx^4} y(x) - 8 \left(\frac{d^3}{dx^3} y(x) \right) + 42 \left(\frac{d^2}{dx^2} y(x) \right) - 104 \left(\frac{d}{dx} y(x) \right) + 169\, y(x) = 0 \tag{7}$$

```
> SolaucionDos := dsolve(EcuacionDos)
```

$$SolaucionDos := y(x) = \_C1\, e^{2x} \sin(3\, x) + \_C2\, e^{2x} \cos(3\, x) + \_C3\, e^{2x} \sin(3\, x)\, x + \_C4\, e^{2x} \cos(3\, x)\, x \tag{8}$$

```
> restart
> SolucionTresInicial := y(x) = C1·cos(4·x) + C2·sin(4·x)
```

$$SolucionTresInicial := y(x) = C1 \cos(4\, x) + C2 \sin(4\, x) \tag{9}$$

```
> EcuacionCaracTres := expand((m - 4 I)·(m + 4 I)) = 0
```

$$EcuacionCaracTres := m^2 + 16 = 0 \tag{10}$$

```
> EcuacionTres := diff(y(x), x$2) + 16·y(x) = 0
```

$$EcuacionTres := \frac{d^2}{dx^2} y(x) + 16\, y(x) = 0 \tag{11}$$

```
> SolucionTres := dsolve(EcuacionTres)
```

$$SolucionTres := y(x) = \_C1 \sin(4\, x) + \_C2 \cos(4\, x) \tag{12}$$

```
> restart
> SolucionCuatroInicial := y(x) = C1·exp(-4·x) + C2·x·exp(-4·x) + C3·exp(x)
```

$$SolucionCuatroInicial := y(x) = C1\, e^{-4x} + C2\, x\, e^{-4x} + C3\, e^{x} \tag{13}$$

> $EcuacionCaracCuatro := expand((m+4)\cdot\cdot 2\cdot(m-1)) = 0$

$$EcuacionCaracCuatro := m^3 + 7\,m^2 + 8\,m - 16 = 0 \quad (14)$$

> $EcuacionCuatro := diff(y(x), x\$3) + 7\cdot diff(y(x), x\$2) + 8\cdot diff(y(x), x) - 16\cdot y(x) = 0$

$$EcuacionCuatro := \frac{d^3}{dx^3} y(x) + 7\left(\frac{d^2}{dx^2} y(x)\right) + 8\left(\frac{d}{dx} y(x)\right) - 16\,y(x) = 0 \quad (15)$$

> $SolucionCuatro := dsolve(EcuacionCuatro)$

$$SolucionCuatro := y(x) = \_C1\, e^{x} + \_C2\, e^{-4x} + \_C3\, e^{-4x} x \quad (16)$$

> $restart$

> $Ecuacion := diff(y(x), x\$2) - 5\cdot diff(y(x), x) + 6\cdot y(x) = 4\cdot\exp(-3\cdot x)$

$$Ecuacion := \frac{d^2}{dx^2} y(x) - 5\left(\frac{d}{dx} y(x)\right) + 6\,y(x) = 4\,e^{-3x} \quad (17)$$

> $EcuacionHom := lhs(Ecuacion) = 0$

$$EcuacionHom := \frac{d^2}{dx^2} y(x) - 5\left(\frac{d}{dx} y(x)\right) + 6\,y(x) = 0 \quad (18)$$

> $EcuacionCarac := m\cdot\cdot 2 - 5\cdot m + 6 = 0$

$$EcuacionCarac := m^2 - 5\,m + 6 = 0 \quad (19)$$

> $Raiz := solve(EcuacionCarac)$

$$Raiz := 3, 2 \quad (20)$$

> $SolucionHom := y(x) = C1\cdot\exp(Raiz[1]\cdot x) + C2\cdot\exp(Raiz[2]\cdot x)$

$$SolucionHom := y(x) = C1\, e^{3x} + C2\, e^{2x} \quad (21)$$

Método del Operador Diferencial

> $ParteNoHom := Q(x) = rhs(Ecuacion)$

$$ParteNoHom := Q(x) = 4\,e^{-3x} \quad (22)$$

> $Operadores := (D-3)\cdot(D-2)\cdot(D+3)[A] = 0$

$$Operadores := (D-3)\,(D-2)\,(D+3)_A = 0 \quad (23)$$

> $SolucionHomAsociada := y(x) = C1\cdot\exp(3\cdot x) + C2\cdot\exp(2\cdot x) + C3\cdot\exp(-3\cdot x)$

$$SolucionHomAsociada := y(x) = C1\, e^{3x} + C2\, e^{2x} + C3\, e^{-3x} \quad (24)$$

> $SolucionNoHom := y(x) = C1\, e^{3x} + C2\, e^{2x} + A\, e^{-3x}$

$$SolucionNoHom := y(x) = C1\, e^{3x} + C2\, e^{2x} + A\, e^{-3x} \quad (25)$$

> $SolucionPartQ := y(x) = A\cdot\exp(-3\cdot x)$

$$SolucionPartQ := y(x) = A\, e^{-3x} \quad (26)$$

> $Parametro := isolate(eval(subs(y(x) = rhs(SolucionPartQ), Ecuacion)), A)$

$$Parametro := A = \frac{2}{15} \quad (27)$$

> $SolucionNoHomogenea := subs(A = rhs(Parametro), SolucionNoHom)$

$$SolucionNoHomogenea := y(x) = C1\, e^{3x} + C2\, e^{2x} + \frac{2}{15} e^{-3x} \quad (28)$$

> $restart$

> $EcuacionNoHom := diff(y(x), x\$2) + 6 \cdot diff(y(x), x) + 8 \cdot y(x) = 12 \cdot \exp(-2 \cdot x)$

$$EcuacionNoHom := \frac{d^2}{dx^2} y(x) + 6 \left(\frac{d}{dx} y(x) \right) + 8\, y(x) = 12\, e^{-2x} \quad (29)$$

> $EcuacionHom := lhs(EcuacionNoHom) = 0$

$$EcuacionHom := \frac{d^2}{dx^2} y(x) + 6 \left(\frac{d}{dx} y(x) \right) + 8\, y(x) = 0 \quad (30)$$

> $EcuacionCarac := m \cdot\cdot 2 + 6 \cdot m + 8 = 0$

$$EcuacionCarac := m^2 + 6\, m + 8 = 0 \quad (31)$$

> $Raiz := solve(EcuacionCarac)$

$$Raiz := -2, -4 \quad (32)$$

> $SolucionHom := y(x) = C1 \cdot \exp(Raiz[1] \cdot x) + C2 \cdot \exp(Raiz[2] \cdot x)$

$$SolucionHom := y(x) = C1\, e^{-2x} + C2\, e^{-4x} \quad (33)$$

> $ParteNoHom := Q(x) = rhs(EcuacionNoHom)$

$$ParteNoHom := Q(x) = 12\, e^{-2x} \quad (34)$$

> $Operadores := (D + 2) \cdot (D + 4) \cdot (D + 2)[A] = 0$

$$Operadores := (D + 2)\ (D + 4)\ (D + 2)_A = 0 \quad (35)$$

> $OperadoresDos := (D + 2) \cdot\cdot 2 \cdot (D + 4) = 0$

$$OperadoresDos := (D + 2)^2\ (D + 4) = 0 \quad (36)$$

> $SolucionHomAsociada := y(x) = C1 \cdot \exp(-2 \cdot x) + C2 \cdot x \cdot \exp(-2 \cdot x) + C3 \cdot \exp(-4 \cdot x)$

$$SolucionHomAsociada := y(x) = C1\, e^{-2x} + C2\, x\, e^{-2x} + C3\, e^{-4x} \quad (37)$$

> $SolucionHom$

$$y(x) = C1\, e^{-2x} + C2\, e^{-4x} \quad (38)$$

> $SolucionNoHom := y(x) = C1 \cdot \exp(-2 \cdot x) + C2 \cdot \exp(-4 \cdot x) + A \cdot x \cdot \exp(-2 \cdot x)$

$$SolucionNoHom := y(x) = C1\, e^{-2x} + C2\, e^{-4x} + A\, x\, e^{-2x} \quad (39)$$

> $SolucionPartQ := y(x) = A \cdot x \cdot \exp(-2 \cdot x)$

$$SolucionPartQ := y(x) = A\, x\, e^{-2x} \quad (40)$$

> $Parametro := isolate(eval(subs(y(x) = rhs(SolucionPartQ), EcuacionNoHom)), A)$

$$Parametro := A = 6 \quad (41)$$

> $SolucionNoHomogenea := subs(A = rhs(Parametro), SolucionNoHom)$

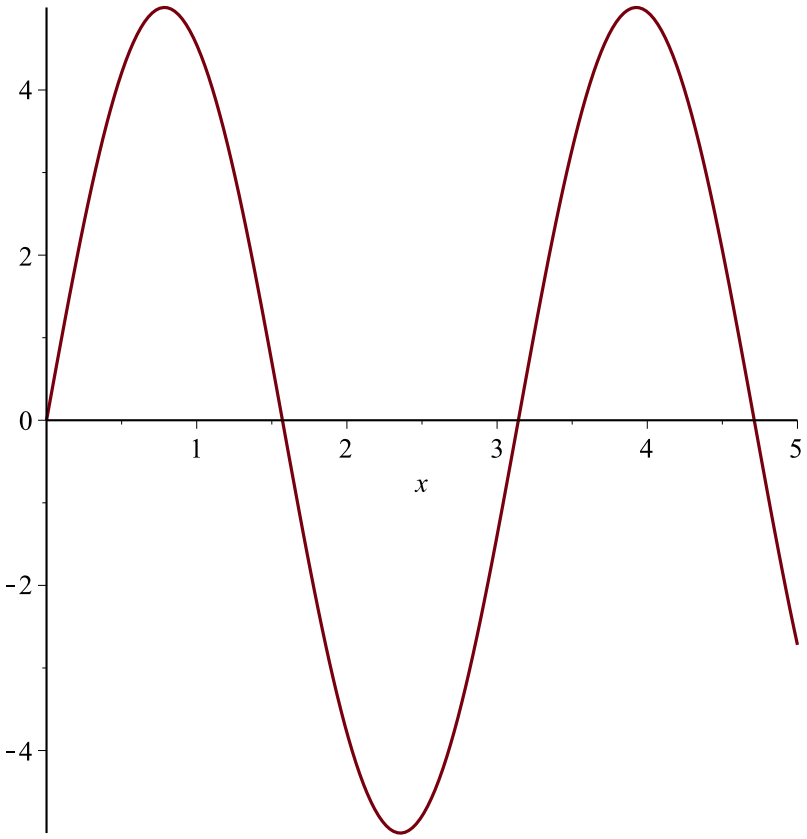
$$SolucionNoHomogenea := y(x) = C1\, e^{-2x} + C2\, e^{-4x} + 6\, x\, e^{-2x} \quad (42)$$

> $restart$

> $Sol := 5 \sin(2\, x)$

$$Sol := 5 \sin(2\, x) \quad (43)$$

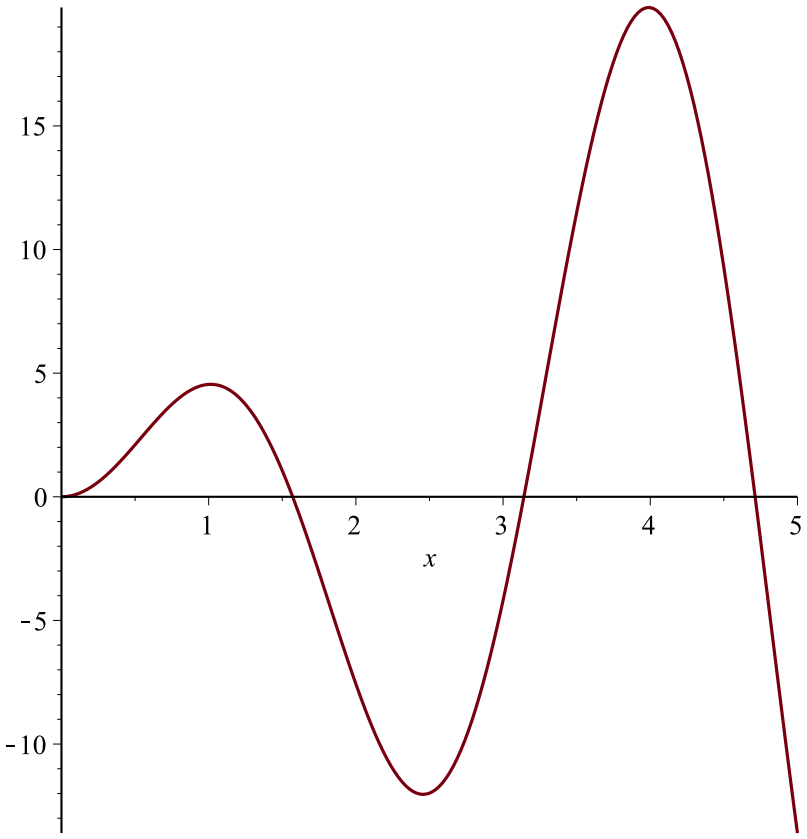
> $plot(Sol, x = 0 \ldots 5)$



> $SolUno := 5 \cdot x \cdot \sin(2\,x)$

$$SolUno := 5\,x\,\sin(2\,x) \tag{44}$$

> $plot(SolUno, x = 0..5)$




```
> restart
>
```