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> restart
> Ecua := y'' - 2·y' + 2·y = 0
      Ecua :=  $\frac{d^2}{dx^2} y(x) - 2 \frac{d}{dx} y(x) + 2 y(x) = 0$  (1)
=
> EcuaCarac := m2 - 2·m + 2 = 0
      EcuaCarac :=  $m^2 - 2 m + 2 = 0$  (2)
=
> Raiz := solve(EcuaCarac)
      Raiz := 1 + I, 1 - I (3)
=
> yy[1] := exp(Re(Raiz[1])·x)·cos(Im(Raiz[1])·x); yy[2] := exp(Re(Raiz[1])·x)
  ·sin(Im(Raiz[1])·x)
      yy1 := ex cos(x)
      yy2 := ex sin(x) (4)
=
> SolGral := y(x) = C[1]·yy[1] + C[2]·yy[2]
      SolGral := y(x) = C1 ex cos(x) + C2 ex sin(x) (5)
=
> CondIni := y(0) = 0, D(y)(0) = 1
      CondIni := y(0) = 0, D(y)(0) = 1 (6)
=
> CondIniUno := eval(subs(x=0, rhs(SolGral) = 0))
      CondIniUno := C1 = 0 (7)
=
> CondIniDos := eval(subs(x=0, rhs(diff(SolGral, x)))) = 1
      CondIniDos := C1 + C2 = 1 (8)
=
> with(linalg) :
> Para := solve( {CondIniUno, CondIniDos}, {C[1], C[2]} )
      Para := {C1 = 0, C2 = 1} (9)
=
> SolPart := subs(C[1] = rhs(Para[1]), C[2] = rhs(Para[2]), SolGral)
      SolPart := y(x) = ex sin(x) (10)
=
> SolPartDos := eval(SolGral, Para)
      SolPartDos := y(x) = ex sin(x) (11)
=
> restart
> Ecua := y'' - 2·y' + 3·y = 0
      Ecua :=  $\frac{d^2}{dx^2} y(x) - 2 \frac{d}{dx} y(x) + 3 y(x) = 0$  (12)
=
> CondIni := y(0) = 1, D(y)(0) = 3
      CondIni := y(0) = 1, D(y)(0) = 3 (13)
=
> EcuaCarac := m2 - 2·m + 3 = 0
      EcuaCarac :=  $m^2 - 2 m + 3 = 0$  (14)
=
> Raiz := solve(EcuaCarac)
      Raiz := 1 + I√2, 1 - I√2 (15)

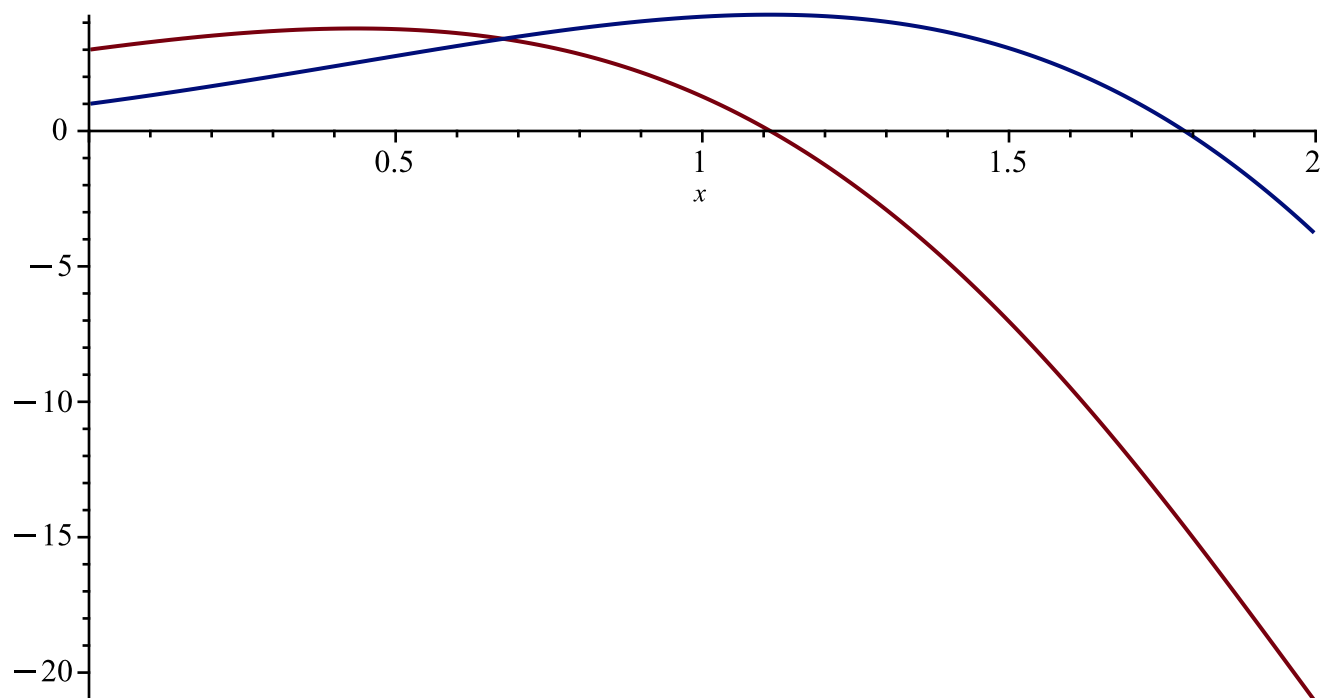
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> yy[1] := exp(Re(Raiz[1])·x)·cos(Im(Raiz[1])·x); yy[2] := exp(Re(Raiz[1])·x)
  ·sin(Im(Raiz[1])·x)
      yy1 := ex cos(√2 x)
      yy2 := ex sin(√2 x)
(16)
=
> SolGral := y(x) = C[1]·yy[1] + C[2]·yy[2]
      SolGral := y(x) = C1 ex cos(√2 x) + C2 ex sin(√2 x)
(17)
=
> CondIniUno := simplify(subs(x=0, rhs(SolGral) = 1))
      CondIniUno := C1 = 1
(18)
=
> CondIniDos := simplify(subs(x=0, rhs(diff(SolGral, x)) = 3))
      CondIniDos := √2 C2 + C1 = 3
(19)
=
> Para := solve({CondIniUno, CondIniDos})
      Para := {C1 = 1, C2 = √2}
(20)
=
> SolPart := eval(SolGral, Para)
      SolPart := y(x) = ex cos(√2 x) + √2 ex sin(√2 x)
(21)
=
> ComprobarUno := simplify(subs(x=0, SolPart))
      ComprobarUno := y(0) = 1
(22)
=
> CondIni[1]
      y(0) = 1
(23)
=
> ComprobarDos := D(y)(0) = simplify(subs(x=0, rhs(diff(SolPart, x))))
      ComprobarDos := D(y)(0) = 3
(24)
=
> CondIni[2]
      D(y)(0) = 3
(25)
=
> ComprobarTres := simplify(eval(subs(y(x) = rhs(SolPart), Ecua)))
      ComprobarTres := 0 = 0
(26)
=
> Ecua
      
$$\frac{d^2}{dx^2} y(x) - 2 \frac{d}{dx} y(x) + 3 y(x) = 0$$

(27)
=
> ComprobarCuatro := simplify(eval(subs(y(x) = rhs(SolGral), Ecua)))
      ComprobarCuatro := 0 = 0
(28)
=
> SolGral
      y(x) = C1 ex cos(√2 x) + C2 ex sin(√2 x)
(29)
=
> plot({rhs(SolPart), rhs(diff(SolPart, x))}, x=0..2)

```



> CondIni

$$y(0) = 1, D(y)(0) = 3 \quad (30)$$

> SolPart

$$y(x) = e^x \cos(\sqrt{2} x) + \sqrt{2} e^x \sin(\sqrt{2} x) \quad (31)$$

> restart

> SolGral := y(x) = C[1]·exp(-2 x) + C[2]·x·exp(-2·x) + C[3]·exp(3 x)

$$\text{SolGral} := y(x) = C_1 e^{-2x} + C_2 x e^{-2x} + C_3 e^{3x} \quad (32)$$

> DerSolGral := diff(SolGral, x)

$$\text{DerSolGral} := \frac{d}{dx} y(x) = -2 C_1 e^{-2x} + C_2 e^{-2x} - 2 C_2 x e^{-2x} + 3 C_3 e^{3x} \quad (33)$$

> DerDerSolGral := diff(SolGral, x\$2)

$$\text{DerDerSolGral} := \frac{d^2}{dx^2} y(x) = 4 C_1 e^{-2x} - 4 C_2 e^{-2x} + 4 C_2 x e^{-2x} + 9 C_3 e^{3x} \quad (34)$$

> DerDerDerSolGral := diff(SolGral, x\$3)

$$\text{DerDerDerSolGral} := \frac{d^3}{dx^3} y(x) = -8 C_1 e^{-2x} + 12 C_2 e^{-2x} - 8 C_2 x e^{-2x} + 27 C_3 e^{3x} \quad (35)$$

> Para := solve({DerSolGral, DerDerSolGral, DerDerDerSolGral}, {C[1], C[2], C[3]}) :
Para[1]; Para[2]; Para[3]

$$C_1 = -\frac{1}{100 e^{-2x}} \left(10 x \left(\frac{d^3}{dx^3} y(x) \right) - 10 x \left(\frac{d^2}{dx^2} y(x) \right) - 60 x \left(\frac{d}{dx} y(x) \right) - 7 \frac{d^3}{dx^3} y(x) \right. \\ \left. - 3 \frac{d^2}{dx^2} y(x) + 72 \frac{d}{dx} y(x) \right)$$

$$C_2 = \frac{-6 \frac{d}{dx} y(x) - \frac{d^2}{dx^2} y(x) + \frac{d^3}{dx^3} y(x)}{10 e^{-2x}}$$

$$C_3 = \frac{4 \frac{d}{dx} y(x) + 4 \frac{d^2}{dx^2} y(x) + \frac{d^3}{dx^3} y(x)}{75 e^{3x}} \quad (36)$$

> *EcuaInicial* := simplify(subs(C[1]=rhs(Para[1]), C[2]=rhs(Para[2]), C[3]=rhs(Para[3]), SolGral))

$$EcuaInicial := y(x) = \frac{\frac{d^3}{dx^3} y(x)}{12} + \frac{\frac{d^2}{dx^2} y(x)}{12} - \frac{2 \frac{d}{dx} y(x)}{3} \quad (37)$$

> *EcuaInicialDos* := *EcuaInicial*·12

$$EcuaInicialDos := 12 y(x) = \frac{d^3}{dx^3} y(x) + \frac{d^2}{dx^2} y(x) - 8 \frac{d}{dx} y(x) \quad (38)$$

> *EcuaFinal* := rhs(*EcuaInicialDos*) - lhs(*EcuaInicialDos*) = 0

$$EcuaFinal := \frac{d^3}{dx^3} y(x) + \frac{d^2}{dx^2} y(x) - 8 \frac{d}{dx} y(x) - 12 y(x) = 0 \quad (39)$$

>

> *SolGralDos* := dsolve(*EcuaFinal*)

$$SolGralDos := y(x) = c_1 e^{3x} + c_2 e^{-2x} + c_3 e^{-2x} x \quad (40)$$

> restart

> *Ecua* := exp(x)·log(y) + $\frac{\exp(2x) \cdot y'}{2 \cdot y} = 0$

$$Ecua := e^x \ln(y(x)) + \frac{e^{2x} \left(\frac{d}{dx} y(x) \right)}{2 y(x)} = 0 \quad (41)$$

> *CondIni* := y(0) = exp(1)

$$CondIni := y(0) = e \quad (42)$$

> with(DEtools) :

> odeadvisor(*Ecua*)

$$[_{separable}] \quad (43)$$

> *M* := e^x ln(y)

$$M := e^x \ln(y) \quad (44)$$

> *N* := $\frac{\exp(2x)}{2 \cdot y}$

$$N := \frac{e^{2x}}{2 y} \quad (45)$$

> *P* := exp(x)

$$P := e^x \quad (46)$$

$$\begin{array}{|l} \text{> } Q := \log(y) \\ \text{=} \end{array} \quad Q := \ln(y) \quad (47)$$

$$\begin{array}{|l} \text{> } R := \exp(2\,x) \\ \text{=} \end{array} \quad R := e^{2\,x} \quad (48)$$

$$\begin{array}{|l} \text{> } S := \frac{1}{2 \cdot y} \\ \text{=} \end{array} \quad S := \frac{1}{2\,y} \quad (49)$$

$$\begin{array}{|l} \text{> } SolGral := \int \left(\frac{P}{R}, x \right) + \int \left(\frac{S}{Q}, y \right) = C[1] \\ \text{=} \end{array} \quad SolGral := -\frac{e^x}{e^{2\,x}} + \frac{\ln(\ln(y))}{2} = C_1 \quad (50)$$

$$\begin{array}{|l} \text{> } Para := \text{simplify}(\text{subs}(x=0, y=\exp(1), SolGral)) \\ \text{=} \end{array} \quad Para := -1 = C_1 \quad (51)$$

$$\begin{array}{|l} \text{> } SolPart := \text{simplify}(\text{subs}(C[1]=\text{lhs}(Para), SolGral)) \\ \text{=} \end{array} \quad SolPart := -e^{-x} + \frac{\ln(\ln(y))}{2} = -1 \quad (52)$$

$\begin{array}{|l} \text{> } restart \\ \text{=} \end{array}$

$\begin{array}{|l} \text{> } \end{array}$