```
> restart
> Ecua := (x/sqrt(x^2+y(x)^2) + 1/x + 1/y(x)) + (y(x)/sqrt(x^2+y(x)^2) + 1/y(x) - x/y(x)^2)
      ·diff(y(x), x) = 0
```

$$Ecua := \frac{x}{\sqrt{x^2+y(x)^2}} + \frac{1}{x} + \frac{1}{y(x)} + \left(\frac{y(x)}{\sqrt{x^2+y(x)^2}} + \frac{1}{y(x)} - \frac{x}{y(x)^2}\right)\left(\frac{d}{dx}y(x)\right) = 0 \quad (1)$$

```
> with(DEtools) :
> odeadvisor(Ecua)
```

$$[\_exact] \quad (2)$$

```
> M := x/sqrt(x^2+y^2) + 1/x + 1/y
```

$$M := \frac{x}{\sqrt{x^2+y^2}} + \frac{1}{x} + \frac{1}{y} \quad (3)$$

```
> N := y/sqrt(x^2+y^2) + 1/y - x/y^2
```

$$N := \frac{y}{\sqrt{x^2+y^2}} + \frac{1}{y} - \frac{x}{y^2} \quad (4)$$

```
> Comprobacion := (diff(M, y) - diff(N, x)) = 0
```

$$Comprobacion := 0 = 0 \quad (5)$$

```
> IntMx := int(M, x)
```

$$IntMx := \sqrt{x^2+y^2} + \ln(x) + \frac{x}{y} \quad (6)$$

```
> SolGral := IntMx + int((N - diff(IntMx, y)), y) = _C1
```

$$SolGral := \sqrt{x^2+y^2} + \ln(x) + \frac{x}{y} + \ln(y) = \_C1 \quad (7)$$

```
> SolGralFinal := sqrt(x^2+y(x)^2) + ln(x) + x/y(x) + ln(y(x)) = _C1
```

$$SolGralFinal := \sqrt{x^2+y(x)^2} + \ln(x) + \frac{x}{y(x)} + \ln(y(x)) = \_C1 \quad (8)$$

```
> Ecua
```

$$\frac{x}{\sqrt{x^2+y(x)^2}} + \frac{1}{x} + \frac{1}{y(x)} + \left(\frac{y(x)}{\sqrt{x^2+y(x)^2}} + \frac{1}{y(x)} - \frac{x}{y(x)^2}\right)\left(\frac{d}{dx}y(x)\right) = 0 \quad (9)$$

```
> DerSolGral := simplify(isolate(diff(SolGralFinal, x), diff(y(x), x)))
```

$$DerSolGral := \frac{d}{dx}y(x) = -\frac{y(x)\left(y(x)\,x^2 + \sqrt{x^2+y(x)^2}\,y(x) + x\sqrt{x^2+y(x)^2}\right)}{x\left(y(x)^3 + \sqrt{x^2+y(x)^2}\,y(x) - x\sqrt{x^2+y(x)^2}\right)} \quad (10)$$

```
> DerEcua := simplify(isolate(Ecua, diff(y(x), x)))
```

$$DerEcua := \frac{d}{dx}y(x) = -\frac{y(x)\left(y(x)\,x^2 + \sqrt{x^2+y(x)^2}\,y(x) + x\sqrt{x^2+y(x)^2}\right)}{x\left(y(x)^3 + \sqrt{x^2+y(x)^2}\,y(x) - x\sqrt{x^2+y(x)^2}\right)} \quad (11)$$

```
> ComprobarDos := rhs(DerEcua) - rhs(DerSolGral) = 0
```

$$ComprobarDos := 0 = 0 \quad (12)$$

```
> restart
> Ecua := (1 - x^2*y(x)) + x^2*(y(x) - x)*diff(y(x), x) = 0
```

$$Ecua := 1 - x^2\,y(x) + x^2\,(y(x) - x)\left(\frac{d}{dx}\,y(x)\right) = 0 \tag{13}$$

```
> with(DEtools):
> odeadvisor(Ecua)
```

[_rational, [_1st_order, _with_symmetry_[F(x),G(x)]], [_Abel, 2nd type, class B]] (14)

```
> M := 1 - x^2*y
```

$$M := -x^2\,y + 1 \tag{15}$$

```
> N := x^2*(y - x)
```

$$N := x^2\,(y - x) \tag{16}$$

```
> ComprobarExacta := diff(M, y) <> diff(N, x)
```

$$ComprobarExacta := -x^2 \neq 2\,x\,(y - x) - x^2 \tag{17}$$

```
> f := (diff(M, y) - diff(N, x))/N
```

$$f := -\frac{2}{x} \tag{18}$$

```
> IntFact := isolate(int(1/mu, mu) = int(f, x), mu)
```

$$IntFact := \mu = \frac{1}{x^2} \tag{19}$$

```
> MM := expand(rhs(IntFact)*M)
```

$$MM := -y + \frac{1}{x^2} \tag{20}$$

```
> NN := expand(rhs(IntFact)*N)
```

$$NN := y - x \tag{21}$$

```
> ComprExacta := diff(MM, y) = diff(NN, x)
```

$$ComprExacta := -1 = -1 \tag{22}$$

```
> EcuaExacta := MM + NN*diff(y(x), x) = 0
```

$$EcuaExacta := -y + \frac{1}{x^2} + (y - x)\left(\frac{d}{dx}\,y(x)\right) = 0 \tag{23}$$

```
> IntMMx := int(MM, x)
```

$$IntMMx := -y\,x - \frac{1}{x} \tag{24}$$

```
> SolGral := IntMMx + int((NN - diff(IntMMx, y)), y) = _C1
```

$$SolGral := -y\,x - \frac{1}{x} + \frac{1}{2}\,y^2 = \_C1 \tag{25}$$

```
> SolGralFinal := -y(x)*x - 1/x + 1/2*y(x)^2 = _C1
```

$$SolGralFinal := -y(x)\,x - \frac{1}{x} + \frac{1}{2}\,y(x)^2 = \_C1 \tag{26}$$

```
> Ecua
```

(27)

$$1 - x^2 y(x) + x^2 (y(x) - x) \left(\frac{d}{dx} y(x) \right) = 0 \quad (27)$$

> $DerEcua := isolate(Ecua, diff(y(x), x))$

$$DerEcua := \frac{d}{dx} y(x) = \frac{-1 + x^2 y(x)}{x^2 (y(x) - x)} \quad (28)$$

> $DerSolGral := isolate(diff(SolGralFinal, x), diff(y(x), x))$

$$DerSolGral := \frac{d}{dx} y(x) = \frac{y(x) - \frac{1}{x^2}}{y(x) - x} \quad (29)$$

> $ComprobaFinal := simplify(rhs(DerEcua) - rhs(DerSolGral)) = 0$

$$ComprobaFinal := 0 = 0 \quad (30)$$

> $restart$

> $y[1] := \sin(x - 3 \cdot Pi)$

$$y_1 := -\sin(x) \quad (31)$$

> $y[2] := sen(x - 3 \cdot Pi)$

$$y_2 := sen(x - 3\,\pi) \quad (32)$$

> $y[3] := \sin(x - 3 \cdot pi)$

$$y_3 := -\sin(-x + 3\,\pi) \quad (33)$$

> $diff(y[1], x)$

$$-\cos(x) \quad (34)$$

> $diff(y[2], x)$

$$D(sen)(x - 3\,\pi) \quad (35)$$

> $diff(y[3], x)$

$$\cos(-x + 3\,\pi) \quad (36)$$

> $evalf(Pi)$

$$3.141592654 \quad (37)$$

> $evalf(pi)$

$$\pi \quad (38)$$

> $evalf(PI)$

$$\Pi \quad (39)$$

> $restart$

> $Ecua[1] := y'' - 4 \cdot y' + 4 \cdot y = 0$

$$Ecua_1 := \frac{d^2}{dx^2} y(x) - 4 \left(\frac{d}{dx} y(x) \right) + 4\, y(x) = 0 \quad (40)$$

> $Sol[1] := dsolve(Ecua[1])$

$$Sol_1 := y(x) = \_C1\, e^{2x} + \_C2\, e^{2x} x \quad (41)$$

> $Ecua[2] := y'' - 3 \cdot y' + 3 \cdot y = 0$

$$Ecua_2 := \frac{d^2}{dx^2} y(x) - 3 \left(\frac{d}{dx} y(x) \right) + 3\, y(x) = 0 \quad (42)$$

> $Sol[2] := dsolve(Ecua[2])$

$$Sol_2 := y(x) = \_C1\, e^{\frac{3}{2}x} \sin\left(\frac{1}{2}\sqrt{3}\,x\right) + \_C2\, e^{\frac{3}{2}x} \cos\left(\frac{1}{2}\sqrt{3}\,x\right) \quad (43)$$

> $Ecua[3] := y'' - 2\cdot y' + 2\cdot y = 0$

$$Ecua_3 := \frac{d^2}{dx^2} y(x) - 2\left(\frac{d}{dx} y(x)\right) + 2\,y(x) = 0 \quad (44)$$

> $Sol[3] := dsolve(Ecua[3])$

$$Sol_3 := y(x) = \_C1\, e^{x} \sin(x) + \_C2\, e^{x} \cos(x) \quad (45)$$

> $Ecua[4] := y'' - y' + y = 0$

$$Ecua_4 := \frac{d^2}{dx^2} y(x) - \left(\frac{d}{dx} y(x)\right) + y(x) = 0 \quad (46)$$

> $Sol[4] := dsolve(Ecua[4])$

$$Sol_4 := y(x) = \_C1\, e^{\frac{1}{2}x} \sin\left(\frac{1}{2}\sqrt{3}\,x\right) + \_C2\, e^{\frac{1}{2}x} \cos\left(\frac{1}{2}\sqrt{3}\,x\right) \quad (47)$$

> $Ecua[5] := y'' - 5\cdot y' + 6\,y = 0$

$$Ecua_5 := \frac{d^2}{dx^2} y(x) - 5\left(\frac{d}{dx} y(x)\right) + 6\,y(x) = 0 \quad (48)$$

> $Sol[5] := dsolve(Ecua[5])$

$$Sol_5 := y(x) = \_C1\, e^{2x} + \_C2\, e^{3x} \quad (49)$$

> $restart$

> $Ecua_5 := \frac{d^2}{dx^2} y(x) - 5\left(\frac{d}{dx} y(x)\right) + 6\,y(x) = 10\cdot\exp(3\cdot x)$

$$Ecua_5 := \frac{d^2}{dx^2} y(x) - 5\left(\frac{d}{dx} y(x)\right) + 6\,y(x) = 10\, e^{3x} \quad (50)$$

> $Sol_5 := y(x) = \_C1\, e^{2x} + \_C2\, e^{3x}$

$$Sol_5 := y(x) = \_C1\, e^{2x} + \_C2\, e^{3x} \quad (51)$$

> $yy[1] := e^{2x}; yy[2] := e^{3x}$

$$yy_1 := e^{2x}$$

$$yy_2 := e^{3x} \quad (52)$$

> $Q := 10\, e^{3x}$

$$Q := 10\, e^{3x} \quad (53)$$

> $with(linalg)$:

> $WW := array([[yy[1], yy[2]], [diff(yy[1], x), diff(yy[2], x)]])$

$$WW := \begin{bmatrix} e^{2x} & e^{3x} \\ 2\, e^{2x} & 3\, e^{3x} \end{bmatrix} \quad (54)$$

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

$$BB := \begin{bmatrix} 0 & 10\, e^{3x} \end{bmatrix} \quad (55)$$

```
> Raiz := linsolve(WW, BB)
```

$$Raiz := \begin{bmatrix} -\dfrac{10\,e^{3x}}{e^{2x}} & 10 \end{bmatrix} \tag{56}$$

```
> Aprima := Raiz[1]; Bprima := Raiz[2]
```

$$Aprima := -\frac{10\,e^{3x}}{e^{2x}}$$

$$Bprima := 10 \tag{57}$$

```
> SolGral := y(x) = simplify(subs(_C2 = _C20 + 10, simplify((int(Aprima, x) + _C1)·yy[1]
      + (int(Bprima, x) + _C2)·yy[2])))
```

$$SolGral := y(x) = e^{3x}\,\_C20 + 10\,e^{3x}x + \_C1\,e^{2x} \tag{58}$$

```
> restart
>
>
>
>
>
```