

```
> restart;
```

```
> Ecua := (diff(y(x), x)) · 2 · (2 - 3 · y(x)) · 2 = 4 · (1 - y(x))
```

$$Ecua := \left(\frac{d}{dx} y(x) \right)^2 (2 - 3 y(x))^2 = 4 - 4 y(x) \quad (1)$$

```
> Sol := dsolve(Ecua) : SolSing := Sol[1];
```

$$SolSing := y(x) = 1 \quad (2)$$

```
> SolGral := y(x) · 2 · (1 - y(x)) = (x - C) · 2
```

$$SolGral := y(x)^2 (1 - y(x)) = (x - C)^2 \quad (3)$$

```
> SolPart := subs(C=5, SolGral)
```

$$SolPart := y(x)^2 (1 - y(x)) = (x - 5)^2 \quad (4)$$

```
> DerUno := isolate(Ecua, diff(y(x), x) · 2)
```

$$DerUno := \left(\frac{d}{dx} y(x) \right)^2 = \frac{4 - 4 y(x)}{(2 - 3 y(x))^2} \quad (5)$$

```
> DerSol := isolate(diff(SolGral, x), diff(y(x), x))
```

$$DerSol := \frac{d}{dx} y(x) = \frac{2 x - 2 C}{2 y(x) (1 - y(x)) - y(x)^2} \quad (6)$$

```
> Param := isolate(DerSol, C)
```

$$Param := C = -\frac{1}{2} \left(\frac{d}{dx} y(x) \right) (2 y(x) (1 - y(x)) - y(x)^2) + x \quad (7)$$

```
> DerSolGral := isolate(subs(C=rhs(Param), SolGral), diff(y(x), x) · 2)
```

$$DerSolGral := \left(\frac{d}{dx} y(x) \right)^2 = \frac{4 y(x)^2 (1 - y(x))}{(2 y(x) (1 - y(x)) - y(x)^2)^2} \quad (8)$$

```
> Comprobacion := simplify(rhs(DerUno) - rhs(DerSolGral)) = 0
```

$$Comprobacion := 0 = 0 \quad (9)$$

```
> ComprobacionDos := eval(subs(y(x)=rhs(SolSing), Ecua))
```

$$ComprobacionDos := 0 = 0 \quad (10)$$

```
>
```

```
> restart;
```

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

$$Ecua := 1 - x^2 y(x) + x^2 (y(x) - x) \left(\frac{d}{dx} y(x) \right) = 0 \quad (11)$$

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

$$M := -x^2 y + 1 \quad (12)$$

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

$$N := x^2 (y - x) \quad (13)$$

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

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

(14)

```
> FI:=intfactor(Ecua);

FI:= 1/x^2
```

(15)

```
> MM:=expand(FI*M);

MM:= -y + 1/x^2
```

(16)

```
> NN:=expand(FI*N);

NN:= y - x
```

(17)

```
> Comprobacion:=diff(MM,y)-diff(NN,x)=0;
Comprobacion:= 0 = 0
```

(18)

```
> IntMMx:=Int(MM,x);

IntMMx:= ∫ (-y + 1/x^2) dx
```

(19)

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

IntMMx:= -x y - 1/x
```

(20)

```
> SolGral:=IntMMx+Int((NN-diff(IntMMx,y)),y)=C1;

SolGral:= -x y - 1/x + ∫ y dy = C1
```

(21)

```
> SolGral:=IntMMx+int((NN-diff(IntMMx,y)),y)=C1;

SolGral:= -x y - 1/x + y^2/2 = C1
```

(22)

```
> Ecua;

1 - x^2 y(x) + x^2 (y(x) - x) (d/dx y(x)) = 0
```

(23)

```
> SolGralDos:=-x*y(x)-1/x+1/2*y(x)^2 = C1;
```

(24)

$$SolGralDos := -x y(x) - \frac{1}{x} + \frac{1}{2} y(x)^2 = C1 \quad (24)$$

> DerivSol:=diff(SolGralDos,x);

$$DerivSol := -y(x) - x \left(\frac{d}{dx} y(x) \right) + \frac{1}{x^2} + y(x) \left(\frac{d}{dx} y(x) \right) = 0 \quad (25)$$

> Ecua;

$$1 - x^2 y(x) + x^2 (y(x) - x) \left(\frac{d}{dx} y(x) \right) = 0 \quad (26)$$

> DespUno:=isolate(DerivSol,diff(y(x),x));

$$DespUno := \frac{d}{dx} y(x) = \frac{y(x) - \frac{1}{x^2}}{y(x) - x} \quad (27)$$

> DespDos:=isolate(Ecua,diff(y(x),x));

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

> Comprobacion:=simplify(rhs(DespUno)-rhs(DespDos))=0;

$$Comprobacion := 0 = 0 \quad (29)$$

> restart;

> Ecua:=diff(x(t),t\$2)+2*diff(x(t),t)+x(t)=3*exp(-t)+4*t*exp(-t);

$$Ecua := \frac{d^2}{dt^2} x(t) + 2 \left(\frac{d}{dt} x(t) \right) + x(t) = 3 e^{-t} + 4 t e^{-t} \quad (30)$$

> EcuaHom:=lhs(Ecua)=0;

$$EcuaHom := \frac{d^2}{dt^2} x(t) + 2 \left(\frac{d}{dt} x(t) \right) + x(t) = 0 \quad (31)$$

> Q:=rhs(Ecua);

$$Q := 3 e^{-t} + 4 t e^{-t} \quad (32)$$

> EcuaCarac:=m**2+2*m+1=0;

$$EcuaCarac := m^2 + 2 m + 1 = 0 \quad (33)$$

> Raiz:=solve(EcuaCarac);

$$Raiz := -1, -1 \quad (34)$$

> x1:=exp(Raiz[1]*t);

$$x1 := e^{-t} \quad (35)$$

> x2:=t*exp(Raiz[1]*t);

$$x2 := t e^{-t} \quad (36)$$

> Sol:=x(t)=C1*x1+C2*x2;

(37)

$$Sol := x(t) = C1 e^{-t} + C2 t e^{-t} \quad (37)$$

```
> SolNoHom:=x(t)=A*x1+B*x2;
```

$$SolNoHom := x(t) = A e^{-t} + B t e^{-t} \quad (38)$$

```
> with(linalg):
```

```
> WW:=wronskian([x1,x2],t);
```

$$WW := \begin{bmatrix} e^{-t} & t e^{-t} \\ -e^{-t} & e^{-t} - t e^{-t} \end{bmatrix} \quad (39)$$

```
> ZZ:=array([0,Q]);
```

$$ZZ := \begin{bmatrix} 0 & 3 e^{-t} + 4 t e^{-t} \end{bmatrix} \quad (40)$$

```
> Param:=linsolve(WW,ZZ);
```

$$Param := \begin{bmatrix} -t(4t+3) & 4t+3 \end{bmatrix} \quad (41)$$

```
> Aprima:=Param[1];
```

$$Aprima := -t(4t+3) \quad (42)$$

```
> Bprima:=Param[2];
```

$$Bprima := 4t+3 \quad (43)$$

```
> A:=int(Aprima,t)+C1;B:=int(Bprima,t)+C2;
```

$$A := -\frac{4}{3} t^3 - \frac{3}{2} t^2 + C1 \quad (44)$$

$$B := 2 t^2 + C2 + 3 t$$

```
> SolSol:=expand(SolNoHom);
```

$$SolSol := x(t) = \frac{2}{3} \frac{t^3}{e^t} + \frac{3}{2} \frac{t^2}{e^t} + \frac{C1}{e^t} + \frac{t C2}{e^t} \quad (45)$$

```
> SolPart:=subs(C1=1,C2=2,SolSol);
```

```
> SolPartDos:=subs(C1=2,C2=1,SolSol);
```

$$SolPart := x(t) = \frac{2}{3} \frac{t^3}{e^t} + \frac{3}{2} \frac{t^2}{e^t} + \frac{1}{e^t} + \frac{2t}{e^t} \quad (46)$$

$$SolPartDos := x(t) = \frac{2}{3} \frac{t^3}{e^t} + \frac{3}{2} \frac{t^2}{e^t} + \frac{2}{e^t} + \frac{t}{e^t}$$

```
> plot([rhs(SolPart),rhs(SolPartDos),rhs(diff(SolPart,t)),rhs(diff(SolPartDos,t))],t=0..10);
```

