

```
> restart
> EcuacionAlgebraica := x^2 + 3·x + 2 = 0
      EcuacionAlgebraica := x^2 + 3 x + 2 = 0
```

(1)

```
> Raiz := solve(EcuacionAlgebraica)
      Raiz := -1, -2
```

(2)

```
> ComprobarUno := expand((x - Raiz[1]) · (x - Raiz[2])) = 0
      ComprobarUno := x^2 + 3 x + 2 = 0
```

(3)

```
> ComprobarDos := subs(x = Raiz[1], EcuacionAlgebraica)
      ComprobarDos := 0 = 0
```

(4)

```
> ComprobarTres := subs(x = Raiz[2], EcuacionAlgebraica)
      ComprobarTres := 0 = 0
```

(5)

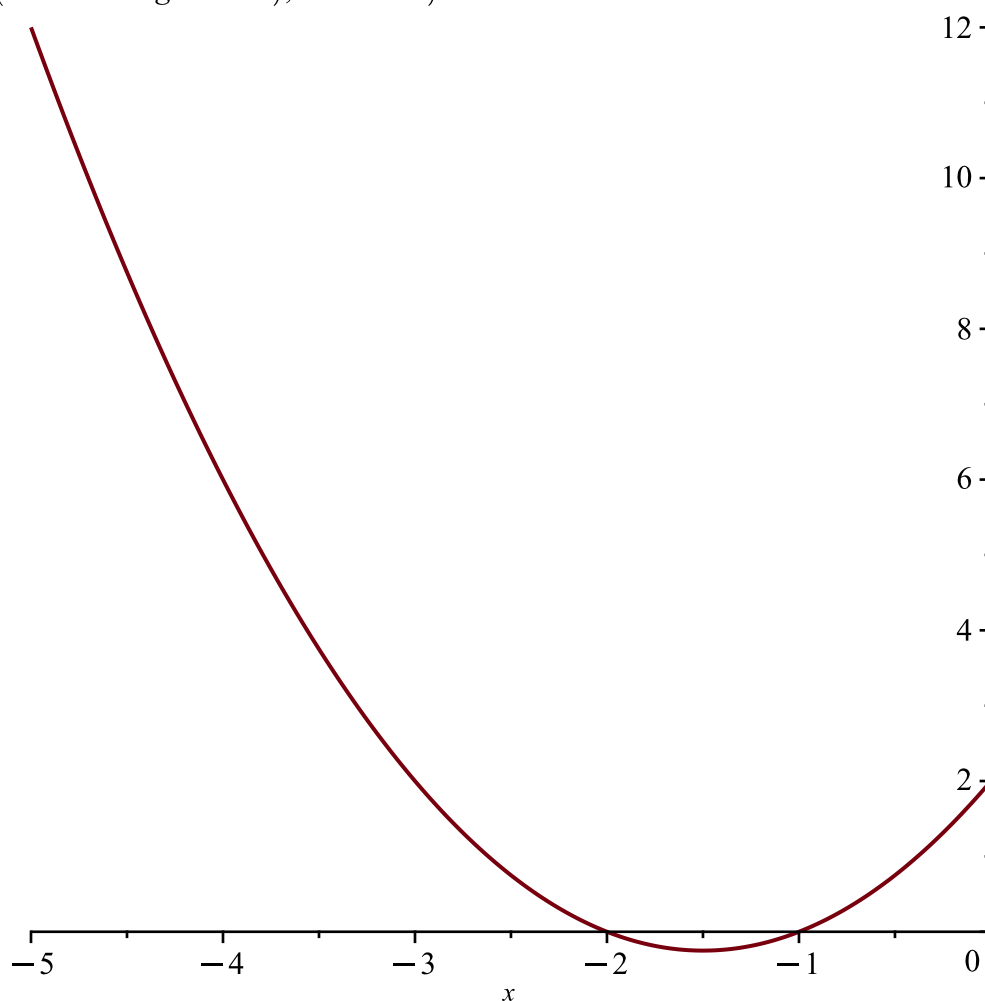
```
> Raiz[1]
      -1
```

(6)

```
> Raiz[2]
      -2
```

(7)

```
> plot(lhs(EcuacionAlgebraica), x = -5..0)
```



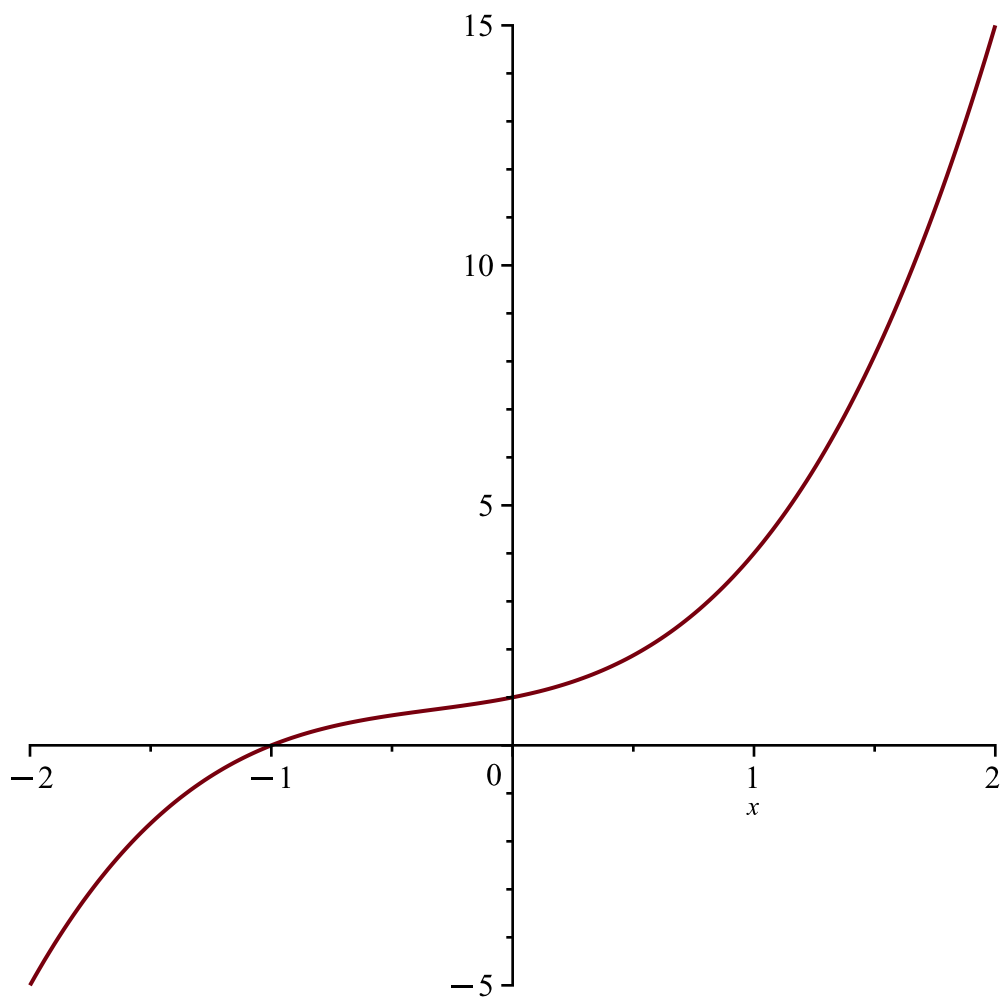
```
> EcuacionAlgebraica
      x^2 + 3 x + 2 = 0
```

(8)

```

>
=
>
=
> restart
=
> Raiz[1]
Raiz1 (9)
=
> ConstanteUno := pi
ConstanteUno := π (10)
=
> ConstanteDos := PI
ConstanteDos := Π (11)
=
> ConstanteTres := Pi
ConstanteTres := π (12)
=
> evalf(ConstanteTres)
3.141592654 (13)
=
> evalf(ConstanteUno)
π (14)
=
> evalf(ConstanteDos)
Π (15)
=
> Digits := 100
Digits := 100 (16)
=
> evalf(ConstanteTres)
3.141592653589793238462643383279502884197169399375105820974944592307816406286208\ (17)
998628034825342117068
=
> evalf(ConstanteTres, 1000) :
> evalf(ConstanteTres, 20000) :
> restart
> EcuaAlg := x3 + x2 + x + 1 = 0 : Raiz := solve(EcuaAlg); EcuaOrig := expand((x + Raiz[1])
· (x - Raiz[2]) · (x - Raiz[3]));
Raiz := -1, I, -I
EcuaOrig := x3 - x2 + x - 1 (18)
=
> ValorReal := Re(Raiz[2])
ValorReal := 0 (19)
=
> ValorImag := Im(Raiz[2])
ValorImag := 1 (20)
=
> ValorImag := Im(Raiz[3])
ValorImag := -1 (21)
=
> plot(lhs(EcuaAlg), x=-2..2)

```



```
> EcuaAlg
```

$$x^3 + x^2 + x + 1 = 0$$

(22)

```
>
```

```
>
```

```
> restart
```

```
> exp(Pi*I)
```

$$-1$$

(23)

```
> exp(1)
```

$$e$$

(24)

```
> evalf(exp(1))
```

$$2.718281828$$

(25)

```
> evalf(Pi)
```

$$3.141592654$$

(26)

```
> eval(I^2)
```

$$-1$$

(27)

```
> restart
```

```
> Func := 5*exp(3*x) + 4*cos(2*x) - x^3 + 2*x^2
```

$$Func := 5 e^{3x} + 4 \cos(2x) - x^3 + 2x^2$$

(28)

$$\begin{aligned} &> \text{Derivada} := \text{Diff}(\text{Func}, x) = \text{diff}(\text{Func}, x) \\ &\quad \text{Derivada} := \frac{d}{dx} (5 e^{3x} + 4 \cos(2x) - x^3 + 2x^2) = 15 e^{3x} - 8 \sin(2x) - 3x^2 + 4x \end{aligned} \quad (29)$$

$$\begin{aligned} &> \text{Integral} := \text{Int}(\text{Func}, x) = \text{int}(\text{Func}, x) \\ &\quad \text{Integral} := \int (5 e^{3x} + 4 \cos(2x) - x^3 + 2x^2) dx = \frac{2x^3}{3} - \frac{x^4}{4} + 2 \sin(2x) + \frac{5 e^{3x}}{3} \end{aligned} \quad (30)$$

$$\begin{aligned} &> \text{LadoIzqDer} := \text{lhs}(\text{Derivada}) \\ &\quad \text{LadoIzqDer} := \frac{d}{dx} (5 e^{3x} + 4 \cos(2x) - x^3 + 2x^2) \end{aligned} \quad (31)$$

$$\begin{aligned} &> \text{LadoDerDerivada} := \text{rhs}(\text{Derivada}) \\ &\quad \text{LadoDerDerivada} := 15 e^{3x} - 8 \sin(2x) - 3x^2 + 4x \end{aligned} \quad (32)$$

> restart

$$\begin{aligned} &> \text{Semana} := ([\text{lunes}, \text{martes}, \text{miércoles}, \text{jueves}, \text{viernes}, \text{sábado}, \text{domingo}]) \\ &\quad \text{Semana} := [\text{lunes}, \text{martes}, \text{miércoles}, \text{jueves}, \text{viernes}, \text{sábado}, \text{domingo}] \end{aligned} \quad (33)$$

$$\begin{aligned} &> \text{Semana}[2] \\ &\quad \text{martes} \end{aligned} \quad (34)$$

$$\begin{aligned} &> \text{SemanaHabil} := \text{Semana}[1..5] \\ &\quad \text{SemanaHabil} := [\text{lunes}, \text{martes}, \text{miércoles}, \text{jueves}, \text{viernes}] \end{aligned} \quad (35)$$

$$\begin{aligned} &> \text{FinDeSemana} := \text{Semana}[6..7] \\ &\quad \text{FinDeSemana} := [\text{sábado}, \text{domingo}] \end{aligned} \quad (36)$$

> restart

Matrices y Vectores

$$\begin{aligned} &> \text{with}(\text{linalg}) \\ &\quad [\text{BlockDiagonal}, \text{GramSchmidt}, \text{JordanBlock}, \text{LUdecomp}, \text{QRdecomp}, \text{Wronskian}, \text{addcol}, \\ &\quad \text{addrow}, \text{adj}, \text{adjoint}, \text{angle}, \text{augment}, \text{backsub}, \text{band}, \text{basis}, \text{bezout}, \text{blockmatrix}, \text{charmat}, \\ &\quad \text{charpoly}, \text{cholesky}, \text{col}, \text{coldim}, \text{colspace}, \text{colspan}, \text{companion}, \text{concat}, \text{cond}, \text{copyinto}, \\ &\quad \text{crossprod}, \text{curl}, \text{definite}, \text{delcols}, \text{delrows}, \text{det}, \text{diag}, \text{diverge}, \text{dotprod}, \text{eigenvals}, \text{eigenvalues}, \\ &\quad \text{eigenvectors}, \text{eigenvects}, \text{entermatrix}, \text{equal}, \text{exponential}, \text{extend}, \text{ffgausselim}, \text{fibonacci}, \\ &\quad \text{forwardsub}, \text{frobenius}, \text{gausselim}, \text{gaussjord}, \text{geneqns}, \text{genmatrix}, \text{grad}, \text{hadamard}, \text{hermite}, \\ &\quad \text{hessian}, \text{hilbert}, \text{htranspose}, \text{ihermite}, \text{indexfunc}, \text{innerprod}, \text{intbasis}, \text{inverse}, \text{ismith}, \text{issimilar}, \\ &\quad \text{iszero}, \text{jacobian}, \text{jordan}, \text{kernel}, \text{laplacian}, \text{leastsqrs}, \text{linsolve}, \text{matadd}, \text{matrix}, \text{minor}, \text{minpoly}, \\ &\quad \text{mulcol}, \text{mulrow}, \text{multiply}, \text{norm}, \text{normalize}, \text{nullspace}, \text{orthog}, \text{permanent}, \text{pivot}, \text{potential}, \\ &\quad \text{randmatrix}, \text{randvector}, \text{rank}, \text{ratform}, \text{row}, \text{rowdim}, \text{rowspan}, \text{rref}, \text{scalarmul}, \\ &\quad \text{singularvals}, \text{smith}, \text{stackmatrix}, \text{submatrix}, \text{subvector}, \text{sumbasis}, \text{swapcol}, \text{swaprow}, \text{sylvester}, \\ &\quad \text{toeplitz}, \text{trace}, \text{transpose}, \text{vandermonde}, \text{vecpotent}, \text{vectdim}, \text{vector}, \text{wronskian}] \end{aligned} \quad (37)$$

$$\begin{aligned} &> \text{MatrizEjemplo} := \text{array}([[1, 2, 3], [4, -5, 6], [7, 8, 9]]) \\ &\quad \text{MatrizEjemplo} := \begin{bmatrix} 1 & 2 & 3 \\ 4 & -5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \end{aligned} \quad (38)$$

$$\begin{aligned} &> \text{Valor} := \det(\text{MatrizEjemplo}) \\ &\qquad\qquad\qquad \text{Valor} := 120 \end{aligned} \tag{39}$$

$$\begin{aligned} &> \text{MatrizInversa} := \text{inverse}(\text{MatrizEjemplo}) \\ &\qquad\qquad\qquad \text{MatrizInversa} := \begin{bmatrix} -\frac{31}{40} & \frac{1}{20} & \frac{9}{40} \\ \frac{1}{20} & -\frac{1}{10} & \frac{1}{20} \\ \frac{67}{120} & \frac{1}{20} & -\frac{13}{120} \end{bmatrix} \end{aligned} \tag{40}$$

$$\begin{aligned} &> \text{Identidad} := \text{evalm}(\text{MatrizEjemplo} \&* \text{MatrizInversa}) \\ &\qquad\qquad\qquad \text{Identidad} := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \end{aligned} \tag{41}$$

$$\begin{aligned} &> \text{yy}[1] := \exp(5 \cdot x) \\ &\qquad\qquad\qquad \text{yy}_1 := e^{5x} \end{aligned} \tag{42}$$

$$\begin{aligned} &> \text{yy}[2] := \cos(4 \cdot x) \\ &\qquad\qquad\qquad \text{yy}_2 := \cos(4x) \end{aligned} \tag{43}$$

$$\begin{aligned} &> \text{yy}[3] := \sin(4 \cdot x) \\ &\qquad\qquad\qquad \text{yy}_3 := \sin(4x) \end{aligned} \tag{44}$$

$$\begin{aligned} &> \text{WW} := \text{wronskian}([\text{yy}[1], \text{yy}[2], \text{yy}[3]], x) \\ &\qquad\qquad\qquad \text{WW} := \begin{bmatrix} e^{5x} & \cos(4x) & \sin(4x) \\ 5e^{5x} & -4\sin(4x) & 4\cos(4x) \\ 25e^{5x} & -16\cos(4x) & -16\sin(4x) \end{bmatrix} \end{aligned} \tag{45}$$

> restart

$$\begin{aligned} &> \text{EcuaDif} := y'' + 6 \cdot y' - 2 \cdot y = 2 \cdot \exp(3x) + \cos(4x) + x^2 \\ &\qquad\qquad\qquad \text{EcuaDif} := \frac{d^2}{dx^2} y(x) + 6 \frac{d}{dx} y(x) - 2y(x) = 2e^{3x} + \cos(4x) + x^2 \end{aligned} \tag{46}$$

$$\begin{aligned} &> \text{EcuaDifDos} := \text{diff}(x(t), t^2) + 6 \cdot \text{diff}(x(t), t) - 2 \cdot x(t) = 2 \cdot \exp(3 \cdot t) + \cos(4t) + t^2 \\ &\qquad\qquad\qquad \text{EcuaDifDos} := \frac{d^2}{dt^2} x(t) + 6 \frac{d}{dt} x(t) - 2x(t) = 2e^{3t} + \cos(4t) + t^2 \end{aligned} \tag{47}$$

$$\begin{aligned} &> \text{SolGral} := \text{dsolve}(\text{EcuaDif}); \text{evalf}(\%, 2) \\ &\text{SolGral} := y(x) = e^{(-3+\sqrt{11})x} c_2 + e^{-(3+\sqrt{11})x} c_1 + \frac{2e^{3x}}{25} - \frac{x^2}{2} + \frac{2\sin(4x)}{75} - \frac{\cos(4x)}{50} \\ &\qquad\qquad\qquad - 3x - \frac{19}{2} \\ &y(x) = e^{0.3x} c_2 + e^{-6.3x} c_1 + 0.080 e^{3 \cdot x} - 0.50 x^2 + 0.027 \sin(4 \cdot x) - 0.020 \cos(4 \cdot x) - 3 \cdot x - 9.5 \end{aligned} \tag{48}$$

```

> SolGralDos := dsolve(EcuaDifDos); evalf(%, 2)
SolGralDos := x(t) = e(-3+√11)t c2 + e-(3+√11)t c1 +  $\frac{2 e^{3 t}}{25} - \frac{t^2}{2} + \frac{2 \sin(4 t)}{75} - \frac{\cos(4 t)}{50}$ 
      - 3 t -  $\frac{19}{2}$ 
x(t) = e0.3 t c2 + e-6.3 t c1 + 0.080 e3. t - 0.50 t2 + 0.027 sin(4. t) - 0.020 cos(4. t) - 3. t - 9.5 (49)
=
> ComprobarUno := simplify(eval(subs(y(x) = rhs(SolGral), lhs(EcuaDif) - rhs(EcuaDif)
      = 0)))
ComprobarUno := 0 = 0 (50)
=
> ComprobarDos := simplify(eval(subs(x(t) = rhs(SolGralDos), lhs(EcuaDifDos)
      - rhs(EcuaDifDos) = 0)))
ComprobarDos := 0 = 0 (51)
>

```