8. sympy

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1 sympy para cálculos simbólicos

```
In [1]: from sympy import *
```

Para crear variables que son objetos simbólicos:

```
In [7]: x = symbols("x")

        # Crea un nombre ‘x‘ que se refiere al simbolo con la representacion visual ‘x‘
```

```
In [3]: x
```

```
Out[3]: x
```

```
In [4]: y
```

```
        ---------------------------------------------------------------------------
    NameError                                 Traceback (most recent call last)

        <ipython-input-4-009520053b00> in <module>()
    ----> 1 y


        NameError: name 'y' is not defined
```

Para que se vean bonitos:

```
In [5]: init_printing()
```

```
In [6]: x
```

```
Out[6]:
```

$$x$$

```
In [8]: 2 * x
```

```
Out[8]:
```

$$2x$$

```
In [9]: x * x
```

Out[9]:

$$x^2$$

In [11]:
```
expr = 2*x + 3*x**2
```

In [12]:
```
diff(expr, x)
```

Out[12]:

$$6x + 2$$

In [13]:
```
integrate(expr, x)
```

Out[13]:

$$x^3 + x^2$$

In [14]:
```
integrate(_, x)
```

Out[14]:

$$\frac{x^4}{4} + \frac{x^3}{3}$$

In [15]:
```
diff(_, x)
```

Out[15]:

$$x^3 + x^2$$

In [16]:
```
s = sin(x)
```

In [17]:
```
s
```

Out[17]:

$$\sin(x)$$

In [18]:
```
diff(s, x)
```

Out[18]:

$$\cos(x)$$

In [20]:
```
y = symbols("y")
```

In [21]:
```
diff(s, y)
```

Out[21]:

$$0$$

In [22]:
```
p = x*y
```

In [23]:
```
diff(p, x)
```

Out[23]:

$$y$$

$$2$$

In [24]:
```
diff(p, y)
```

Out[24]:

$$x$$

In [27]:
```
s
```

Out[27]:

$$\sin(x)$$

In [28]:
```
s * s
```

Out[28]:

$$\sin^2(x)$$

In [29]:
```
s * expr
```

Out[29]:

$$\left(3x^2 + 2x\right)\sin(x)$$

In [36]:
```
r = series(s, x, n=10)
```

In [41]:
```
r.coeff(x, 5)
```

Out[41]:

$$\frac{1}{120}$$

In [42]:
```
M = Matrix([x, x**2, x**3, x**4])
```

In [43]:
```
M
```

Out[43]:

$$\begin{bmatrix} x \\ x^2 \\ x^3 \\ x^4 \end{bmatrix}$$

In [48]:
```
M = Matrix([x, x**2, x**3, x**5]).reshape(2,2)
```

In [49]:
```
M
```

Out[49]:

$$\begin{bmatrix} x & x^2 \\ x^3 & x^5 \end{bmatrix}$$

In [50]:
```
M.det()
```

Out[50]:

$$x^6 - x^5$$

In [51]:
```
M.inv()
```

Out[51]:

$$\begin{bmatrix} \frac{1}{x} + \frac{1}{x(x-1)} & -\frac{1}{x^3(x-1)} \\ -\frac{1}{x^2(x-1)} & \frac{1}{x^4(x-1)} \end{bmatrix}$$

In [55]:
```
M.inv().subs(x,10)
```

Out[55]:

$$\begin{bmatrix} \frac{1}{9} & -\frac{1}{9000} \\ -\frac{1}{900} & \frac{1}{90000} \end{bmatrix}$$

In [56]:
```
M.subs({x:10, y:3})
```

Out[56]:

$$\begin{bmatrix} 10 & 100 \\ 1000 & 100000 \end{bmatrix}$$

In [57]:
```
M
```

Out[57]:

$$\begin{bmatrix} x & x^2 \\ x^3 & x^5 \end{bmatrix}$$

In [63]:
```
M.eigenvals()
```

Out[63]:

$$\left\{ \frac{x}{2}\left(x^4+1\right) - \frac{1}{2}\sqrt{x^2\left(x^8-2x^4+4x^3+1\right)} : 1, \quad \frac{x}{2}\left(x^4+1\right) + \frac{1}{2}\sqrt{x^2\left(x^8-2x^4+4x^3+1\right)} : 1 \right\}$$

In [64]:
```
expr = x**4 - x**2 + 1
```

In [65]:
```
solve(expr, x)
```

Out[65]:

$$\left[-\frac{\sqrt{3}}{2} - \frac{i}{2}, \quad -\frac{\sqrt{3}}{2} + \frac{i}{2}, \quad \frac{\sqrt{3}}{2} - \frac{i}{2}, \quad \frac{\sqrt{3}}{2} + \frac{i}{2} \right]$$

In [68]:
```
expr = x**5 + 2*x**4 - x**2 + 1
```

In [69]:
```
solve(expr, x)
```

Out[69]:

$$\left[\text{RootOf}\left(x^5+2x^4-x^2+1, 0\right), \quad \text{RootOf}\left(x^5+2x^4-x^2+1, 1\right), \quad \text{RootOf}\left(x^5+2x^4-x^2+1, 2\right), \quad \text{RootOf}\left(x^5+2x^4-x^2+\right.\right.$$

In [72]:
```
import sympy
```

In [73]:
```
theta = symbols("theta")
```

In [74]:
```
theta
```

Out[74]:

$$\theta$$

In [80]: thet = symbols("theta")

In [81]: thet

Out[81]:

$$\theta$$

In []: