SymPy

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SymPy is a Python library that implements a **computer algebra system**, like (parts of) Maple or Mathematica or MATLAB's symbolic math toolbox

- sympy cheat sheet (from sympy github)

Basics

- need to define **symbols** first

```
from sympy import *         ## not usually recommended but OK here
x, y = symbols(('x','y'))   ## names don't *have* to match but should usually
## or
x = Symbol('x')
print(x)
print(y)
print(x+x+x)  ## surprise!
```

```
## x
## y
## 3*x
```

- then we can do anything we like:
- `.factor()`: polynomial factoring

```
z = x**2-x*y-x
z2 = z.factor())
print(z2)
```

```
## x*(x - y - 1)
```

- `.expand()`: multiply out a polynomial

```
print(z2.expand())
```

```
## x**2 - x*y - x
```

- `.collect(x)`: collect terms in powers of `x`

```
print(z.collect(x))
```

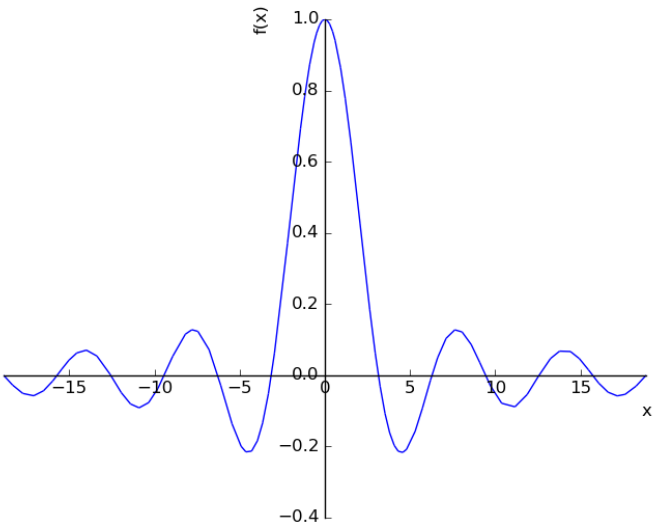
```
## x**2 + x*(-y - 1)
```

```
print(z.subs(y,0))
```

- `.subs(x,val)`: substitute values

```
## x**2 - x
```

Calculus

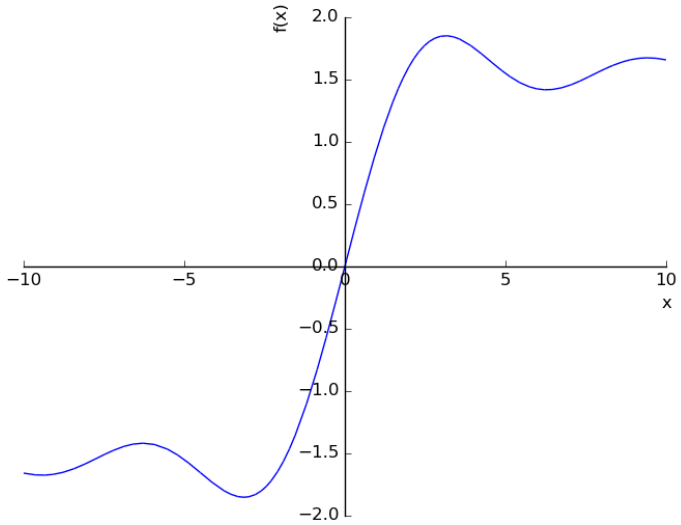


Limits:

```
f = sin(x)/x
print(f.subs(x,0))
print(limit(f,x,0))
```

Integrate and differentiate:

```
print(diff(f,x))
i1 = integrate(f,x)
print(i1)    ## what's this??
plot(i1)
```




```
## Si(x)
```

Series expansion:

```
print(i1.series(x,0,5))
```

```
## x - x**3/18 + O(x**5)
```

Arbitrary-precision arithmetic: mpmath