Using Sage in Calculus

Plotting piecewise functions:
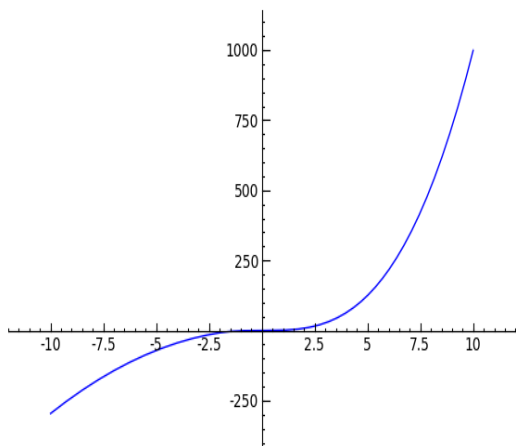
$$f(x) = \begin{cases} -3\,x^2 + 4 & x < -2 \\ x^3 & -2 \le x \end{cases}$$

```
f1=-3*x^2+4
f2=x^3
f=piecewise([[(-10,-2),f1],[(-2,10),f2]])
f.plot()
```


$$f(x) = \begin{cases} -3\,x^2 + 4 & x < -2 \\ x^3 & -2 \le x \end{cases}$$

```
f1=-3*x^2+4
f2=x^3
f=piecewise([[(-10,-2),f1],[(-2,10),f2]])
f.plot()
```

Note! must be parenthesis

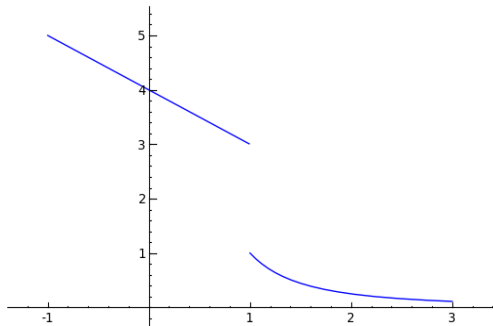$$f(x) = \begin{cases} -x+4 & x<1 \\ \dfrac{1}{x^2} & x>1 \end{cases}$$

```
f1=-x+2
f2=1/x^2
f=piecewise([[(-1,1),f1],[(1,3),f2]])
f.plot()
```

Limits

$$\lim_{x\to 5} \frac{x^2-25}{x-5}$$

```
limit((x^2-25)/(x-5),x=5)
```
(answer = 10)

$$\lim_{x\to -2} \frac{x+1}{x^2+3x+2}$$

```
limit((x+1)/(x^2+3*x+2),x=-2)
```
(answer = und)

$$\lim_{x\to 0} \frac{\sin x}{x}$$

```
limit(sin(x)/x,x=0)
```
(answer = 1)

…Why??

Plot:

```
plot(sin(x)/x,x,-100,100)
```
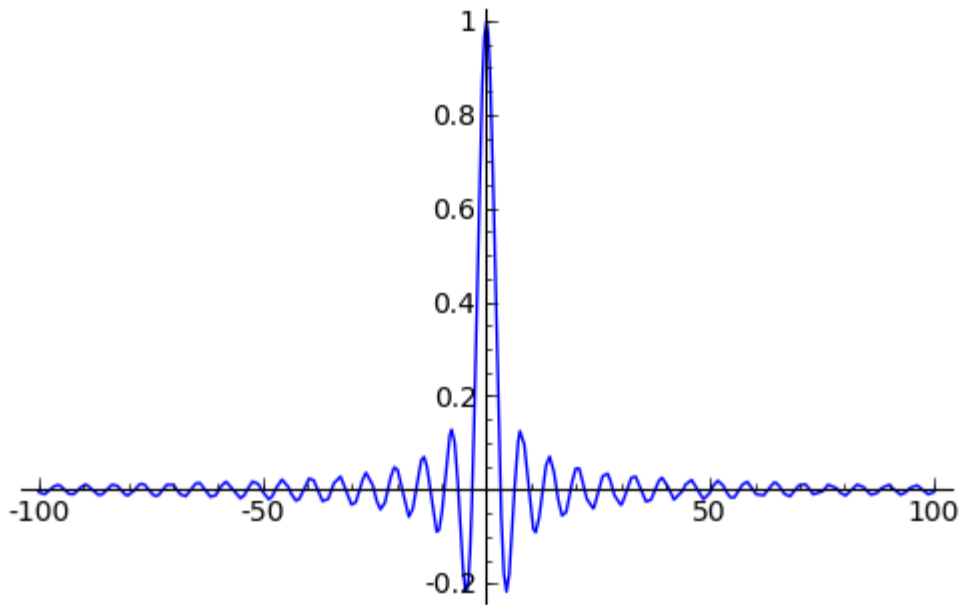

Table:

```
def table():
    print'|     x      | sin(x)/x  |'
    print'|----------|-----------|'
    for x in [-1,-.5,-.1,.1,.5,1]:
        print'|%+f | %+f |'%(x,sin(x)/x)
table()
```

```
|     x      | sin(x)/x  |
|----------|-----------|
|-1.000000 | +0.841471 |
|-0.500000 | +0.958851 |
|-0.100000 | +0.998334 |
|+0.100000 | +0.998334 |
|+0.500000 | +0.958851 |
|+1.000000 | +0.841471 |
```

Derivatives:

$$\frac{d}{dx}\left(x^2\right)$$

```
diff(x^2,x)
```
or

```
derivative(x^2,x)
```

Find $f'(x)$

$$f(x)=\sin(x^3)+x\cos(x)$$

```
f=sin(x^3)+x*cos(x)
diff(f,x)
```

answer = 3*x^2*cos(x^3) - x*sin(x) + cos(x)

Find $f''(x)$

$$f(x)=\sin(x^3)+x\cos(x)$$

```
f=sin(x^3)+x*cos(x)
diff(f,x,x)
```
or

```
f=sin(x^3)+x*cos(x)
diff(f,x,2)
```

Could also give order (nth derivative)

answer= -9*x^4*sin(x^3) + 6*x*cos(x^3) - x*cos(x) - 2*sin(x)

Integration:

$$\int 3x^2\,dx$$

```
integral(3*x^2,x)
```

answer = x^3

$$\int_0^4 x^2\,dx$$

```
integral(x^2,x,0,4)
```

```
     64/3
```

$$\int_0^{\pi/2} x\sin(x^2)\,dx$$

```
integral(x*sin(x^2),x,0,pi/2)
```

```
      -1/2*cos(1/4*pi^2) + 1/2
```