```python
In [110… import sympy as sp

In [111… x = sp.Symbol('x')

In [112… f = sp.Function('f')

In [113… f = x*sp.sin(x) + 5*x**2 + 1

In [114… display(f)
```

$\displaystyle 5 x^{2} + x \sin{\left(x \right)} + 1$

```python
In [115… display(r'la courbe de f pour x = [-2,2]')
         sp.plot(f,(x,-2,2))
```
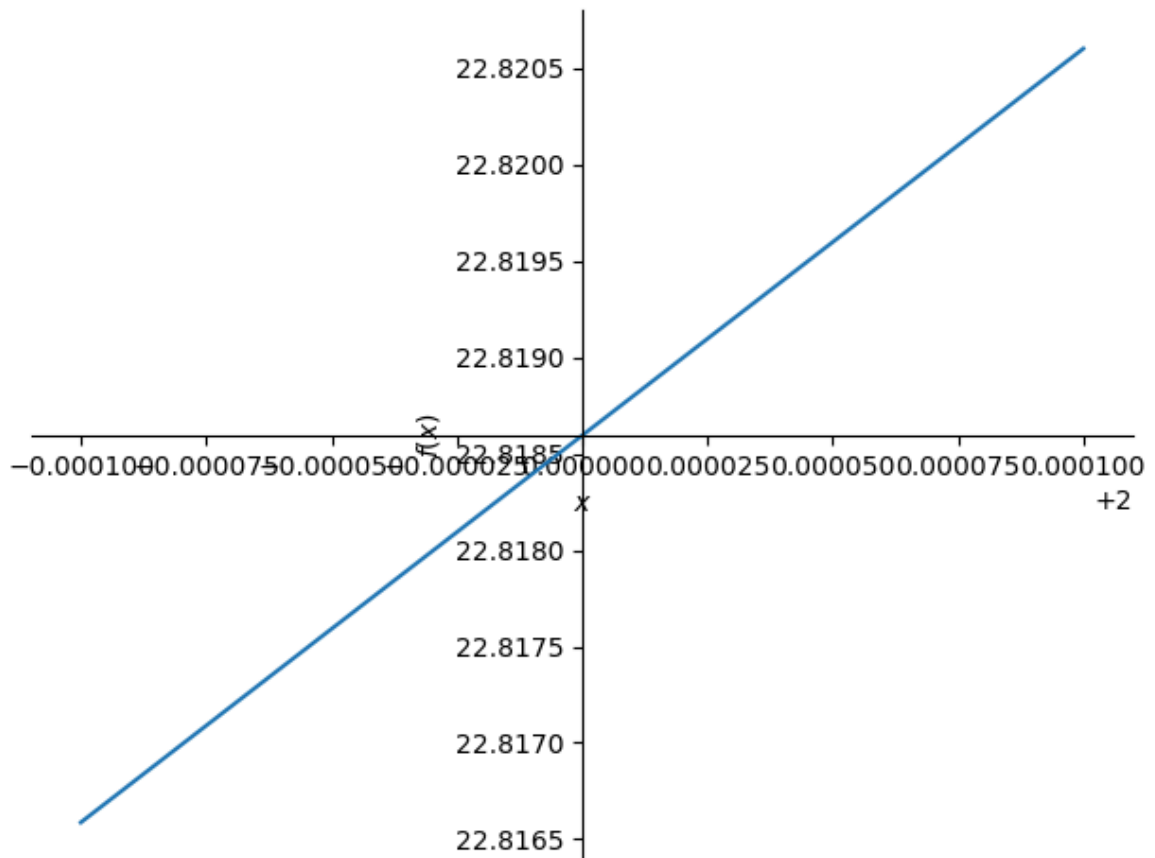
'la courbe de f pour x = [-2,2]'
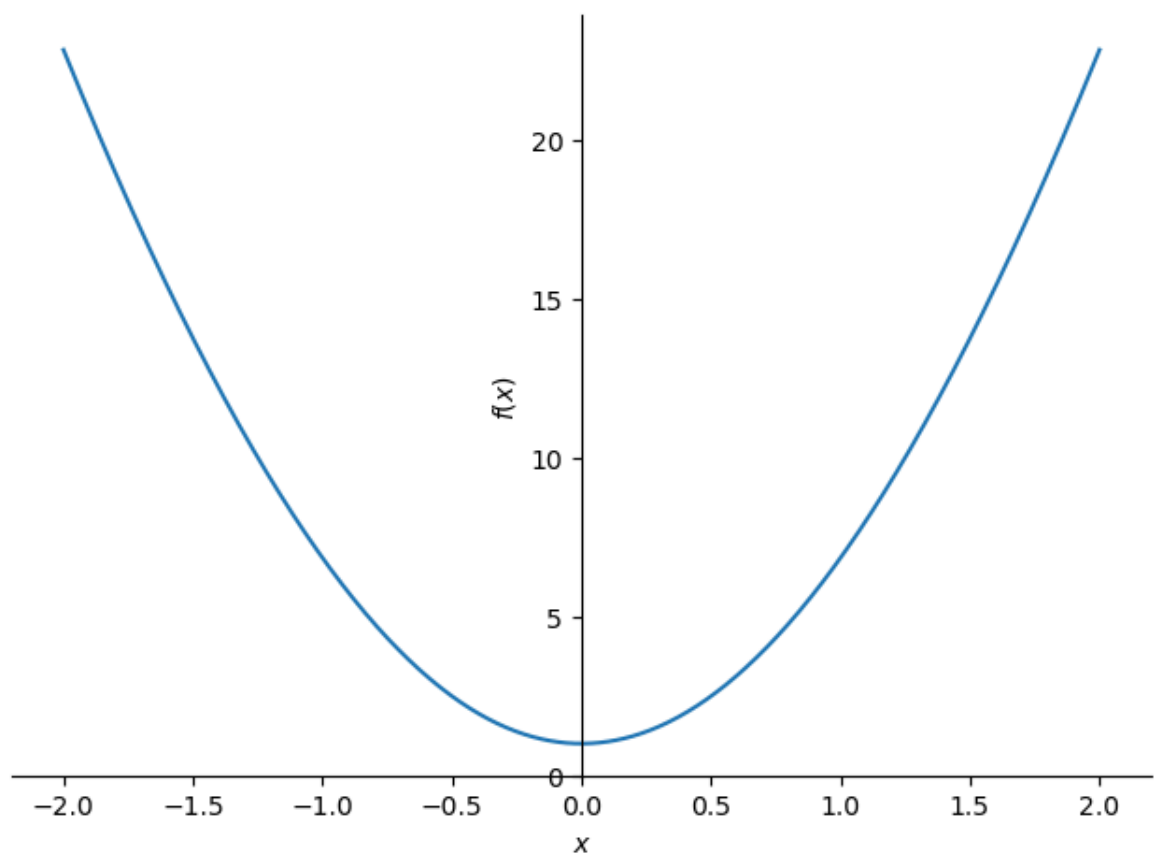

```
Out[115… <sympy.plotting.backends.matplotlibbackend.matplotlib.MatplotlibBackend at 0x20
         e557b53a0>
```

```python
In [116… display(r'la courbe de f pour x = [1.9999,2.0001]')
```

'la courbe de f pour x = [1.9999,2.0001]'

```python
In [117… sp.plot(f,(x,1.9999,2.0001))
```

`<sympy.plotting.backends.matplotlibbackend.matplotlib.MatplotlibBackend at 0x20 e55de5a30>`

In [118...
```python
Vgauche = [1.9999,1.99999,1.999999]
Vdroite = [2.000001,2.00001,2.0001]
print('Limite à gauche')
Ugauche = [f.subs(x,i) for i in Vgauche]
print(Vgauche)
print(Ugauche)
```

```
Limite à gauche
[1.9999, 1.99999, 1.999999]
[22.8165871900219, 22.8183940839813, 22.8185747766513]
```

In [119...
```python
print('limite à droite')
Udroite = [f.subs(x,i) for i in Vdroite]
print(Vdroite)
print(Udroite)
```

```
limite à droite
[2.000001, 2.00001, 2.0001]
[22.8186149306588, 22.8187956240564, 22.8206025907720]
```

In [120...
```python
print(sp.limit(f,x,2,'-'))
```

```
2*sin(2) + 21
```

In [121...
```python
print(sp.limit(f,x,2,'+'))
```

```
2*sin(2) + 21
```

In [130...
```python
import numpy as np
import matplotlib.pyplot as plt
```
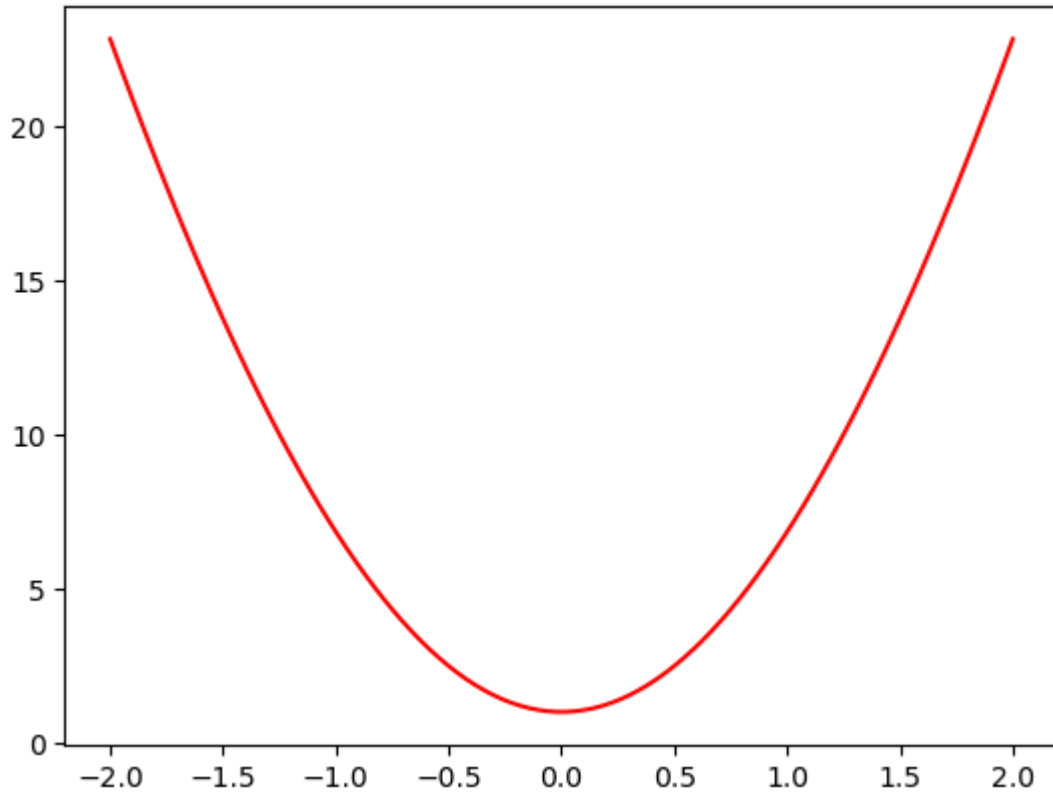
```
In [131...  x = np.linspace(-2,2,100)
```
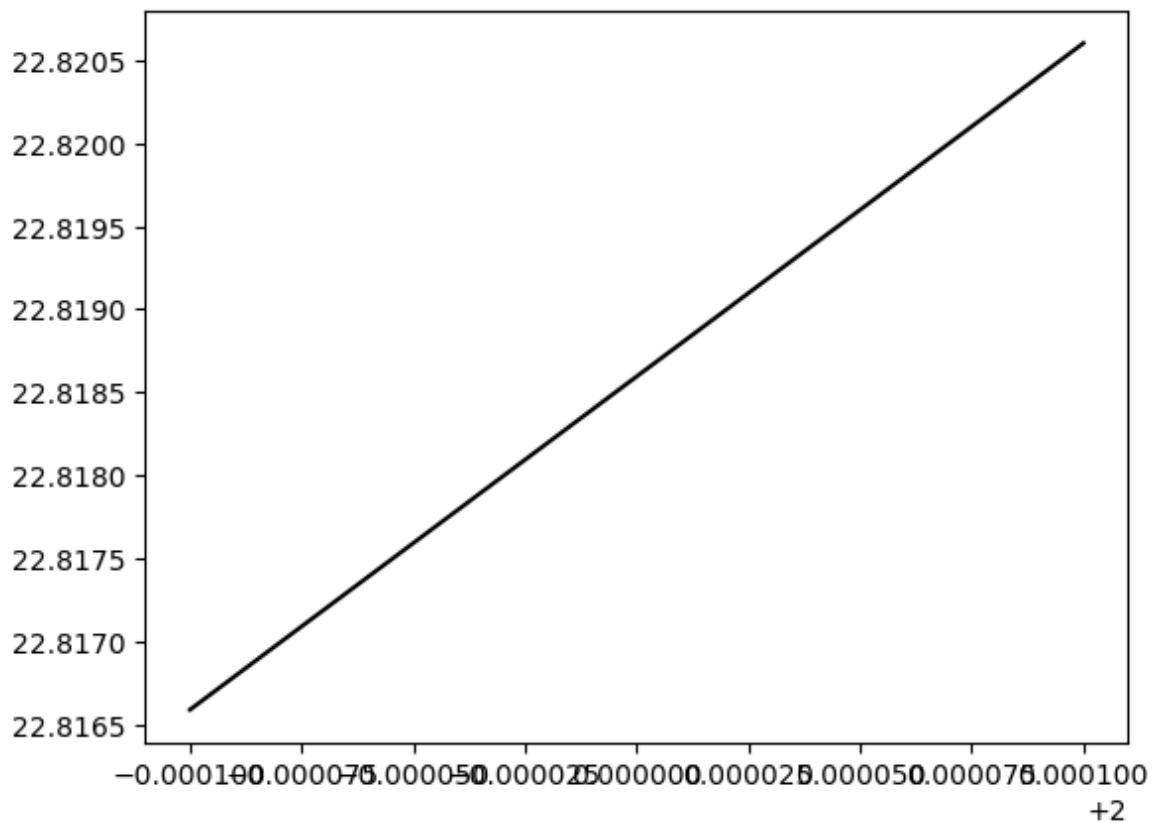
```
In [132...  def f(x):
                return x*np.sin(x) + 5*x**2 + 1
```

```
In [133...  print(r'la courbe de f sur [-2,2]')
            plt.plot(x,f(x),"r")
            plt.show()
```

la courbe de f sur [-2,2]


```
In [134...  x = np.linspace(1.9999,2.0001,10)
            plt.plot(x,f(x),"k")
            plt.show()
```

```
Vgauche = np.array([1.9999,1.99999,1.999999])
print("limite à gauche")
Ugauche = f(Vgauche)
print(Vgauche)
print(Ugauche)
```

```
limite à gauche
[1.9999   1.99999  1.999999]
[22.81658719 22.81839408 22.81857478]
```

```
Vdroite = np.array([2.000001,2.00001,2.0001])
print("limite à droite")
Udroite = f(Vdroite)
print(Vdroite)
print(Udroite)
```

```
limite à droite
[2.000001 2.00001  2.0001  ]
[22.81861493 22.81879562 22.82060259]
```