```
In [5]:  import sympy as sp
         import math
```

```
In [3]:  x = sp.Symbol('x')
```

```
In [4]:  f = sp.Function('f')
```
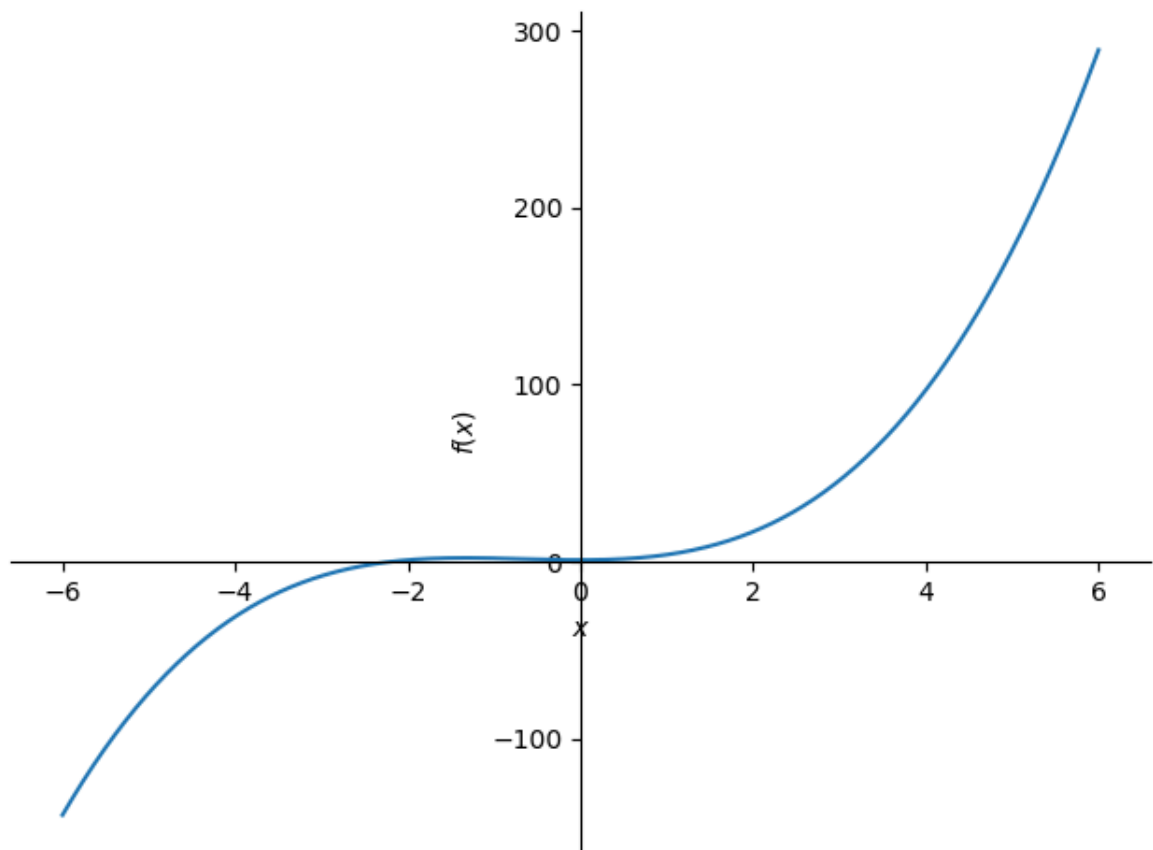
```
In [6]:  f = pow(x,3) + 2*x**2 + 1
```

```
In [7]:  display(f)
```

$\displaystyle x^{3} + 2 x^{2} + 1$

```
In [9]:  display(r'la courbe de f pour x = [-6,6]')
         sp.plot(f,(x,-6,6))
```
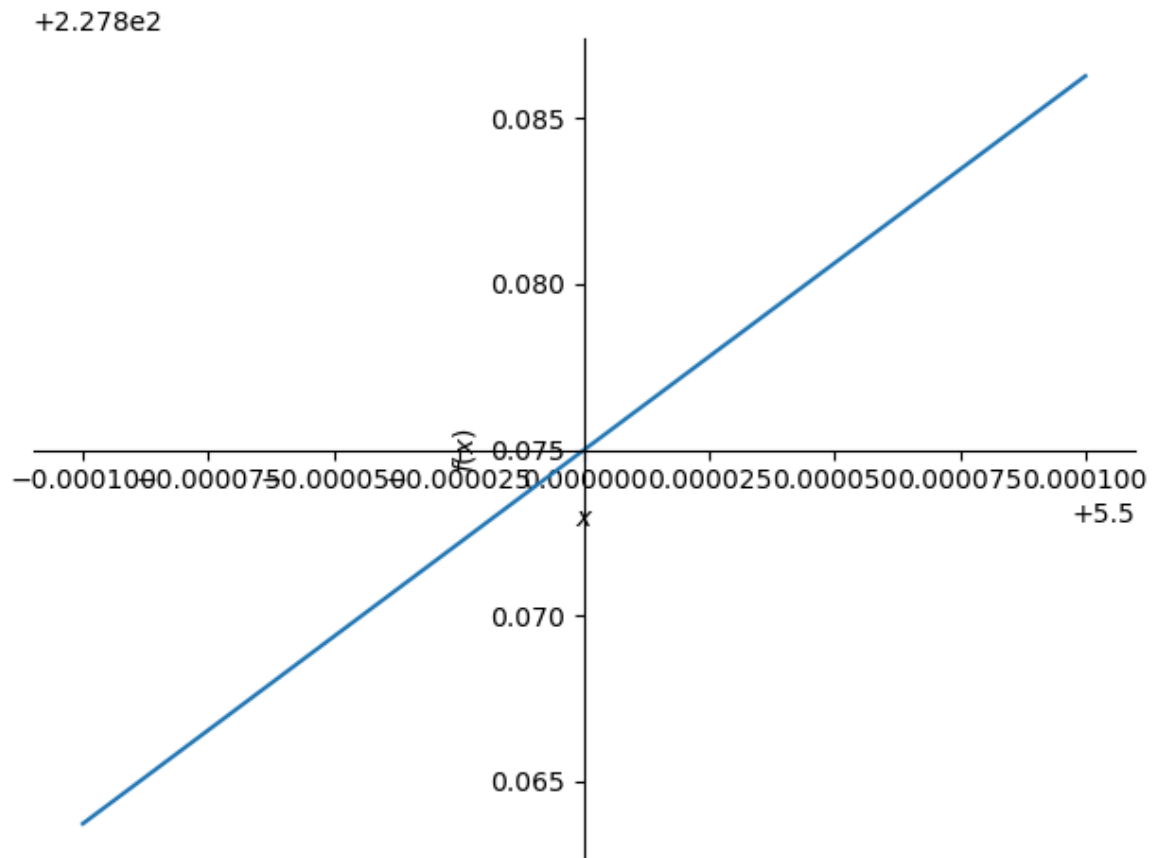
'la courbe de f pour x = [-6,6]'


```
Out[9]:  <sympy.plotting.backends.matplotlibbackend.matplotlib.MatplotlibBackend at 0x20
         e4c49dd00>
```

```
In [11]:  display(r'la courbe de f pour x = [5.4999,5.5001]')
```

'la courbe de f pour x = [5.4999,5.5001]'

```
In [13]:  sp.plot(f,(x,5.4999,5.5001))
```

```
+2.278e2
```

Out[13]: `<sympy.plotting.backends.matplotlibbackend.matplotlib.MatplotlibBackend at 0x20`
`e4ef4b5f0>`

In [15]:
```python
Vgauche = [5.4999,5.49999,5.499999]
Vdroite = [5.500001,5.50001,5.5001]
print('Limite à gauche')
Ugauche = [f.subs(x,i) for i in Vgauche]
print(Vgauche)
print(Ugauche)
```

```
Limite à gauche
[5.4999, 5.49999, 5.499999]
[227.863725184999, 227.873872501850, 227.874887250018]
```

In [16]:
```python
print('limite à droite')
Udroite = [f.subs(x,i) for i in Vdroite]
print(Vdroite)
print(Udroite)
```

```
limite à droite
[5.500001, 5.50001, 5.5001]
[227.875112750019, 227.876127501850, 227.886275185001]
```

In [19]:
```python
print(sp.limit(f,x,5.5,'-'))
```

```
227.875000000000
```

In [20]:
```python
print(sp.limit(f,x,5.5,'+'))
```
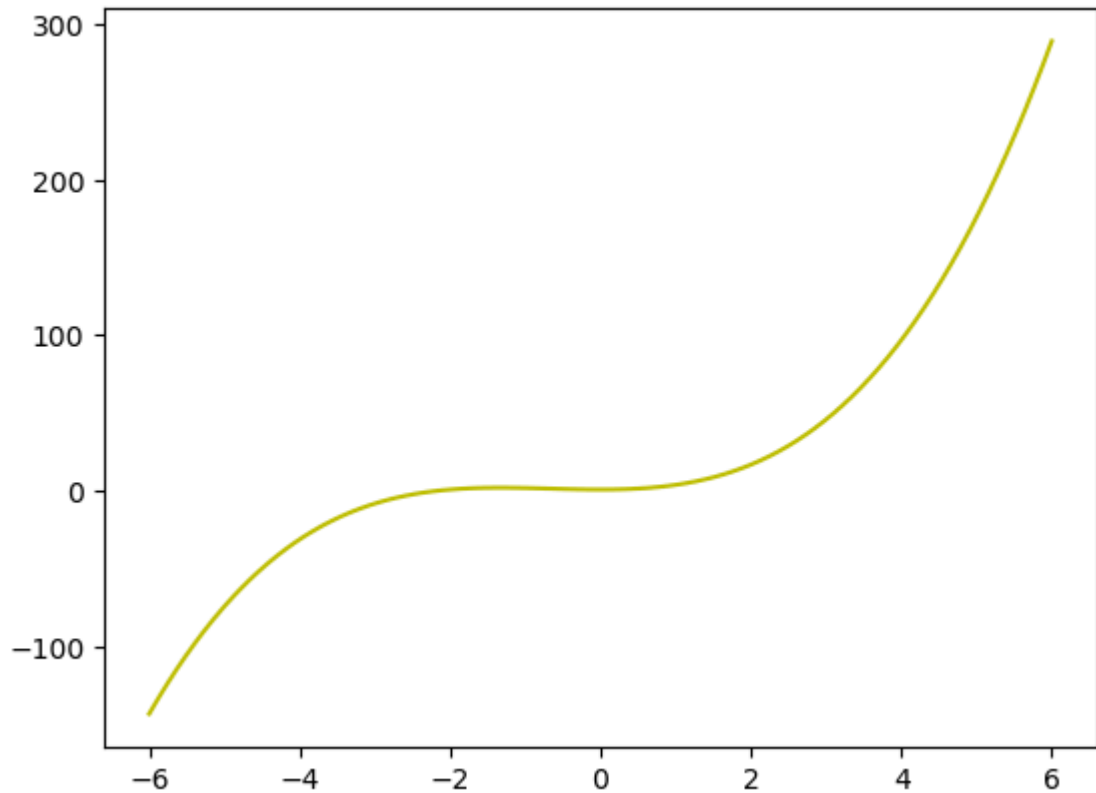
```
227.875000000000
```

In [22]:
```python
import numpy as np
import matplotlib.pyplot as plt
import math
```

```
In [23]: x = np.linspace(-6,6,100)
```

```
In [24]: def f(x):
             return pow(x,3) + 2*x**2 + 1
```

```
In [25]: print(r'la courbe de f sur [-6,6]')
         plt.plot(x,f(x),"y")
         plt.show()
```

la courbe de f sur [-6,6]


```
In [26]: x = np.linspace(5.4999,5.5001,10)
         plt.plot(x,f(x),"b")
         plt.show()
```

+2.278e2

```
In [27]: Vgauche = np.array([5.4999,5.49999,5.499999])
         print("limite à gauche")
         Ugauche = f(Vgauche)
         print(Vgauche)
         print(Ugauche)
```

```
limite à gauche
[5.4999    5.49999  5.499999]
[227.86372518 227.8738725  227.87488725]
```

```
In [29]: Vdroite = np.array([5.500001,5.50001,5.5001])
         print("limite à droite")
         Udroite = f(Vdroite)
         print(Vdroite)
         print(Udroite)
```

```
limite à droite
[5.500001 5.50001  5.5001  ]
[227.87511275 227.8761275  227.88627519]
```

```
In [ ]:
```