```
[1]: 1+1
```

```
[1]: 2
```

```
[2]: _+3
```

```
[2]: 5
```

```
[3]: x0 = 12
```

```
[4]: x0 + x0 + 3
```

```
[4]: 27
```

SYMPY

[6]:
```
from sympy import *
```

[7]:
```
x, y = symbols('x y')
```

[8]:
```
3*x - x + 1 + x*y/x
```

[8]: $2x + y + 1$

CALCUL DANS R

[9]:
```
1+2*3+2**4
```

[9]:
```
23
```

[10]:
```
3/9
```

[10]:
```
0.3333333333333333
```

[11]:
```
Rational(3, 9)
```

[11]: $\frac{1}{3}$

FONCTIONS USUELLES

[12]:
```
sin(pi/3)
```

[12]: $\frac{\sqrt{3}}{2}$

[13]:
```
sqrt(8)
```

[13]: $2\sqrt{2}$

[14]:
```
sqrt(8).evalf()
```

[14]: 2.82842712474619

SIMPLIFICATION

[15]:
```
expand((x-1)**2)
```

[15]: $x^2 - 2x + 1$

[16]:
```
factor(x**2 - 1)
```

[16]: $(x - 1)(x + 1)$

[17]:
```
simplify(x**2/(x + x**3))
```

[17]: $\frac{x}{x^2 + 1}$

RESOLUTION D'EQUATIONS

[18]:
```
solve(x**2+x-2, x)
```

[18]:
```
[-2, 1]
```

[19]:
```
solve([x+2*y-7, x-y-1], [x, y])
```

[19]:
```
{x: 3, y: 2}
```

[20]:
```
roots(x**3-3*x**2-9*x+27, x)
```

[20]:
```
{-3: 1, 3: 2}
```

[21]:
```
nsolve(cos(x)-x, x,(0, 1))
```

[21]: 0.739085133215161

INEGALITES

[22]:
```
reduce_inequalities(x**2-1 >= 0, x)
```

[22]: $(1 \leq x \wedge x < \infty) \vee (x \leq -1 \wedge -\infty < x)$

ETUDE DE FONCTIONS

[23]:
```
def f(x):
    return 2*x**2-3
```

[24]:
```
f(3)
```

[24]: 15

[25]:
```
f(x+1)
```

[25]: $2(x+1)^2 - 3$

[26]:
```
limit(f(x), x, 0)
```

[26]: -3

[27]:
```
limit(f(x), x, oo)
```

[27]: ∞

[28]:
```
limit(1/x, x, 0, '-')
```

[28]: $-\infty$

[29]:
```
diff(f(x), x)
```

[29]: $4x$

[30]:
```
diff(f(x), x, 2)
```

[30]: 4

[31]:
```
is_convex(x**2, x)
```

[31]: True

[32]:
```
is_convex(x**3, x)
```

[32]: False

[32]:
```
is_convex(x**3, x)
```

[32]: False

[33]:
```
is_convex(x**3, x,
          domain = Interval(0, oo))
```

[33]: True

[34]:
```
integrate(f(x), x)
```

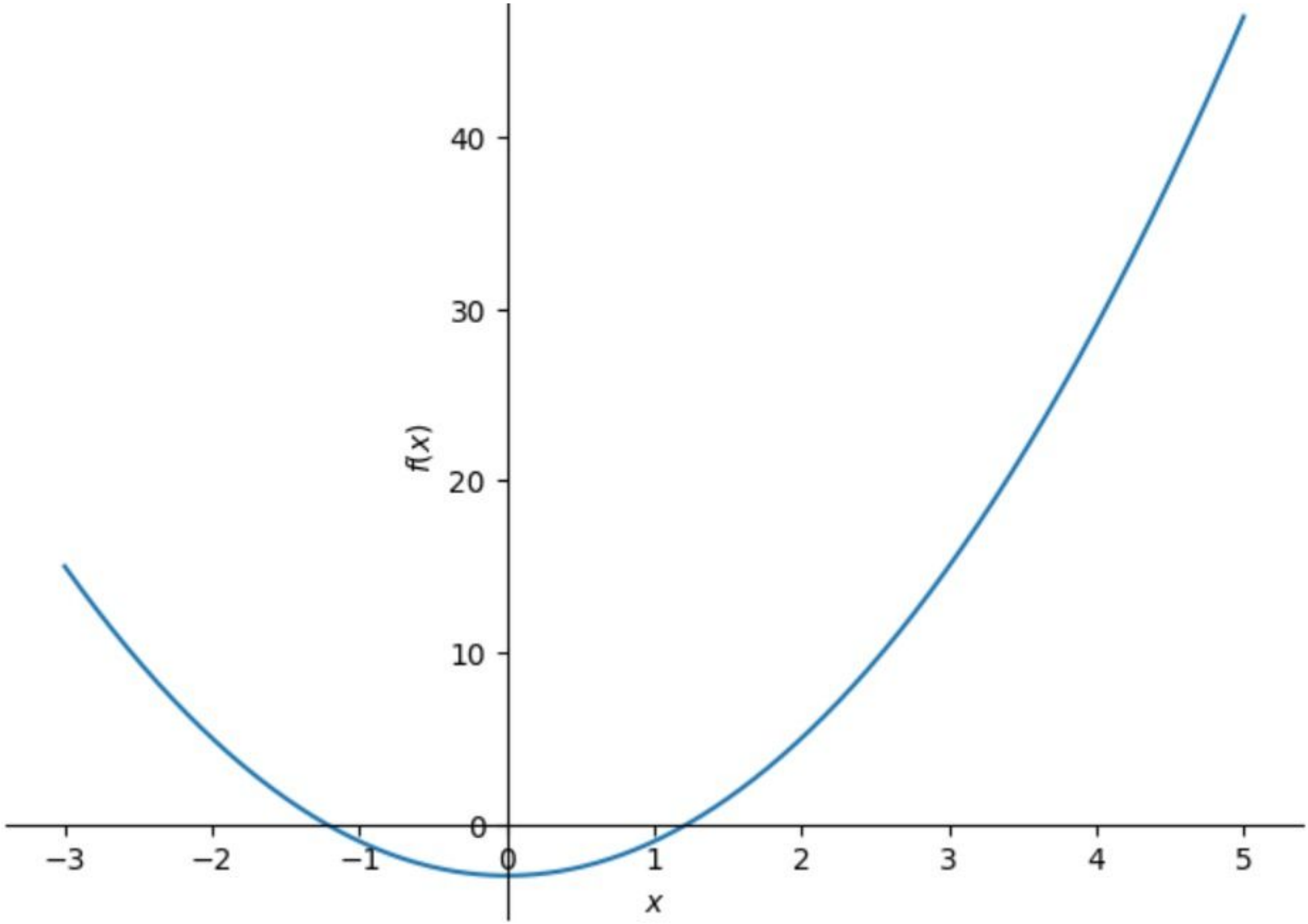
[34]: $$\frac{2x^3}{3} - 3x$$

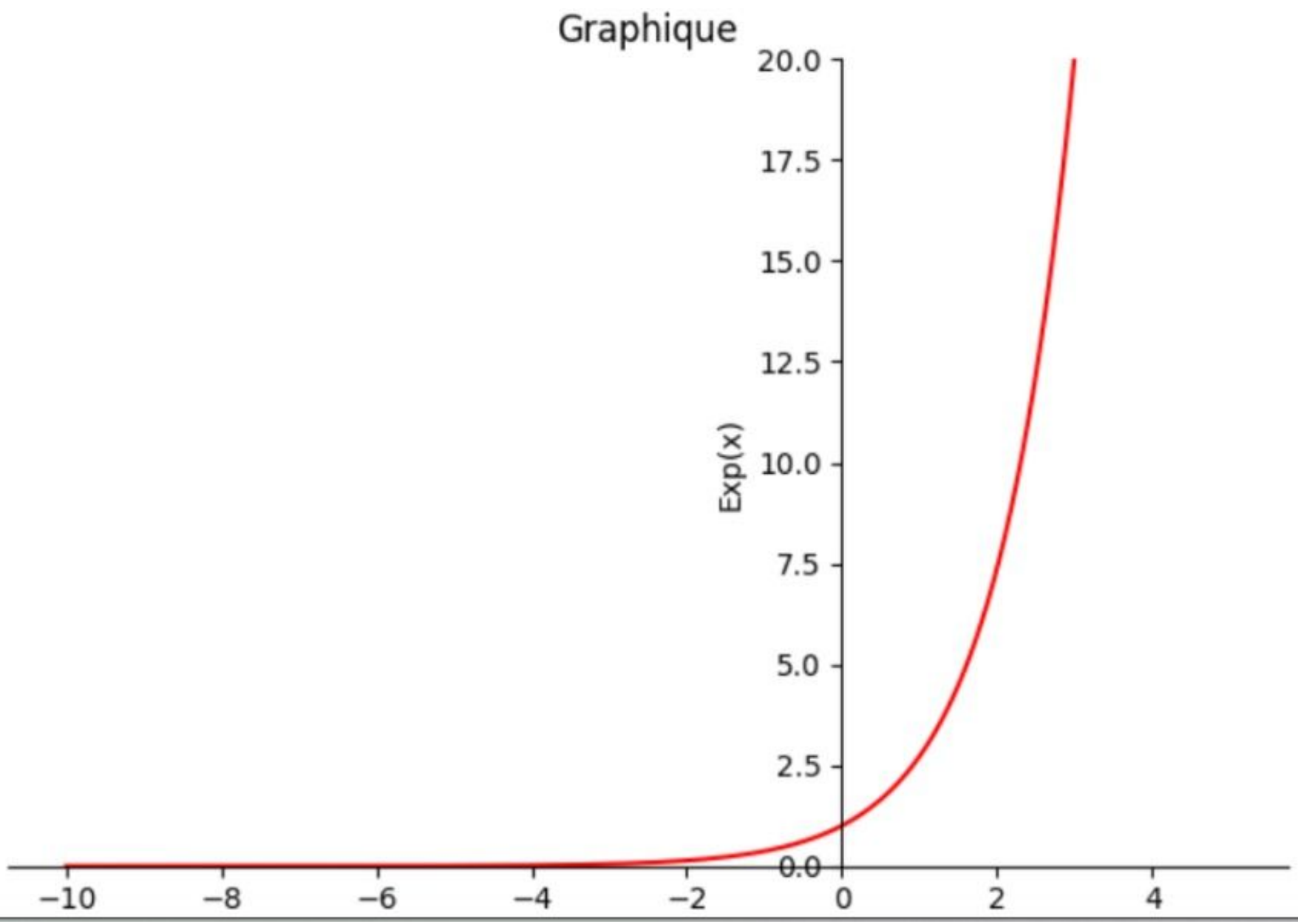
[35]:
```
integrate(f(x), (x, 0, 1))
```

[35]: $$-\frac{7}{3}$$

[36]:
```
series(exp(x), x, 0, 4)
```

[36]: $$1 + x + \frac{x^2}{2} + \frac{x^3}{6} + O\left(x^4\right)$$


40
30
20
10
0
f(x)
−3
−2
−1
0
1
2
3
4
5
x


Graphique
Exp(x)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
−10
−8
−6
−4
−2
0
2
4

[48]:
```
Matrix(derive_by_array(f(x,y), [x,y]))
```

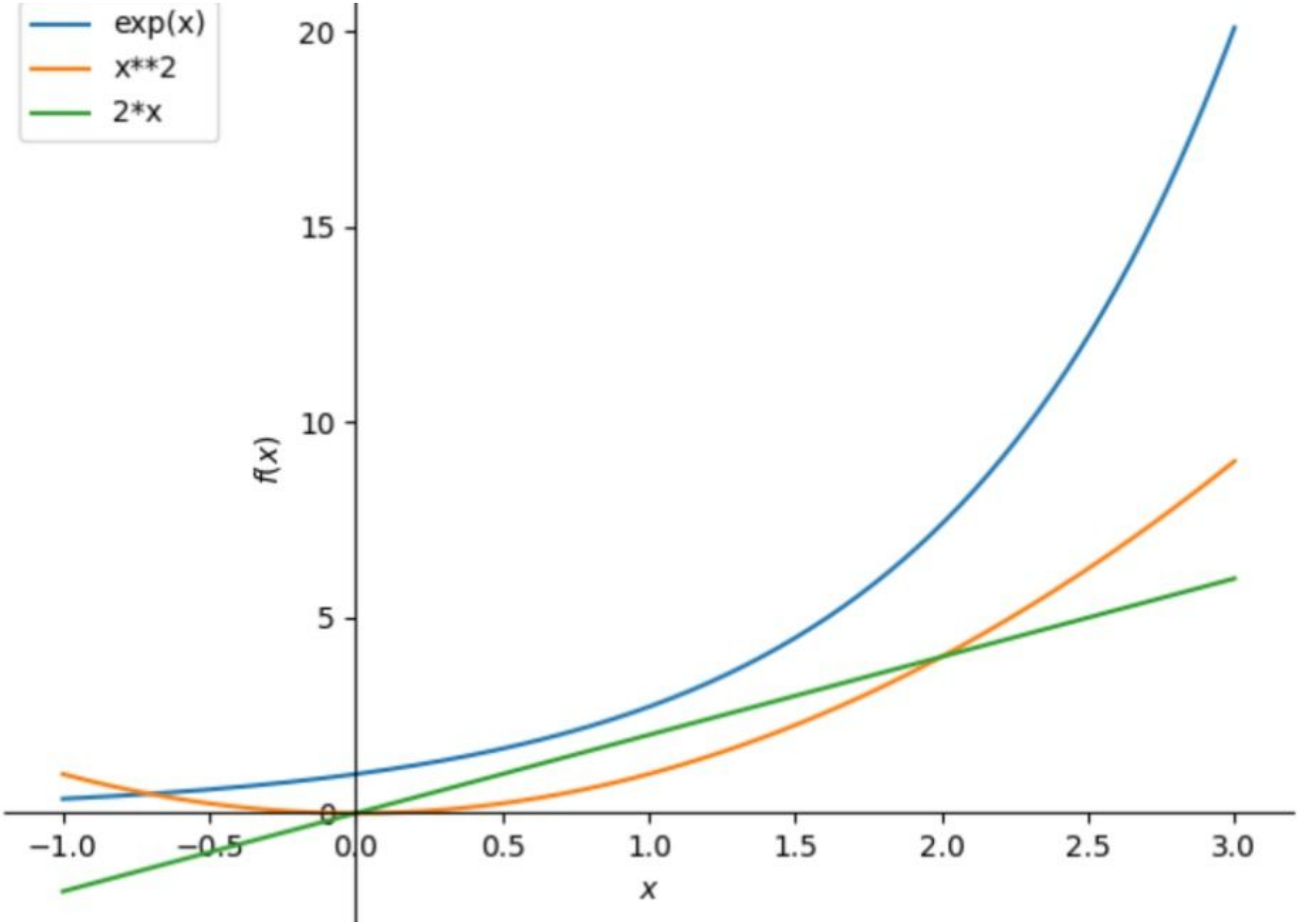
[48]:
$$\begin{bmatrix} -2x + y \\ x \end{bmatrix}$$

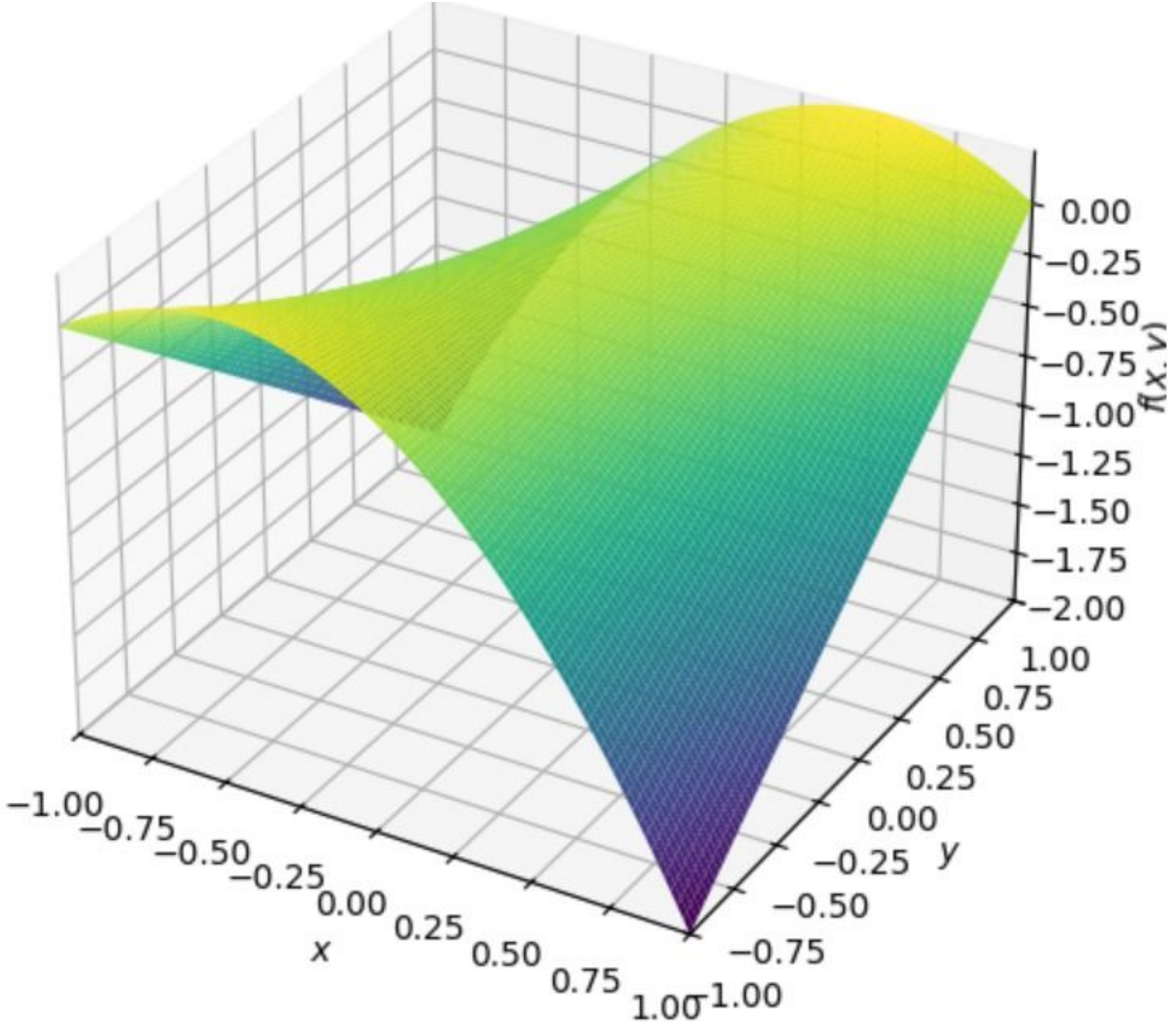
[49]:
```
hessian(f(x,y), (x,y))
```

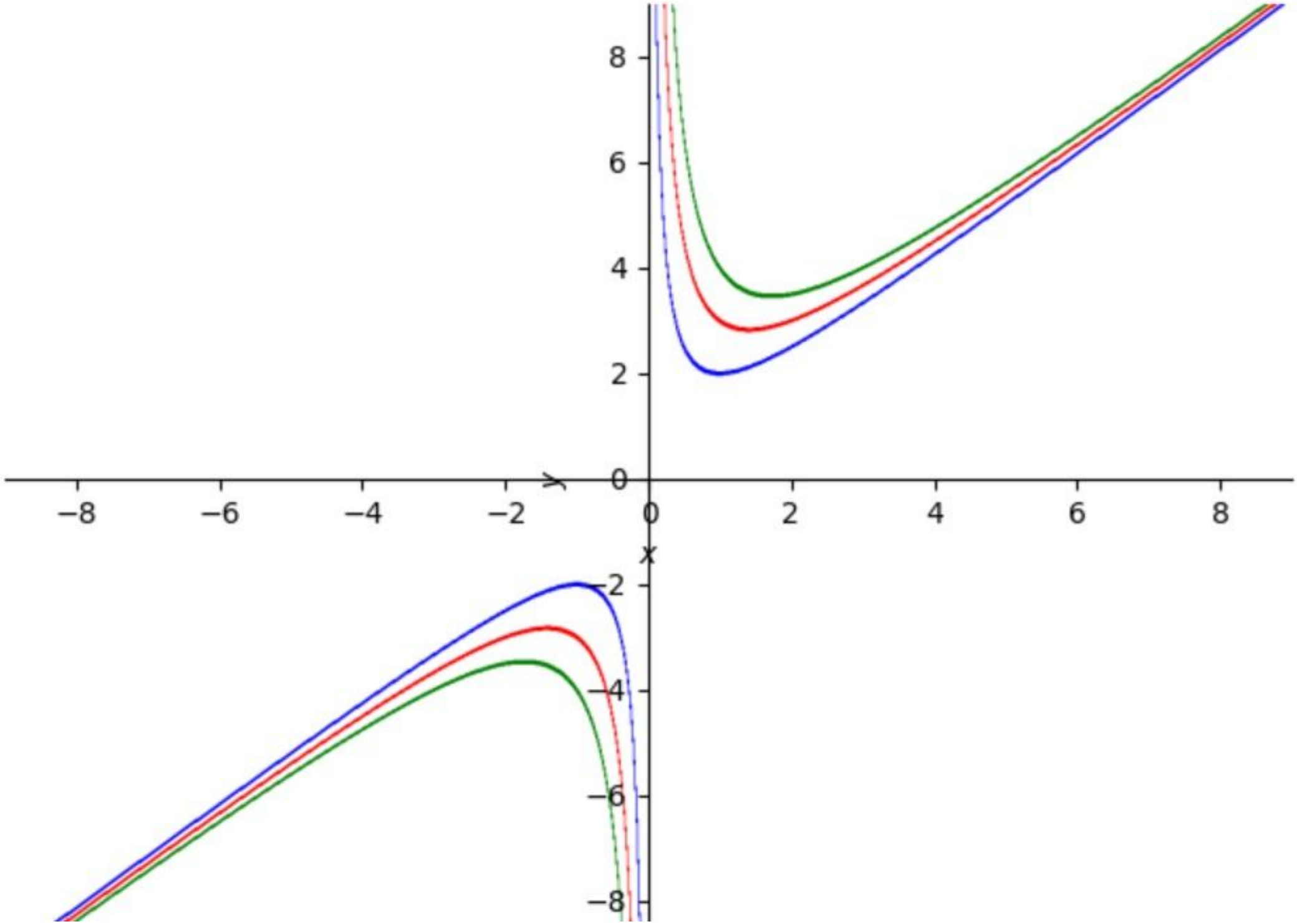
[49]:
$$\begin{bmatrix} -2 & 1 \\ 1 & 0 \end{bmatrix}$$

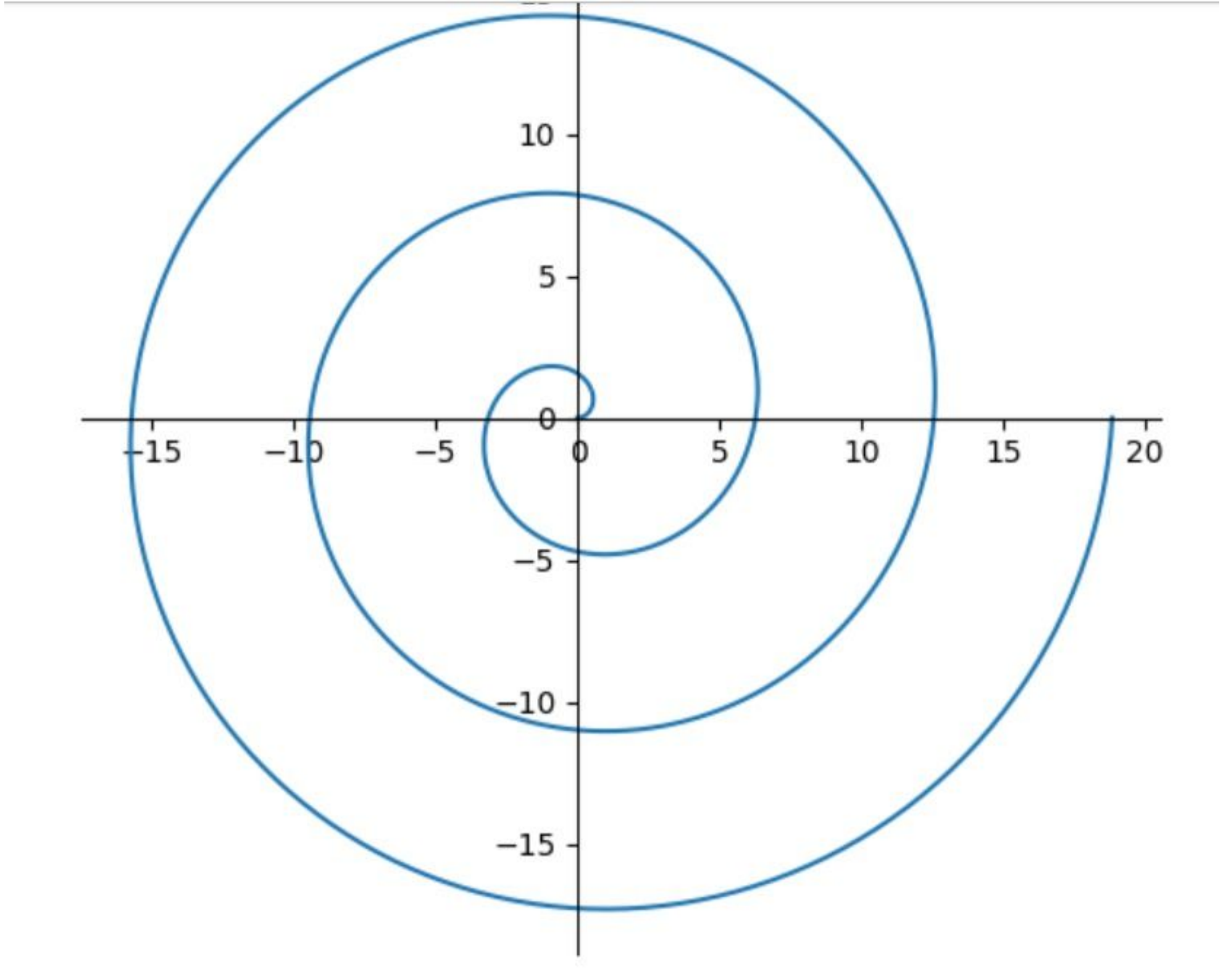
[53]:
```
det(hessian(f(x,y), (x,y)))
```

[53]:
$$-1$$


exp(x)
x**2
2*x
20
15
10
5
0
f(x)
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
x


0.00
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
f(x, y)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
y
−1.00
−0.75
−0.50
−0.25
0.00
0.25
0.50
0.75
1.00
x


8
6
4
2
0
−2
−4
−6
−8
y
x
−8
−6
−4
−2
0
2
4
6
8


10
5
0
−5
−10
−15
−15
−10
−5
0
5
10
15
20