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Assignment No 4 - Implement Gradient Descent Algorithm to find the local minima of a function. For example, find the local minima of the function $y=(x+3)^2$ starting from the point x=2.

```
import numpy as np
import matplotlib.pyplot as plt

def f(x):
    return (x+3)**2

def df(x):
    return 2*x + 6

def gradient_descent(initial_x, learning_rate, num_iterations):
    x = initial_x
    x_history = [x]

    for i in range(num_iterations):
        gradient = df(x)
        x = x - learning_rate * gradient
        x_history.append(x)

    return x, x_history

initial_x = 2
learning_rate = 0.1
num_iterations = 50

x, x_history = gradient_descent(initial_x, learning_rate,
num_iterations)

print("Local minimum: {:.2f}".format(x))
```

```
Local minimum: -3.00
```

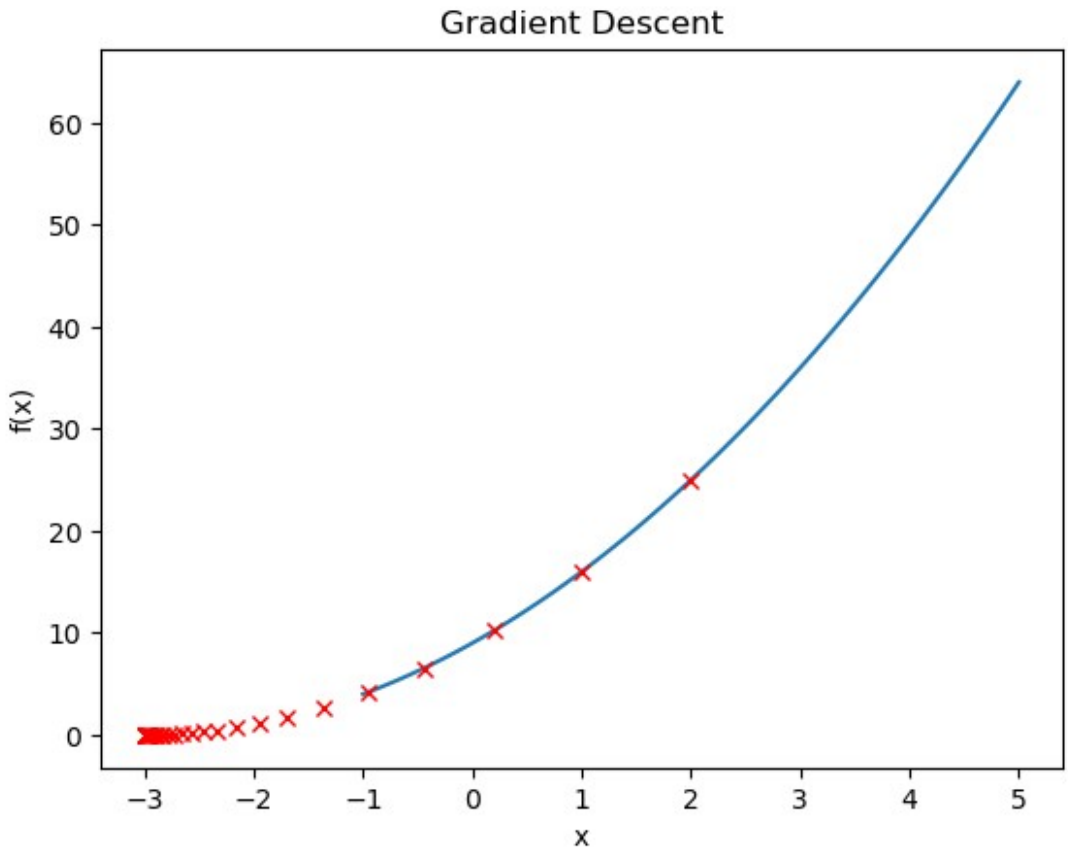
```
#Create a range of x values to plot
x_vals = np.linspace(-1, 5, 100)

#Plot the function f(x)
plt.plot(x_vals, f(x_vals))

# Plot the values of x at each iteration
plt.plot(x_history, f(np.array(x_history)), 'rx')

#Label the axes and add a title
plt.xlabel('x')
plt.ylabel('f(x)')
plt.title('Gradient Descent')

#Show the plot
plt.show()
```


Gradient Descent
f(x)
x
60
50
40
30
20
10
0
−3
−2
−1
0
1
2
3
4
5