CS156 (Introduction to AI), Spring 2022

Homework 1 submission

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Any special notes or anything you would like to communicate to me about this homework submission goes in here.

References and sources

List all your references and sources here. This includes all sites/discussion boards/blogs/posts/etc. where you grabbed some code examples.

Solution

Load libraries and set random number generator seed

In [1]:
```
import numpy as np
```

In [2]:
```
np.random.seed(42)
```

Code the solution

Let $y = 5x^3-20x+2$.

Then $\frac{d}{dx} y = 15x^2-20$.

In [3]:
```
def f(x):
    return 5 * x**3 - 20 * x + 2
```

In [4]:
```
def derivative(x):
    return 15 * x**2 - 20
```

In [5]:
```
learning_rate = 0.01
num_iterations = 1000
precision = 0.0001

def gradient_descent(x):
    for i in range(num_iterations):
```

```
        next_x = x - learning_rate * derivative(x)
        if abs(next_x - x) < precision:
            return next_x
        x = next_x
```

In [6]:

```
import matplotlib.pyplot as plt

a = np.linspace(-3, 3, 1000)
b = f(a)
plt.ylim(-30, 30)
plt.plot(a, b)

xi = np.random.uniform(-1, 2.5)
plt.scatter(xi, f(xi))
plt.text(xi + 0.2, f(xi) + 1, f'{xi:.4}, {f(xi):.4}')

xf = gradient_descent(xi)
plt.scatter(xf, f(xf))
plt.text(xf + 0.2, f(xf) + 1, f'{xf:.4}, {f(xf):.4}')

plt.show()
```