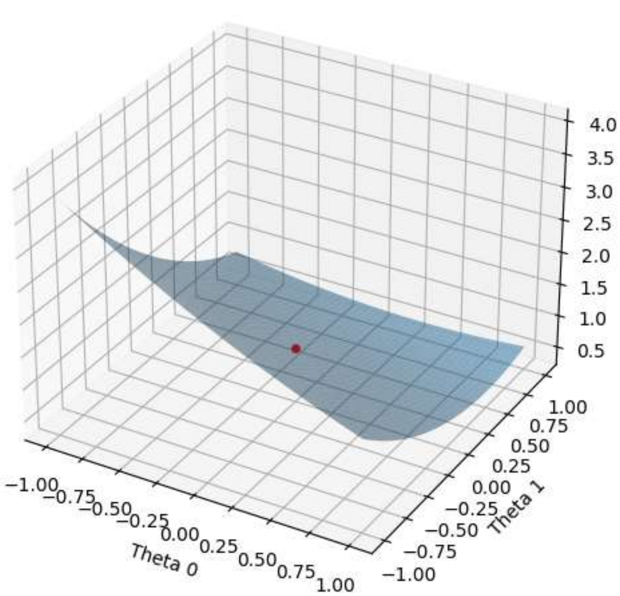
```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D


# x = np.random.rand(10, 1)
# y = 2 * x + np.random.randn(10, 1)
# print(x)
# print("\n")
# print(y)


x = np.array([0.80581147, 0.38348503, 0.6652413, 0.64155897, 0.24070017, 0.35429554, 0.70827991, 0.32378987, 0.8708774 , 0.22902348])
y = np.array([ 2.27515993, -0.15308204, 1.43590601, 0.79686399, -0.45275524, 2.03862963,  1.16148089, 2.68814558, 0.70110376, 0.04881045])


def h(t0, t1):
     return (t0 + t1*x)


def J(t0, t1):
    m = len(y)
    prediction_y = h(t0, t1)
    error = np.square(prediction_y - y)
    cost = (1/(2*m)) * np.sum(error)
    return cost


def plot_cost_surface(J, theta0_vals, theta1_vals, t0, t1):
    theta0_grid, theta1_grid = np.meshgrid(theta0_vals, theta1_vals)

    J_vals = np.zeros((len(theta0_vals), len(theta1_vals)))
    for i in range(len(theta0_vals)):
        for j in range(len(theta1_vals)):
            J_vals[i,j] = J(theta0_vals[i], theta1_vals[j])

    fig = plt.figure(figsize=(10, 6))
    ax = fig.add_subplot(111, projection='3d')
    ax.plot_surface(theta0_grid, theta1_grid, J_vals, alpha=0.5)
    ax.scatter(t0, t1, J(t0, t1), c='r', marker='o', s=15)
    ax.set_xlabel('Theta 0')
    ax.set_ylabel('Theta 1')
    ax.set_zlabel('J')
    plt.show()
```

a) Plot of J(θ0, θ1)on python with a point specifying value of J at initially taken θ0 and θ1.

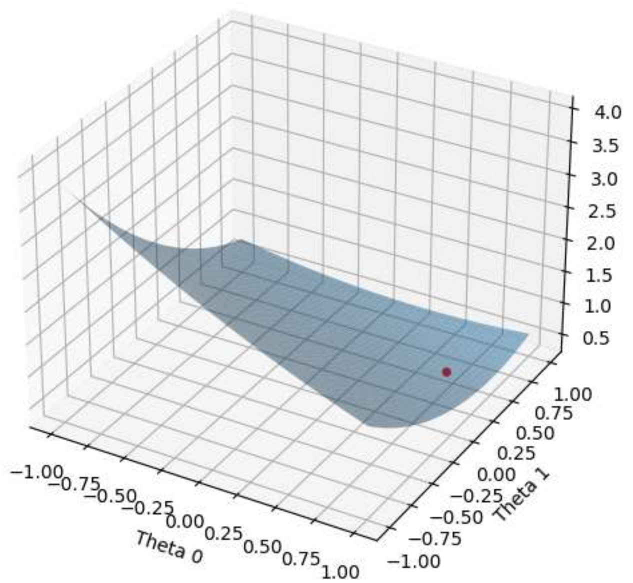
```
plot_cost_surface(J, np.linspace(-1, 1, 100), np.linspace(-1, 1, 100), 0, 0)
```



b) A table with columns J, θ0 and θ1 and at each iteration make a plot of J(θ0, θ1) on which value of J should be marked at updated(θ0, θ1) to see how far are you from your objective. Working of each iteration should also be submitted.

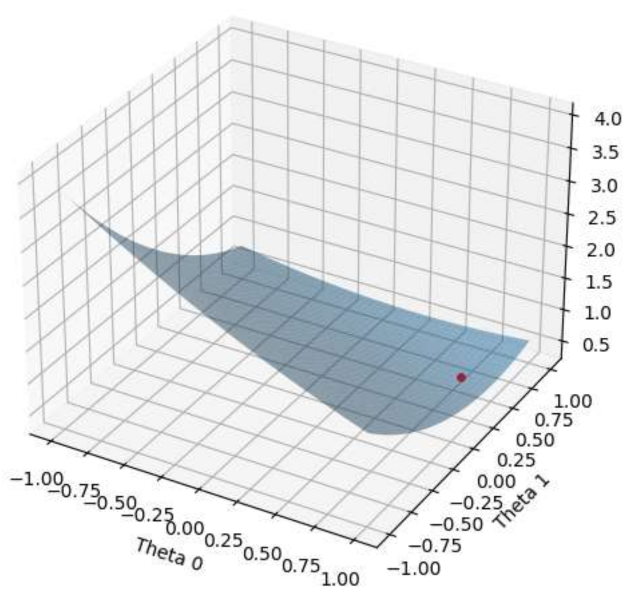
1st iteration: 0.737818 + 0.431844x

```
plot_cost_surface(J, np.linspace(-1, 1, 100), np.linspace(-1, 1, 100),  0.737818, 0.431844)
```



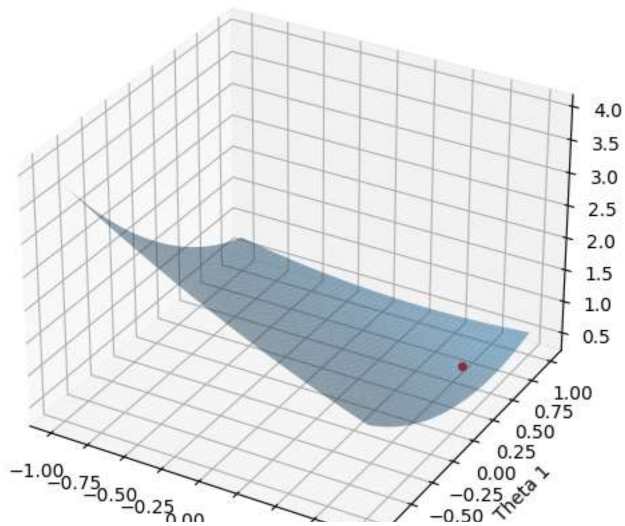
2nd iteration: 0.801275 + 0.495645x

```
plot_cost_surface(J, np.linspace(-1, 1, 100), np.linspace(-1, 1, 100),  0.801275, 0.495645)
```



3rd iteration: 0.796986 + 0.521724x

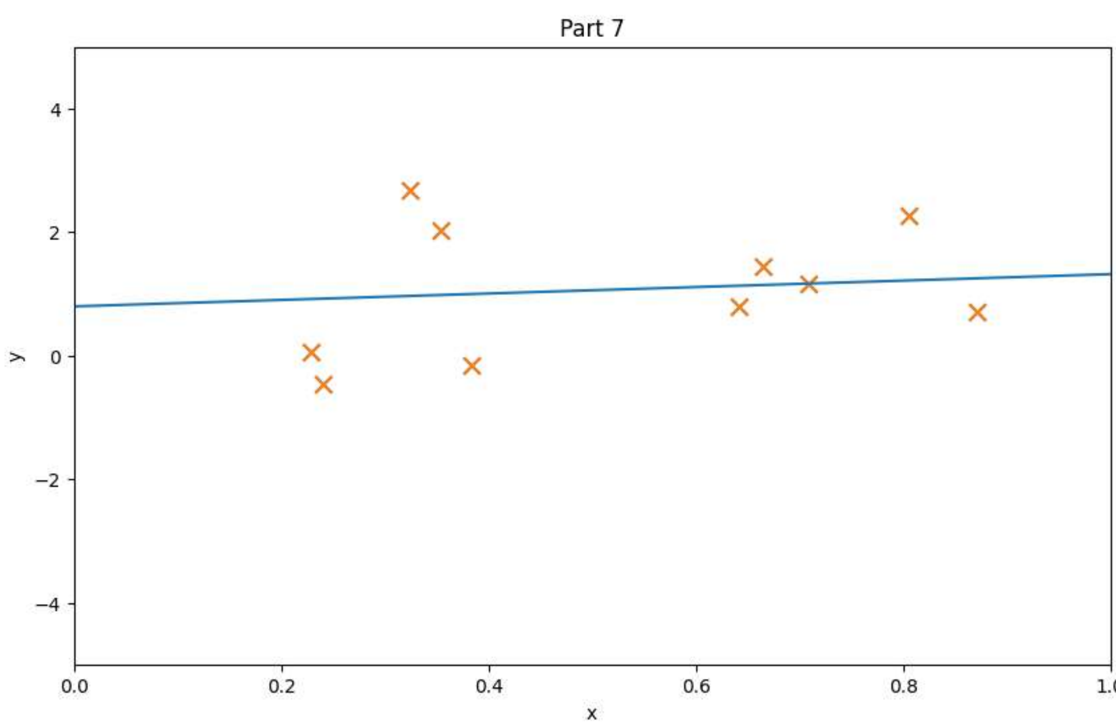
```
plot_cost_surface(J, np.linspace(-1, 1, 100), np.linspace(-1, 1, 100),  0.796986, 0.521724)
```



7- Draw a scatter plot of x and y with the plot of line y = θ0 + θ1x, where θ0 and θ1 are your final values obtained after the last iteration of gradient descent method.

last iteration: y = 0.796986 + 0.521724x

```
theta0_final = 0.796986
theta1_final = 0.521724

plt.figure(figsize=(10,6))
plt.axis([0, 1,-5,5])
plt.scatter(x, y, marker='x', s=80)
best_fit_x = np.linspace(0, 1, 100)
best_fit_y = [theta0_final + theta1_final*xx for xx in best_fit_x]
plt.plot(best_fit_x, best_fit_y, '-')
plt.scatter(x, y, marker='x', s=80)
plt.xlabel('x')
plt.ylabel('y')
plt.title('Part 7')
plt.show()
```



✓ 0s completed at 9:34 PM