1. First of all I plotted data given in dataset, then selected theta values so that the hypothesis function described the data well. Here theta0 =0,01 and theta1 =0,8

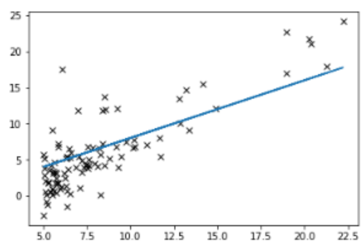
host:8888/notebooks/ml%20hw1.ipynb

jupyter ml hw1 Last Checkpoint: Вчера в 11:43 (unsaved changes) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted | Python 3

In [45]:
```python
import matplotlib.pyplot as plt
import csv
import numpy as np
path='C:\\Users\shaly\Desktop\dataset.txt'

X = []
Y = []
H=[]

with open(path, 'r') as datafile:
    plotting = csv.reader(datafile, delimiter=',')
    for ROWS in plotting:
        X.append(float(ROWS[0]))
        Y.append(float(ROWS[1]))

for i in (X):
    h=0.01+0.8*i
    H.append(h)

plt.plot(X, Y, 'x',color='black')
plt.plot(X, H)
```

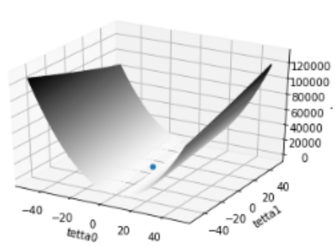
Out[45]: [<matplotlib.lines.Line2D at 0x26a1b8994f0>]



2. Next I plotted cost function using different values of theta and point where theta= 0,01 and theta1= 0,8 to see if this point is close to minimum or not. It can be seen that it is minimum point, so I left these theta values as they fit the given data very well.

In [107]:
```python
tet0=np.linspace(-50,50,100)
tet1=np.linspace(-50,50,100)
m=97
Js=np.zeros((100,100))
for j in range(len(tet0)):
    for k in range (len(tet1)):
        J=[]
        for i in range (len(X)):
            ms=(tet0[j]+tet1[k]*X[i]-Y[i])**2
            J.append(ms)
        s=1/(2*m)*sum(J)
        Js[j][k]=s
fig = plt.figure()
ax = plt.axes(projection='3d')
ax.contour3D(tet0,tet1,Js, 200, cmap='binary')
ax.set_xlabel('tetta0')
ax.set_ylabel('tetta1')
ax.set_zlabel('J');
ax.scatter3D(0.01, 0.8, 26.593283409687096, cmap='Greens')
```

Out[107]: <mpl_toolkits.mplot3d.art3d.Path3DCollection at 0x26a2281a0d0>



$$\theta_1 = \theta_1 - \alpha \underbrace{\frac{1}{m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)\cdot x^{(i)}}_{\to \frac{\partial}{\partial\theta_1} J(\theta_0,\theta_1)}$$

Derivative of Cost function

$$\frac{\partial}{\partial\theta_j} J(\theta_0,\theta_1) = \frac{\partial}{\partial\theta_j}\frac{1}{2m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)^2 = \frac{\partial}{\partial\theta_j}\frac{1}{2m}\sum_{i=1}^{m}\left(\theta_0+\theta_1 x_i - y_i\right)^2$$

$$\frac{\partial}{\partial\theta_0} J(\theta_0,\theta_1) = \frac{\partial}{\partial\theta}\frac{1}{2m}\sum_{i=1}^{m}\left(\theta_0+\theta_1 x_i - y_i\right)^2 = 2\cdot\frac{1}{2m}\sum_{i=1}^{m}\left(\theta_0+\theta_1 x_i - y_i\right)\cdot 1 =$$

$$= \frac{1}{m}\sum_{i=1}^{m}\left(\theta_0+\theta_1 x_i - y_i\right) = \frac{1}{m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)$$

$$\frac{\partial}{\partial\theta_1} J(\theta_0,\theta_1) = \frac{\partial}{\partial\theta_1}\frac{1}{2m}\sum_{i=1}^{m}\left(\theta_0+\theta_1 x_i - y_i\right)^2 = 2\cdot\frac{1}{2m}\sum_{i=1}^{m}$$

$$\left(\theta_0+\theta_1 x_i - y_i\right)\cdot x_i = \frac{1}{m}\sum_{i=1}^{m}\left(h_\theta(x^{(i)}) - y^{(i)}\right)\cdot x^{(i)}$$