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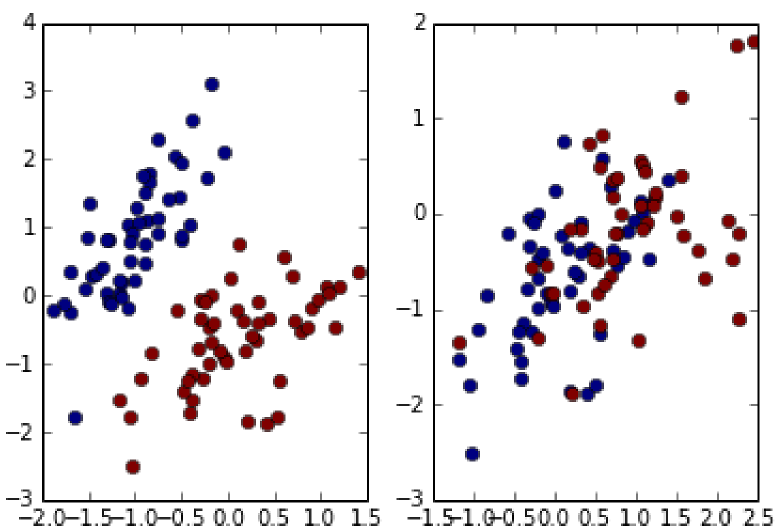
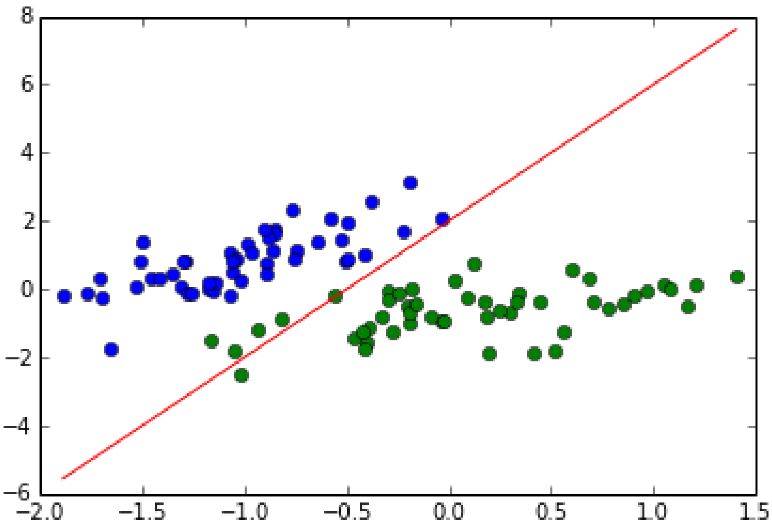
HW #3

In [1]:
```
import matplotlib.pyplot as plt
import mltools as ml
import numpy as np
import mltools.logistic2 as lc2
reload(lc2)
%matplotlib inline
iris = np.genfromtxt("data/iris.txt",delimiter=None)
X, Y = iris[:,0:2], iris[:,-1] # get first two features & target
X,Y = ml.shuffleData(X,Y) # reorder randomly (important later)
X,_ = ml.transforms.rescale(X) # works much better on rescaled data
XA, YA = X[Y<2,:], Y[Y<2] # get class 0 vs 1
XB, YB = X[Y>0,:], Y[Y>0] # get class 1 vs 2
```

In [2]:
```
# ensure seperability
fig, ax = plt.subplots(1,2)
ml.plotClassify2D(None, XA[:,[0,1]],YA,axis=ax[0])
ml.plotClassify2D(None, XB[:,[0,1]],YB,axis=ax[1])
plt.show()
```

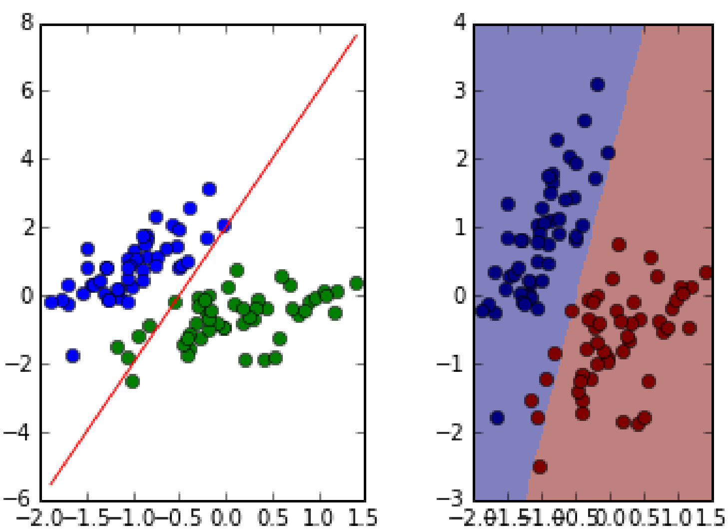


In [3]:
```
# Test of plot boundary
learner = lc2.logisticClassify2();
learner.theta=[[.5, 1, -.25]]
learner.classes=np.unique(YA)
learner.plotBoundary(XA, YA)
plt.show()
print learner.err(XA, YA)
print learner.err(XB, YB)
```



```
0.0505050505051
0.545454545455
```

In [4]:
```
fig, ax = plt.subplots(1,2)
learner.plotBoundary(XA,YA,axis=ax[0])
ml.plotClassify2D(learner, XA, YA,axis=ax[1])
plt.show()
```

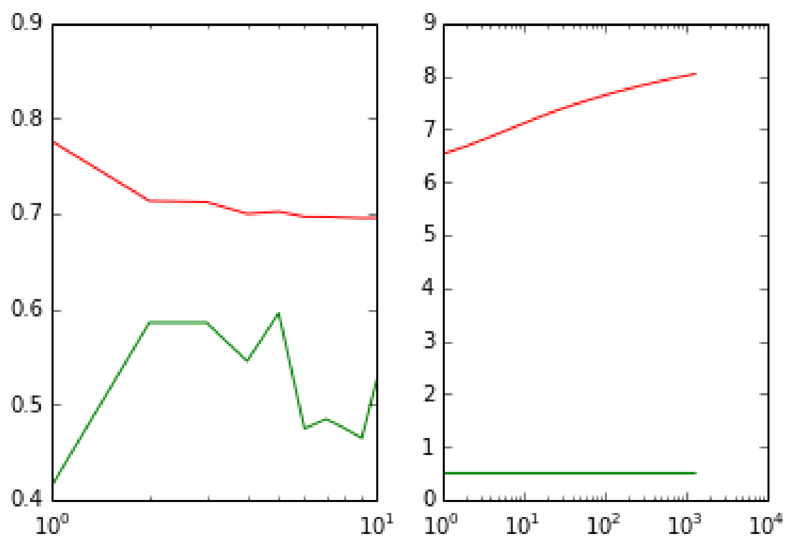


The derivation ended up being:

- (all at j) :: -y(1 - sigma(theta *x)) xOne + (1 - y)sigma(theta *x) xOne

- (all at j) :: -y(1 - sigma(theta *x))* xTwo + (1 - y)sigma(theta *x)* xTwo
- (all at j) :: -y(1 - sigma(theta *x))+ (1 - y)sigma(theta* x)

In [5]:
```
import mltools.logistic2 as lc2
import matplotlib.pyplot as plt
import mltools as ml
import numpy as np
import mltools.logistic2 as lc2
reload(lc2)
%matplotlib inline
iris = np.genfromtxt("data/iris.txt",delimiter=None)
X, Y = iris[:,0:2], iris[:,-1] # get first two features & target
X,Y = ml.shuffleData(X,Y) # reorder randomly (important later)
X,_ = ml.transforms.rescale(X) # works much better on rescaled data
XA, YA = X[Y<2,:], Y[Y<2] # get class 0 vs 1
XB, YB = X[Y>0,:], Y[Y>0] # get class 1 vs 2
fig, ax = plt.subplots(1,2)
learner = lc2.logisticClassify2(XA, YA, plot=ax[0])
learner = lc2.logisticClassify2(XB, YB, plot=ax[1])
plt.show()
```



In [12]:
```
#Demonstrating L2 penalization.
import matplotlib.pyplot as plt
import mltools as ml
import numpy as np
import mltools.logistic2 as lc2
reload(lc2)
%matplotlib inline
iris = np.genfromtxt("data/iris.txt",delimiter=None)
X, Y = iris[:,0:2], iris[:,-1] # get first two features & target
X,Y = ml.shuffleData(X,Y) # reorder randomly (important later)
X,_ = ml.transforms.rescale(X) # works much better on rescaled data
XA, YA = X[Y<2,:], Y[Y<2] # get class 0 vs 1
XB, YB = X[Y>0,:], Y[Y>0] # get class 1 vs 2

learner = lc2.logisticClassify2(XA, YA)
print learner.err(XB,YB)
learner = lc2.logisticClassify2(XA, YA, alpha=2)
print learner.err(XB,YB)
```

```
0.0606060606
0.1818181818
```

part two

a.) Can shatter a, b but not c or d. There is no way to make points (2,2) and (8,7) in the same class

b.) Most points can be shatter. Since c can skew the origin point, you can scatter each point in c, but not in d.

c.) Can up to d. You can not put point (2,2) and 8,7 in the same class with 4,8 and 6,4 in the same class.