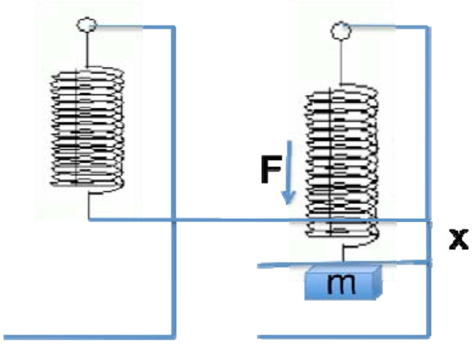
6.00 Handout, Lecture 17
(Not intended to make sense outside of lecture)



```
def getData(fileName):
    dataFile = open(fileName, 'r')
    distances = []
    masses = []
    discardHeader = dataFile.readline()
    for line in dataFile:
        d, m = line.split()
        distances.append(float(d))
        masses.append(float(m))
    dataFile.close()
    return (masses, distances)

def plotData(fileName):
    xVals, yVals = getData(fileName)
    xVals = pylab.array(xVals)
    yVals = pylab.array(yVals)
    xVals = xVals*9.81  #acc. due to gravity
    pylab.plot(xVals, yVals, 'bo', label = 'Measured displacements')
    pylab.title('Measured Displacement of Spring')
    pylab.xlabel('|Force| (Newtons)')
    pylab.ylabel('Distance (meters)')

def fitData(fileName):
    xVals, yVals = getData(fileName)
    xVals = pylab.array(xVals)
    yVals = pylab.array(yVals)
    xVals = xVals*9.81
    pylab.plot(xVals, yVals, 'bo', label = 'Measured displacements')
    pylab.title('Measured Displacement of Spring')
    pylab.xlabel('|Force| (Newtons)')
    pylab.ylabel('Distance (meters)')
    a,b = pylab.polyfit(xVals, yVals, 1)
    estYVals = a*pylab.array(xVals) + b
    k = 1/a
    pylab.plot(xVals, estYVals, label = 'Linear fit, k = '
               + str(round(k, 5)))
    pylab.legend(loc = 'best')
```

```
def tryFits(fName):
    distances, heights = getTrajectoryData(fName)
    distances = pylab.array(distances)*36
    totHeights = pylab.array([0]*len(distances))
    for h in heights:
        totHeights = totHeights + pylab.array(h)
    pylab.title('Trajectory of Projectile (Mean of 4 Trials)')
    pylab.xlabel('Inches from Launch Point')
    pylab.ylabel('Inches Above Launch Point')
    meanHeights = totHeights/float(len(heights))
    pylab.plot(distances, meanHeights, 'bo')
    a,b = pylab.polyfit(distances, meanHeights, 1)
    altitudes = a*distances + b
    pylab.plot(distances, altitudes, 'r',
               label = 'Linear Fit')
    a,b,c = pylab.polyfit(distances, meanHeights, 2)
    altitudes = a*(distances**2) + b*distances + c
    pylab.plot(distances, altitudes, 'g',
               label = 'Quadratic Fit')
    pylab.legend()

def rSquare(measured, estimated):
    """measured: one dimensional array of measured values
       estimate: one dimensional array of predicted values"""
    EE = ((estimated - measured)**2).sum()
    mMean = measured.sum()/float(len(measured))
    MV = ((mMean - measured)**2).sum()
    return 1 - EE/MV

def tryFits1(fName):
...
    pylab.plot(distances, altitudes, 'r',
               label = 'Linear Fit' + ', R2 = '
               + str(round(rSquare(meanHeights, altitudes), 4)))
    a,b,c = pylab.polyfit(distances, meanHeights, 2)
    altitudes = a*(distances**2) + b*distances + c
    pylab.plot(distances, altitudes, 'g',
               label = 'Quadratic Fit' + ', R2 = '
               + str(round(rSquare(meanHeights, altitudes), 4)))
    pylab.legend()
```