Least squares project

For this third programming project, we'll do a least squares approximation to some data using a couple of different types of basis functions. Specifically, use the data set with x coordinates `xs` and y coordinates `ys` given by

```
import numpy as np
from numpy.random import seed, randn
seed(1)
xs = np.linspace(-2,2,10)
ys = [np.sin(x) + randn()/8 for x in xs]
```

This data is shown in figure 1. You should do two polynomial fits:

1. Using the basis functions $1, x, x^2, x^3$
2. Using the basis functions $1, x, 2x^2 - 1, 4x^3 - 3x$

In both cases, you should set up the matrix A whose columns are the basis functions evaluated at the given x data. You should then solve the system

$$A^T A\vec{c} = A^T\vec{y},$$

where $\vec{c}$ is the unknown vector of coefficients and $\vec{y}$ is the vector of y data. In some sense, you should get the same answer for both parts, as both answers should represent a cubic fit to the data. However, you should understand that the answer involves a linear combination of basis functions; you need to tell me the correct coefficients.

You should work this out in a well formatted Jupyter notebook and email that to me by next Tuesday, April 29.

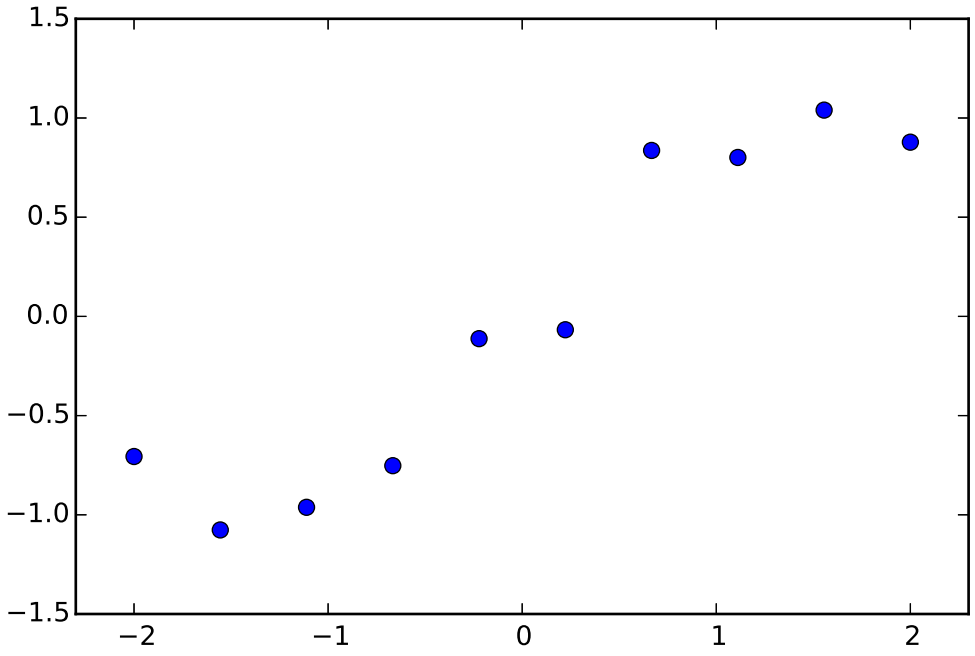

Figure 1: A plot of our data