1. poly(a) is used to find the characteristic polynomial of the matrix A.

```
>> a = [2 -1 0 1 0; -4 3 0 -5 -4; 5 -2 3 1 -1; -6 2 0 -4 -2; 2 -1 0 1 0;];
b = [1; 5; -3; 2; 3;];
c = poly(a);
>> c

c =

    1.0000   -4.0000   -1.0000   16.0000  -12.0000   -0.0000
```

The polynomial has 5 degrees.

2. Polyval returns the value plugged into the characteristic polynomial, any eigenvalue plugged into the characteristic polynomial should return a value of zero, so 5 is not an eigenvalue,

```
>> d = polyval(c, 5);
>> d

d =

   840
```

3. Using the roots command on the polynomial of A allows us to find the true eigenvalues of the matrix A.

```
>> u = eig(a);
>> u

u =

    3.0000
    2.0000
    1.0000
   -2.0000
   -0.0000
```

4. eig(A) allows us to find the eigenvalues and the eigenvectors of the matrix, and stores them into two seperate matrices. D being the eigenvalue matrix and V being the eigenvalue matrix.

```
>> [V,D] = eig(a);
>> V

V =

         0   -0.1474   -0.3015    0.0000   -0.2545
         0    0.2949    0.3015   -0.7001    0.2545
    1.0000    0.8847    0.6030   -0.1400    0.1696
         0    0.2949    0.6030   -0.7001    0.7634
         0   -0.1474   -0.3015    0.0000   -0.5089

>> D

D =

    3.0000         0         0         0         0
         0    2.0000         0         0         0
         0         0    1.0000         0         0
         0         0         0   -2.0000         0
         0         0         0         0   -0.0000
```

5. We cannot compute this directly, instead we have to find X by doing V^-1 * b.

6. This calculates the diagonalization of matrix A, V*D*f should equal A*b due to the properties of diagonalization

```
>> k = 2;
temp = (a^k)*b;
temp1 = V*(D^k)*f;
k = 5;
temp2 = (a^k)*b;
temp3 = V*(D^k)*f;
k = 8;
temp4 = (a^k)*b;
temp5 = V*(D^k)*f;
>> temp

temp =

    -1
    25
   -37
    26
    -1

>> temp1

temp1 =

   -1.0000
   25.0000
  -37.0000
   26.0000
   -1.0000

>> temp2

temp2 =

          -1
        -191
       -1219
        -190
          -1
```