Linear Algebra Homework 12, May 8th 2018, Maxwell Greene

Question #1:

```
A = [2  0  0 ; 1/2 3  1 ; 0  0  2 ]
```

```
A =
    2.0000         0         0
    0.5000    3.0000    1.0000
         0         0    2.0000
```

Part 1(a)

The characteristic polynomial of A is

```
syms L;
CharacteristicPolynomial = charpoly(A,L)
```

CharacteristicPolynomial = $L^3 - 7\,L^2 + 16\,L - 12$

which factors to

$$(\lambda - 2)^2(\lambda - 3).$$

Part 1(b)

The eigenvales of A are

```
lambda = eig(A)'
```

```
lambda =
     3     2     2
```

Part 1(c)

The basis for the eigenvales are given by the column vectors of V corrosponding to the values in matrix D.

```
[P,~] = eig(A)
```

```
P =
         0    0.8944         0
    1.0000   -0.4472   -0.7071
         0         0    0.7071
```

So, the basis vector for eigenvalue D(1,1), $\lambda = 3$ is

```
P(:,1)'
```

```
ans =
     0     1     0
```

That is, $\{ <0,1,0> \}$.

The basis vectors for the eigenvalue D(2,2), $\lambda = 2$ is

```
P(:,2)',P(:,3)'
```

```
ans =
    0.8944   -0.4472         0
ans =
         0   -0.7071    0.7071
```

That is, $\{ <2,-1,0>, <0,-1,1> \}$.

Part 1(d)

The matrix that diagonalizes A is given by

```
P
```

```
P =
         0    0.8944         0
    1.0000   -0.4472   -0.7071
         0         0    0.7071
```

from the previous function

```
[P,D] = eig(A);
```

The matrix $P^{-1}AP$ is

```
inv(P)*A*P
```

```
ans =
     3     0     0
     0     2     0
     0     0     2
```

The value of A^5 is $P^{-1}D^5P$, which is

```
P*(D.^5)*inv(P)
```

```
ans =
   32.0000         0         0
```

```
  105.5000  243.0000  211.0000
         0         0   32.0000
```

Check:

```
A^5
```

```
ans =
   32.0000         0         0
  105.5000  243.0000  211.0000
         0         0   32.0000
```