```
%{
Written by Tianyu Gao
Born on Sept, 20
%}
clc
clear all
```

Problem a

```
A = [3 2 2 1; 2 3 1 2; -1 1 2 0; 2 4 3 5];
[V,D] = eig(A);
V
D
sprintf('Norms of these  four eignevectors are %.2f, %.2f, %.2f and
 %.2f ', ...
 (norm(V(:,1))),(norm(V(:,2))),(norm(V(:,3))),(norm(V(:,4))))
% So we can see that Matlab uses 2-norm to normalize eigenvectors.
```

```
V =

   0.3446 + 0.0000i  -0.1195 - 0.3317i  -0.1195 + 0.3317i  -0.5000 +
 0.0000i
   0.4569 + 0.0000i  -0.5295 + 0.2518i  -0.5295 - 0.2518i  -0.5000 +
 0.0000i
   0.0183 + 0.0000i   0.7213 + 0.0000i   0.7213 + 0.0000i   0.5000 +
 0.0000i
   0.8198 + 0.0000i   0.0723 - 0.0799i   0.0723 + 0.0799i   0.5000 +
 0.0000i


D =

   8.1370 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   1.4315 + 0.8090i   0.0000 + 0.0000i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   1.4315 - 0.8090i   0.0000 +
 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i   2.0000 +
 0.0000i


ans =

Norms of these  four eignevectors are 1.00, 1.00, 1.00 and 1.00
```

Problem b

```
A = sym(A);
```

```
[Ve,De]=eig(A);
Ve
De
% When use sym function. Matlab will output the exact result.
```

```
Ve =

[ -1, (43/(9*(454^(1/2)/3 + 341/27)^(1/3)) + (454^(1/2)/3 +
 341/27)^(1/3) + 11/3)^2/2 - 215/(9*(454^(1/2)/3 + 341/27)^(1/3))
 - 5*(454^(1/2)/3 + 341/27)^(1/3) - 31/3, (43/(18*(454^(1/2)/3 +
 341/27)^(1/3)) + (454^(1/2)/3 + 341/27)^(1/3)/2 + (3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2
 - 11/3)^2/2 + 215/(18*(454^(1/2)/3 + 341/27)^(1/3)) + (5*(454^(1/2)/3
 + 341/27)^(1/3))/2 + (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3))
 - (454^(1/2)/3 + 341/27)^(1/3))*5i)/2 - 31/3, (43/(18*(454^(1/2)/3
 + 341/27)^(1/3)) + (454^(1/2)/3 + 341/27)^(1/3)/2 - (3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2
 - 11/3)^2/2 + 215/(18*(454^(1/2)/3 + 341/27)^(1/3)) + (5*(454^(1/2)/3
 + 341/27)^(1/3))/2 - (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3)) -
 (454^(1/2)/3 + 341/27)^(1/3))*5i)/2 - 31/3]
[ -1, (43/(9*(454^(1/2)/3 + 341/27)^(1/3)) + (454^(1/2)/3 +
 341/27)^(1/3) + 11/3)^2/2 - 172/(9*(454^(1/2)/3 + 341/27)^(1/3)) -
 4*(454^(1/2)/3 + 341/27)^(1/3) - 44/3,           (43/(18*(454^(1/2)/3
 + 341/27)^(1/3)) + (454^(1/2)/3 + 341/27)^(1/3)/2 + (3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2
 - 11/3)^2/2 + 86/(9*(454^(1/2)/3 + 341/27)^(1/3)) + 2*(454^(1/2)/3
 + 341/27)^(1/3) + 3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3))
 - (454^(1/2)/3 + 341/27)^(1/3))*2i - 44/3,           (43/
(18*(454^(1/2)/3 + 341/27)^(1/3)) + (454^(1/2)/3 + 341/27)^(1/3)/2
 - (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3
 + 341/27)^(1/3))*1i)/2 - 11/3)^2/2 + 86/(9*(454^(1/2)/3 +
 341/27)^(1/3)) + 2*(454^(1/2)/3 + 341/27)^(1/3) - 3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*2i -
 44/3]
[  1,          43/(454^(1/2)/3 + 341/27)^(1/3) - (43/(9*(454^(1/2)/3
 + 341/27)^(1/3)) + (454^(1/2)/3 + 341/27)^(1/3) + 11/3)^2 +
 9*(454^(1/2)/3 + 341/27)^(1/3) + 26,       26 - 43/(2*(454^(1/2)/3 +
 341/27)^(1/3)) - (9*(454^(1/2)/3 + 341/27)^(1/3))/2 - (3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*9i)/2
 - (43/(18*(454^(1/2)/3 + 341/27)^(1/3)) + (454^(1/2)/3 +
 341/27)^(1/3)/2 + (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3))
 - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2 - 11/3)^2,       26 - 43/
(2*(454^(1/2)/3 + 341/27)^(1/3)) - (9*(454^(1/2)/3 + 341/27)^(1/3))/2
 + (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3
 + 341/27)^(1/3))*9i)/2 - (43/(18*(454^(1/2)/3 + 341/27)^(1/3)) +
 (454^(1/2)/3 + 341/27)^(1/3)/2 - (3^(1/2)*(43/(9*(454^(1/2)/3 +
 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2 - 11/3)^2]
[  1,

                                                          1,
```

```
                1,



     1]

De =

[ 2,
       0,

                                  0,

                                                                  0]
[ 0, 43/(9*(454^(1/2)/3 + 341/27)^(1/3)) + (454^(1/2)/3 +
 341/27)^(1/3) + 11/3,

                                             0,

                                                                        0]
[ 0,
           0, 11/3 - (454^(1/2)/3 + 341/27)^(1/3)/2 - (3^(1/2)*(43/
(9*(454^(1/2)/3 + 341/27)^(1/3)) - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2
 - 43/(18*(454^(1/2)/3 + 341/27)^(1/3)),

                                                                   0]
[ 0,
           0,

                                             0, 11/3 - (454^(1/2)/3
 + 341/27)^(1/3)/2 + (3^(1/2)*(43/(9*(454^(1/2)/3 + 341/27)^(1/3))
 - (454^(1/2)/3 + 341/27)^(1/3))*1i)/2 - 43/(18*(454^(1/2)/3 +
 341/27)^(1/3))]
```

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