



[Course](#) > [Unit 2:...](#) > [MATLA...](#) > 3. Eige...

3. Eigenvalues of symmetric matrices using MATLAB

Eigenvalues of symmetric matrices (External resource)

(1.0 points possible)

Eigenvalues of symmetric matrices

- Recall that a matrix is symmetric if it equals its transpose, i.e. $\mathbf{A} = \mathbf{A}^T$.
- In order to complete the exercise below, you need to know what the symmetric part of a matrix is. Given any square matrix \mathbf{A} , its *symmetric part* is defined as:

$$\mathbf{B} = \frac{1}{2}[\mathbf{A} + \mathbf{A}^T]$$

You should check for yourself that \mathbf{B} is a symmetric matrix.

There is a very useful result in linear algebra which says that the eigenvalues of any symmetric matrix are real. We will provide a proof for your enjoyment at the end of this recitation. However, MATLAB gives you a simple way to test whether or not this is a reasonable claim. MATLAB can be a useful tool for testing out hypotheses, however, you must remember that numerical experiments are never a substitute for a full proof.

Complete the script below to see that the eigenvalues of a randomly generated symmetric matrix are real.

Your Script

 Save  Reset  MATLAB Documentation (<https://www.mathworks.com/help/>)

```

1 % Firstly generate a random 100x100 matrix A of numbers randomly chosen between -1
2 % Note that rand() generates random numbers between 0 and 1, so we've modified the
3 % by first subtracting 0.5 from each entry to get randomly generated entries betwe
4 % then multiplying by 20 so that the numbers lie between -10 and 10.
5
6 A = (rand(100)-0.5)*20;
7 % Now calculate the symmetric part of the matrix A. Call this matrix B
8 B = (A + A') / 2;
9 % Now calculate the eigenvalues and eigenvectors of A using eig(). Store them in t
10 [V1, D1] = eig(A);
11 % Now calculate the eigenvalues and eigenvectors of B using eig(). Store them in t
12 [V2, D2] = eig(B);
13 % We will now create a scatter plot of the eigenvalues of A and B from the script
14 % If you have filled it in correctly, then you should see that the eigenvalues of
15 % while the eigenvalues of B are all on the real line.
16 figure(1)
17 hold on
18 d1 = diag(D1);
19 plot(real(d1),imag(d1),'*')
20 xlabel('Real part')
```

```
21 ylabel('Imaginary part')
22 xlim([-max(abs(real(d1))), max(abs(real(d1)))])
23 ylim([-max(abs(imag(d1))), max(abs(imag(d1)))])
24 title('Eigenvalues of A')
25 set(gca,'FontSize', 18);
26 axis square
27 %
28 figure(2)
29 hold on
30 d2 = diag(D2);
31 plot(real(d2),imag(d2),'*')
32 xlabel('Real part')
33 ylabel('Imaginary part')
34 xlim([-max(abs(real(d2))), max(abs(real(d2)))])
35 ylim([-1, 1])
36 title('Eigenvalues of B')
37 set(gca,'FontSize', 18);
38 axis square
```

[▶ Run Script](#)**Assessment: Correct**[Submit](#)

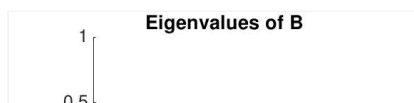
✓ Symmetric part correct

✓ Value of V1

✓ Value of D1

✓ Value of V2

✓ Value of D2

Output

3. Eigenvalues of symmetric matrices using MATLAB

[Hide Discussion](#)

Topic: Unit 2: Linear Algebra, Part 2 / 3. Eigenvalues of symmetric matrices using MATLAB

[Add a Post](#)

Show all posts ▼

by recent activity ▼

There are no posts in this topic yet.

[Learn About Verified Certificates](#)

© All Rights Reserved