```
? Eigenvalues
```

Eigenvalues[m] gives a list of the eigenvalues of the square matrix m.

Eigenvalues[{m, a}] gives the generalized eigenvalues of m with respect to a.

Eigenvalues[m, k] gives the first k eigenvalues of m.

Eigenvalues[{m, a}, k] gives the first k generalized eigenvalues. >>

In[∘]:=
```
sx = 1 / 2 {{0, 2, 0, 0, 0}, {2, 0, √6, 0, 0},
    {0, √6, 0, √6, 0}, {0, 0, √6, 0, 2}, {0, 0, 0, 2, 0}}
```

Out[∘]=

$$\left\{\{0, 1, 0, 0, 0\}, \left\{1, 0, \sqrt{\frac{3}{2}}, 0, 0\right\}, \left\{0, \sqrt{\frac{3}{2}}, 0, \sqrt{\frac{3}{2}}, 0\right\}, \left\{0, 0, \sqrt{\frac{3}{2}}, 0, 1\right\}, \{0, 0, 0, 1, 0\}\right\}$$

In[∘]:=
```
MatrixForm[sx]
```

Out[∘]//MatrixForm=

$$\begin{pmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & \sqrt{\frac{3}{2}} & 0 & 0 \\ 0 & \sqrt{\frac{3}{2}} & 0 & \sqrt{\frac{3}{2}} & 0 \\ 0 & 0 & \sqrt{\frac{3}{2}} & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

In[∘]:=
```
Eigenvalues[sx]
```

Out[∘]= $\{-2, 2, -1, 1, 0\}$

Did we expect this?

Now let' s get the eigenvectors

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? IdentityMatrix
```

IdentityMatrix[n] gives the $n \times n$ identity matrix. >>

```
? Eigenvectors
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Eigenvectors[m] gives a list of the eigenvectors of the square matrix m.

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Eigenvectors[m, k] gives the first k eigenvectors of m.

Eigenvectors[{m, a}, k] gives the first k generalized eigenvectors. >>

In[∘]:=
```
allEV = Eigenvectors[sx]
```

Out[∘]= $\left\{\left\{1, -2, \sqrt{6}, -2, 1\right\}, \left\{1, 2, \sqrt{6}, 2, 1\right\}, \{-1, 1, 0, -1, 1\}, \{-1, -1, 0, 1, 1\}, \left\{1, 0, -\sqrt{\frac{2}{3}}, 0, 1\right\}\right\}$

In[∘]:=
```
myEV = allEV[[2]]
```

Out[∘]= $\left\{1, 2, \sqrt{6}, 2, 1\right\}$

```
? Normalize
```

Normalize[v] gives the normalized form of a vector v.

Normalize[z] gives the normalized form of a complex number z.

Normalize[$expr$, f] normalizes with respect to the norm function f. >>

I' m guessing that the second vector above corresponds to +2 since this is the second Eigenvalue listed above.

In[∘]:=
```
n = Normalize[myEV]
```

Out[∘]= $\left\{\frac{1}{4}, \frac{1}{2}, \frac{\sqrt{\frac{3}{2}}}{2}, \frac{1}{2}, \frac{1}{4}\right\}$

Let' s check if we' re using the right vector

In[∘]:=
```
Dot[sx, n]
```

Out[∘]= $\left\{\frac{1}{2}, 1, \sqrt{\frac{3}{2}}, 1, \frac{1}{2}\right\}$

This looks like 2 times the normalized vector, so that confirms that we’re dealing with the right Eigenvector.