

## Step-1

Objective is to describe all the matrices that are similar to  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ . And write any two of them.

Observe that given  $2 \times 2$  matrix is diagonal. So, eigenvalues of this matrix will be its diagonal entries. It is known that the similar matrices have the same properties. Thus, all the matrices that are similar to  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  will have the eigenvalues as  $\lambda = 1, -1$ .

## Step-2

Eigenvalues play the most important role in describing any matrix. The sum of eigenvalues gives the trace of the matrix and the product of eigenvalues is equal to the determinant of matrix.

Since  $\lambda = 1, -1$  for the given matrix, therefore any matrix similar to  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$  will have:

$$\begin{aligned} \text{Trace} &= 1 + (-1) \\ &= 0 \\ \det &= 1 \cdot (-1) \\ &= -1 \end{aligned}$$

## Step-3

There are so many matrices that are similar to  $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ . Two such matrices are:

$$\begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}, \begin{bmatrix} 1 & 9 \\ 0 & -1 \end{bmatrix}.$$