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The matrices A and B are given below:

$$A = \begin{bmatrix} 1 & -5 \\ -5 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

Find the eigen values and the associated normalized eigen vectors of the above matrices using R software.

SOLUTION:-

Eigen value of given matrix is,

```
> #The eigen value of a matrix and eigen vector
> x=c(1,-5,-5,1)
> x
[1] 1 -5 -5 1
> y=matrix(x,nrow = 2,ncol = 2)
> y
      [,1] [,2]
[1,] 1   -5
[2,] -5   1
> z=eigen(y)
> z
eigen() decomposition
$values
[1] 6 -4

$vectors
      [,1] [,2]
[1,] -0.7071068 -0.7071068
[2,] 0.7071068 -0.7071068

> extr=z$vectors
> extr
      [,1] [,2]
[1,] -0.7071068 -0.7071068
[2,] 0.7071068 -0.7071068
> # To extract the data column and also check the normality.
> extr=z$vectors
> extr
      [,1] [,2]
[1,] -0.7071068 -0.7071068
[2,] 0.7071068 -0.7071068
> col1=extr[,1]
> col1
[1] -0.7071068 0.7071068
> sq=col1*col1
> sq
[1] 0.5 0.5
> sm=sum(sq)
> sm
[1] 1
> col2=extr[,2]
> col2
```

```

[1] -0.7071068 -0.7071068
> sq1=col2*col2
> sq1
[1] 0.5 0.5
> sm1=sum(sq1)
> sm1
[1] 1

```

[2]:→ For matrix B solve the eigen value and eigen vector and cheack the normality.

```

> # second matrix eigen value and normal eigen vector

> T=c(1,-2,0,-2,5,0,0,0,2)
> T
[1] 1 -2 0 -2 5 0 0 0 2
> U=matrix(T,nrow=3,ncol=3)
> U
      [,1] [,2] [,3]
[1,]    1   -2    0
[2,]   -2    5    0
[3,]    0    0    2
> V=eigen(U)
> V
eigen() decomposition
$values
[1] 5.8284271 2.0000000 0.1715729

$vectors
      [,1] [,2] [,3]
[1,] -0.3826834  0 0.9238795
[2,]  0.9238795  0 0.3826834
[3,]  0.0000000  1 0.0000000

> W=V$vectors
> W
      [,1] [,2] [,3]
[1,] -0.3826834  0 0.9238795
[2,]  0.9238795  0 0.3826834
[3,]  0.0000000  1 0.0000000
> # To extract the data in matrix by column and cheack normality

> X=W[,1]
> X
[1] -0.3826834  0.9238795  0.0000000
> SQ=X*X
> SQ
[1] 0.1464466 0.8535534 0.0000000
> SM=sum(SQ)
> SM
[1] 1
> X1=W[,2]
> X1
[1] 0 0 1
> SQ1=X1*X1
> SQ1
[1] 0 0 1
> SM1=sum(SQ1)
> SM1
[1] 1
> X2=W[,3]
> X2
[1] 0.9238795 0.3826834 0.0000000
> SQ2=X2*X2
> SQ2
[1] 0.8535534 0.1464466 0.0000000

```

```
> SM3=sum(SQ1)
> SM3
[1] 1
```

Conclusion:-Above these two matrices have eigen value and associated eigen vector are normalized.