Covariance matrix is:

[[0.08060992 0.40242878 -0.0025104]

 [0.40242878 2.09900159 -0.01439466]

 [-0.0025104 -0.01439466 0.08058254]]

Variance of x: 0.0806099157997998

Covariance matrix for x,y:

[[0.08060992 0.40242878]

 [0.40242878 2.09900159]]

Covariance matrix for y,z:

[[2.09900159 -0.01439466]

 [-0.01439466 0.08058254]]

eigvalues are [2.17638133 0.00333122 0.0804815]

eigenVectors are

[[0.18857784 0.982048   0.00448705]

 [0.98203351 -0.18860355 0.00623651]

 [-0.00697082 -0.00323037 0.99997049]]

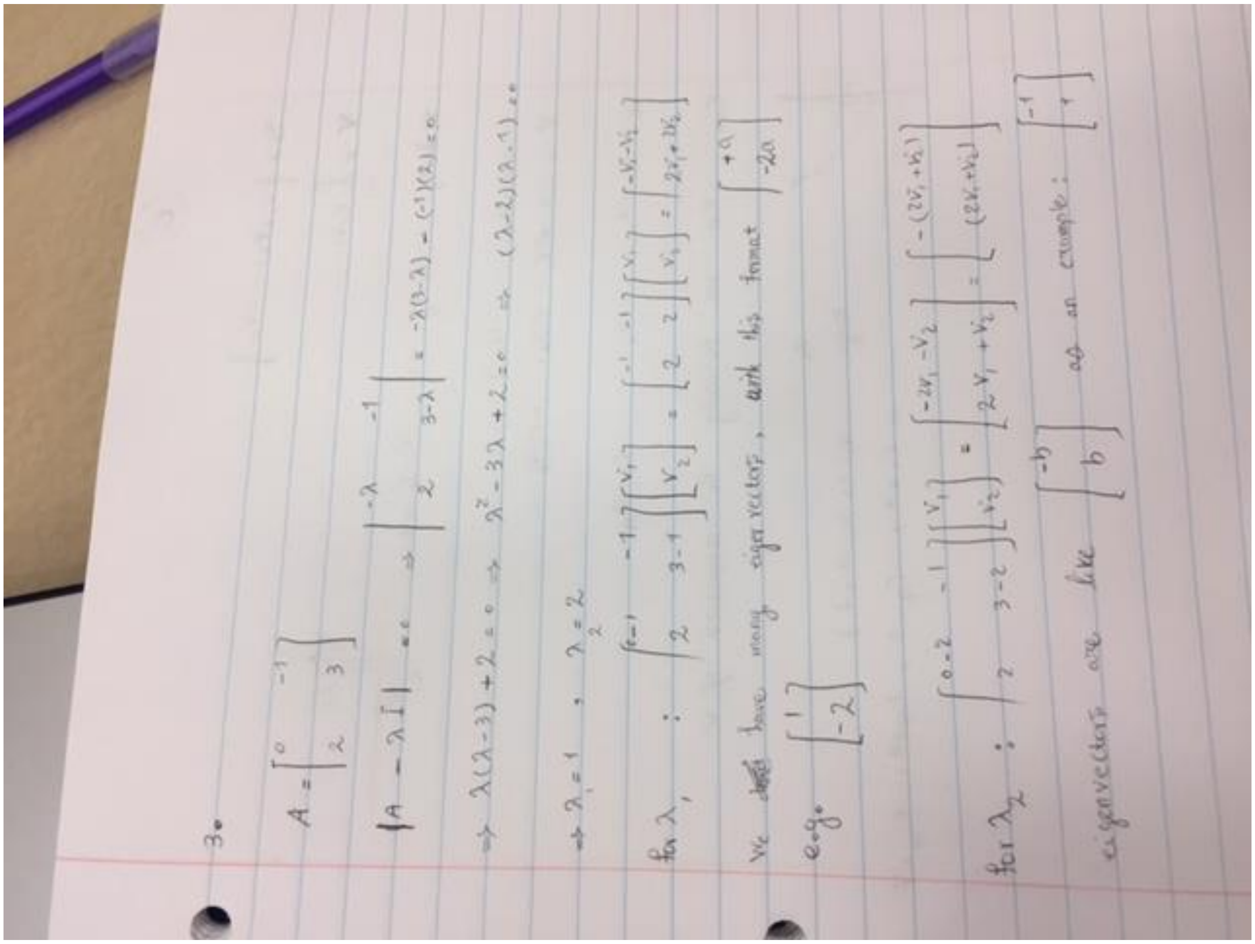
transform matrix is:

[[0.18857784 0.98203351 -0.00697082]

 [0.00448705 0.00623651 0.99997049]

 [0.982048   -0.18860355 -0.00323037]]

Q3



3.

$A = \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix}$

$|A - \lambda I| = 0 \Rightarrow \begin{vmatrix} -\lambda & -1 \\ 2 & 3-\lambda \end{vmatrix} = -\lambda(3-\lambda) - (-1)(2) = 0$

$\Rightarrow \lambda(\lambda-3) + 2 = 0 \Rightarrow \lambda^2 - 3\lambda + 2 = 0 \Rightarrow (\lambda-2)(\lambda-1) = 0$

$\Rightarrow \lambda_1 = 1 \ , \ \lambda_2 = 2$

for λ_1 : $\begin{bmatrix} 1-1 & -1 \\ 2 & 3-1 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} -v_1 - v_2 \\ 2v_1 + 2v_2 \end{bmatrix}$

We ~~dont~~ have many eigen vectors, with this format $\begin{bmatrix} +a \\ -2a \end{bmatrix}$

e.g. $\begin{bmatrix} 1 \\ -2 \end{bmatrix}$

for λ_2 : $\begin{bmatrix} 0-2 & -1 \\ 2 & 3-2 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} -2v_1 - v_2 \\ 2v_1 + v_2 \end{bmatrix} = \begin{bmatrix} -(2v_1 + v_2) \\ (2v_1 + v_2) \end{bmatrix}$

eigenvectors are like $\begin{bmatrix} -b \\ b \end{bmatrix}$ as an example : $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$

```
In [84]: A=[[0,-1],[2,3]]

In [85]: A
Out[85]: [[0, -1], [2, 3]]

In [86]: la.eig(A)
Out[86]:
(array([ 1.,  2.]), array([[-0.70710678,  0.4472136 ],
        [ 0.70710678, -0.89442719]]))
```

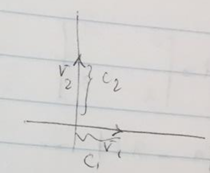
Q2

c

$S = \{v_1, v_2, \ldots, v_n\}$

$V = \sum_{i=1}^{n} c_i v_i$

$v_i \perp v_j \qquad v_i \cdot v_j = 0 \qquad v_i \cdot v_i = 1$

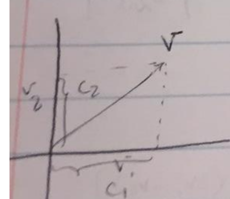


$V = (a_1, a_2, \ldots, a_n)$

$V = c_1 v_1 + c_2 v_2 + c_3 v_3 + \cdots + c_n v_n$

$\Rightarrow \quad c_1 = a_1, \quad c_2 = a_2, \ldots, \quad c_n = a_n$

$c_1, \ldots, c_n$ are basically the components of V



e.g. $\quad V = (1, 2, 4, 7)$

$\Rightarrow c_1 = 1, \quad c_2 = 2, \quad c_3 = 4, \quad c_4 = 7$