3. EIGENVALUES & EIGENVECTORS

a) Eigenvalues & eigenvectors

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1 INTRODUCTION

Eigen vector of a matrix A is a vector represented by a matrix X such that when X is multiplied with matrix A, then the direction of the resultant matrix remains same as vector X. Mathematically, above statement can be represented as:

$AX = X$ where A is any arbitrary matrix,   are eigen values and X is an eigen vector corresponding to each eigen value.

(i) The eigen values and corresponding eigen vectors are given by the characteristic equation, $|A–I| = 0$

(ii) To find the eigen vectors, we use the equation (A − I) X = 0 and solve it by Gaussian elimination, that is, convert the augmented matrix (A − I) = 0 to row echelon form and solve the linear system of equations thus obtained.

2 PYTHON CODE

SYNTAX: np.linalg.eigvals(A) (Returns eigen values)

SYNTAX: np.linalg.eig(A) (Returns eigen vectors)

[7]:
```
from numpy import linalg, matrix
M = matrix([[4, 3, 2], [1, 4, 1], [3, 10, 4]])
eigenValues = linalg.eigvals(M)
eigenVectors = linalg.eig(M)
print("\nEigenvalues...")
for i in eigenValues: print(i)
print("\nEigenvectors...")
for i in eigenVectors: print(i)
```

```
Eigenvalues…
8.982056720677654
2.1289177050273396
0.8890255742950103

Eigenvectors…
[8.98205672 2.12891771 0.88902557]
```

```
[[-0.49247712 -0.82039552 -0.42973429]
 [-0.26523242  0.14250681 -0.14817858]
 [-0.82892584  0.55375355  0.89071407]]
```