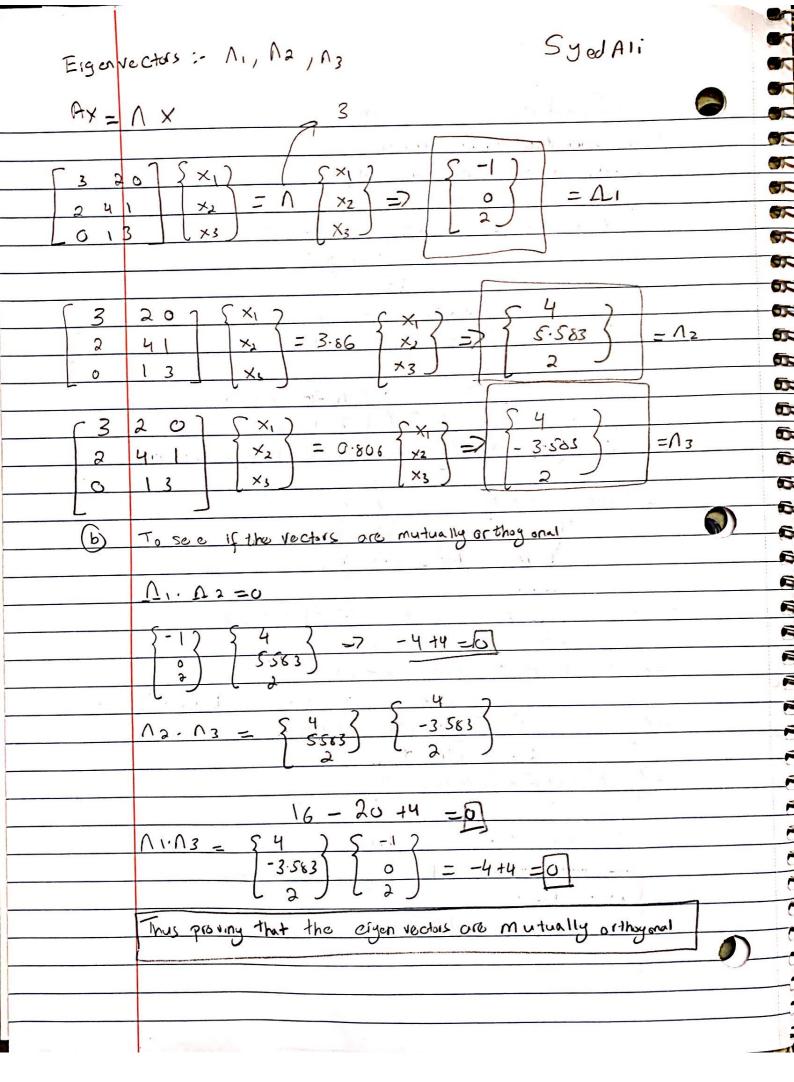
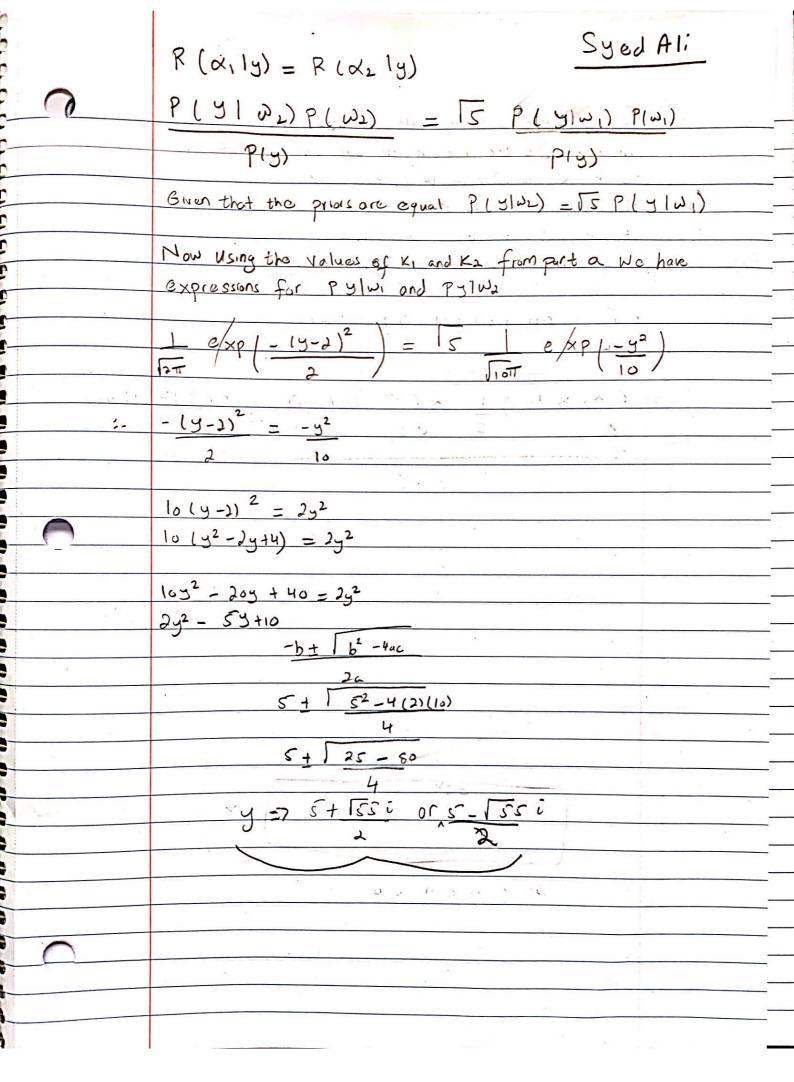
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Syed Ali Port cand d done in python By (x1 W.) - Ki exp (-y2) P(x2 | D2) = K2 exp (- (4-2)2) $P(x_1 | w_1) = K_1 \exp\left(\frac{-y^2}{\Gamma_0}\right) = \frac{1}{12\pi\sigma_1^2} \exp\left(\frac{-(y-\mu)^2}{2\sigma^2}\right)$ $\frac{K_1(4y^2) - 1}{10} + \frac{(y-\mu)^2}{10}$ Where $\mu_1 = 0$; $\sigma_1^2 = 5$ $\frac{y^2}{10} - \frac{1}{2.5} \left(\frac{y-0}{2.5} \right)$ $P(x_1|w_2) = K_2 \exp(-(y-2)^2) = 1 \exp(-(y-2)^2)$ $= \frac{1}{2\pi \sigma_1^2} \exp(-(y-2)^2)$ Similarly $K_2 e \times P \left(-\frac{(y-2)^2}{2}\right) = \frac{1}{12\pi \sigma_1^2} e \times P \left(-\frac{(y-3)^2}{2}\right)$ Plots done in python



Syed Ali

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Syed Ali HMWK4 Problem 1 c and d

```
import numpy as np
import scipy.linalg as la
import matplotlib.pyplot as plt
```

Initialize a covariance matrix for a three dimensional data

```
In [2]: X = np.array([[3,2,0],[2,4,1],[0,1,3]])
    print(X)

[[3 2 0]
    [2 4 1]
    [0 1 3]]
```

find eigenvalues and eigenvectors using numpy.linalg

```
In [3]: eg, egv = la.eig(X)
    print(eg)

[5.79128785+0.j 1.20871215+0.j 3. +0.j]

In [4]: print(eg[0])
    (5.791287847477921+0j)

In [5]: print(egv[0])
    print(egv[1])
    print(egv[2])

[-0.55920734  0.69805956 -0.4472136 ]
    [-7.80454320e-01 -6.25212808e-01  8.06936742e-17]
    [-0.27960367  0.34902978  0.89442719]
```

Distance between two vectors

```
In [6]: y1 = np.array([1,2,1])
    y2 = np.array([2,1,3])

In [7]: d1 = la.norm(y1-y2)
    print(d1)
    2.449489742783178
```

Let us project y1 and y2 on eigenvectors

```
In [8]: y1p = np.dot(egv,y1)
    y2p = np.dot(egv,y2)
```

```
print(y1p)
print(y2p)

[ 0.3896982 -2.03087994 1.31288309]
[-1.76199589 -2.18612145 2.47310402]
```

Distance between the two vectors in the projected space

2.4494897427831774

Based on this we can see that the transformation of space R³ and R³ is distance preserving

Now let us ignore the eigenvalues with the least magnitude which is egv[1]. We will set this row to zero

Now let us project y1 and y2

2.4445654159683534

So based on this we can see that dimensionality reduction is possible from three - two from the covariance matrix and find the eigen vectors (principal components). Ignore or assign zeros to the eigenvector

corresponding to the least value. Then project the original data on new space and eliminate the values in the least eigenvector row.

Problem 2 a

```
In [13]: %matplotlib inline
    k1 = 1.0/np.sqrt(10*np.pi)
    k2 = 1.0/np.sqrt(2*np.pi)

    x = np.arange(-10,30,0.1)
    y1 = k1*np.exp((-x**2)/10)
    y2 = k2*np.exp((-(x-2)**2)/2)

    plt.plot(x, y1, 'blue', x, y2, 'red')
    plt.legend(['p(x|w1)', 'p(x|w2)'])
    plt.xlabel('y')
    plt.ylabel('p')
    plt.yticks(np.arange(0, 0.5, step=0.04))
    plt.show()
```

