1. PCA is employed for Dimensionality reduction
   Ans c
2. The direction of the largest principal component is given as eigenvector corresponding to maximum eigenvalue of the data covariance matrix
   Ans b
3. Principal components of data can be found Via projection of data along principal directions
   Ans a
4. The matrix can be simplified as

$$\mathbf{R} = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix} \begin{bmatrix} 4 & 0 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} & -\frac{1}{\sqrt{5}} \end{bmatrix} \begin{bmatrix} 4 \times \sqrt{5} \times \sqrt{5} & 0 \\ 0 & 3 \times \sqrt{5} \times \sqrt{5} \end{bmatrix} \begin{bmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} & -\frac{1}{\sqrt{5}} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} & -\frac{1}{\sqrt{5}} \end{bmatrix} \begin{bmatrix} 20 & 0 \\ 0 & 15 \end{bmatrix} \begin{bmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} & -\frac{1}{\sqrt{5}} \end{bmatrix}$$

   Hence, principal direction corresponding to eigenvalue 20 is

$$\begin{bmatrix} \frac{1}{\sqrt{5}} \\ \frac{2}{\sqrt{5}} \end{bmatrix}$$

   Ans c
5. The data matrix **X** in the lecture has been defined as

$$\frac{1}{\sqrt{N-1}} \begin{bmatrix} \bar{\mathbf{x}}_1^T \\ \bar{\mathbf{x}}_2^T \\ \vdots \\ \bar{\mathbf{x}}_N^T \end{bmatrix}$$

   Ans c
6. The principal directions can also be obtained as p dominant column space vectors of **X**
   Ans b
7. The PCA routine can be imported in PYTHON as
   from sklearn.decomposition import PCA
   Ans a
8. The Iris dataset can be loaded as
   irisset = datasets.load_iris()
   Ans c
9. PCA can be applied and data X can be transformed in PYTHON as
   Xp = pca.fit(X).transform(X)
   Ans a
10. Gaussian mixture can be loaded as
    from sklearn.mixture import GaussianMixture

Ans a