Sheet#2 LDA

Orthogonal Projection

1) For the given vectors $\mathbf{u}_1$ and $\mathbf{u}_2$
   a) Verify $\mathbf{u}_1$ and $\mathbf{u}_2$ are orthogonal
   b) Find the projection of the point $y=[6,3,-2]^T$
      on $\mathbf{u}_1$ and $\mathbf{u}_2$

$$\mathbf{u}_1 = \begin{bmatrix} 3 \\ 4 \\ 0 \end{bmatrix}, \text{ and } \mathbf{u}_2 = \begin{bmatrix} -4 \\ 3 \\ 0 \end{bmatrix}$$

LDA

2) For the data on two class problem
   a) Compute $\mathbf{\mu}_{+1}$ and $\mathbf{\mu}_{-1}$, and $\mathbf{B}$, the between-class scatter matrix.
   b) Find the best direction $\mathbf{w}$ that discriminates between the classes and **sketch** it.

   Given $\mathbf{S}^{-1} = \begin{pmatrix} 0.056 & -0.029 \\ -0.029 & 0.052 \end{pmatrix}$
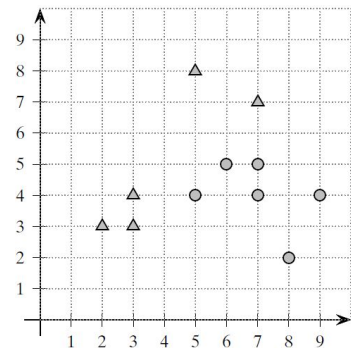
3) For the data on two class problem **[if you encounter numerical issues don't worry use python solvers]**
   a) Compute $\mathbf{\mu}_{+1}$ and $\mathbf{\mu}_{-1}$, and $\mathbf{B}$, the between-class scatter matrix.
   b) Compute $\mathbf{S}_{+1}$ and $\mathbf{S}_{-1}$, and $\mathbf{S}$, the within-class scatter matrix.
   c) Find the best direction $\mathbf{w}$ that discriminates between the classes.
   d) Having found the direction $\mathbf{w}$, find the point on $\mathbf{w}$ that best separates the two classes.

i	$\mathbf{x}_i$	y_i
x_1	(4,2.9)	1
x_2	(3.5,4)	1
x_3	(2.5,1)	−1
x_4	(2,2.1)	−1

4) **Midterm Question Fall 2017**
   For the data on two class problem
   a) Compute μ_{+1} and μ_{-1}, and B, the between-class scatter matrix.
   b) Compute $\mathbf{S}_{+1}$ and $\mathbf{S}_{-1}$, and S, the within-class scatter matrix.
   c) Visually sketch the best direction that splits the data into the two classes

i	x	yi
X1	(1,1)	1
X2	(2,1)	1
X3	(1,2)	1
X4	(2,2)	-1
X5	(3,2)	-1