

## Q.3

$$\begin{aligned} & \text{minimize } \sum_n \left( \bar{v}^T \bar{d}_n \right)^2 \\ & \text{subject to: } \bar{v}^T \bar{w} = 1 \end{aligned}$$

a)

The function: 
$$\begin{aligned} & (v^T D)^2 = (v^T D)(D^T v) \\ & = (v^T D)(v^T D)^T \\ & = v^T D D^T v \end{aligned}$$

$$\bar{v} = v^T D$$

the transpose of  $\bar{v}$  is:

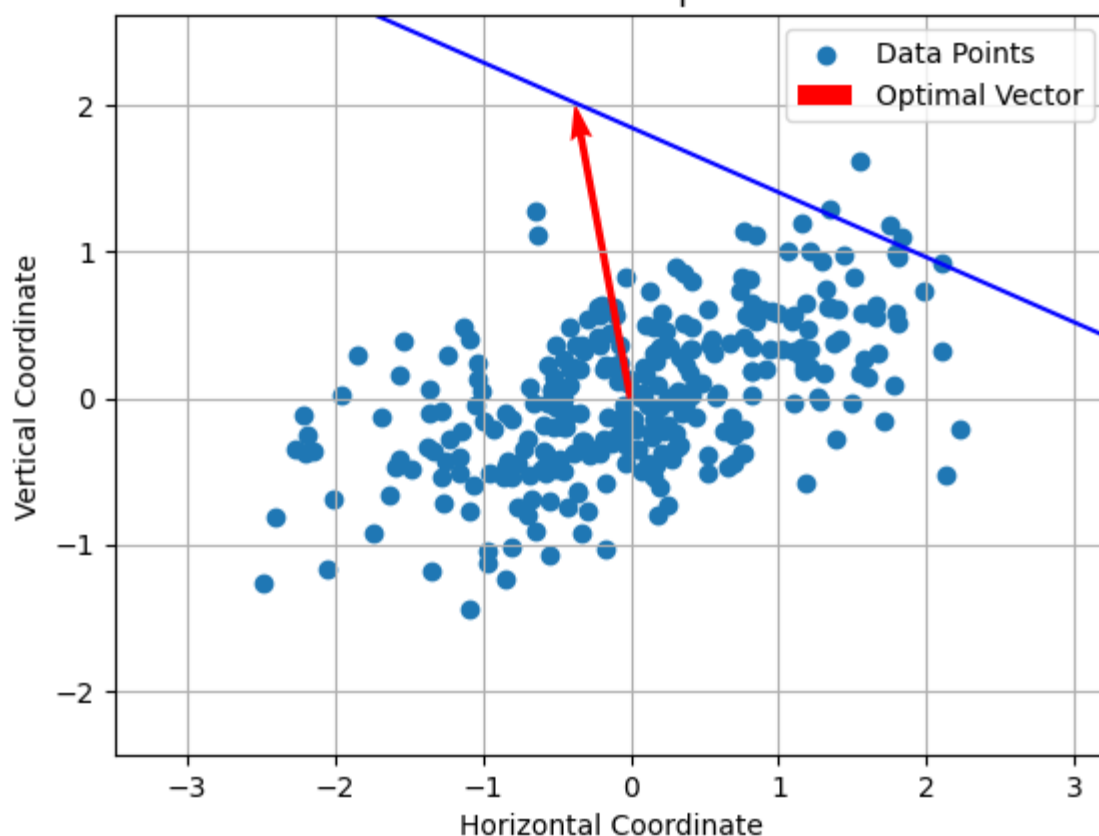
$$\bar{v}^T = D^T v$$

Thus, the constraint in terms of  $\bar{v}$  becomes: 
$$D^T v \bar{w} = 1$$

b)

[-0.37824291 2.0199598]

2D Data Points and Optimal Vector



c)

The optimal vector is perpendicular to the constraint line due to the dot product:  $[0.99999999]$   
The Least Squares Solution and the optimal solution are not the same because of the constraint.

