1. $N = 4$
   $D = 3$

a. Starting point

$W_0 = [2 \quad 3 \quad 5 \quad 1]$

↑ 4 random integers > 0

$$\nabla J = \begin{bmatrix} \frac{\partial J}{\partial w_1} \\ \frac{\partial J}{\partial w_2} \\ \frac{\partial J}{\partial w_3} \\ \frac{\partial J}{\partial w_4} \end{bmatrix}$$

$$\underline{W}_1 = \underline{W}_0 - \rho \nabla_{\underline{W}(0)} J^T(W_{(0)})$$

$$\underline{W}_2 = \underline{W}_1 - \rho \nabla_{\underline{W}(1)} J^T(W_{(1)})$$

$$\underline{W}_3 = \underline{W}_2 - \rho \nabla_{\underline{W}(2)} J^T(W_{(2)})$$

2.

Y \ X	0	1	
0	1/8	3/8	$= 1/2$
1	3/8	1/8	$= 1/2$
	$= 1/2$	$= 1/2$	

$$P(X=0 \mid Y=1) = \frac{3/8}{1/2} = .75$$

$$P(X=0 \mid Y=0) = \frac{1/8}{1/2} = .25 \neq P(X=0) = 1/2$$

3. The test set is used to generate the weight vectors, while the validation set is used to test the weight vectors generated from the test set, this allows for a test of the error of the weight vectors.