Ques 3 $\{x_1 = [1,1]$ & $y = 1\}$ & $\{x_2 = [1,-1], y_2 = -1\}$

perceptron error f^n $e = (\hat{y} - y)^2$ $\hat{y}$ = predicted value

$= w^T x$

for point x ; $x_1 = 1$ $= w_1 x_1 + w_2 x_2$

$x_2 = 1$ then $\hat{y} = w_1 + w_2$

Then $e_1 = (w_1 + w_2 - 1)^2$

$= w_1^2 + (w_2 - 1)^2 + 2(w_1)(w_2 - 1)$

$= w_1^2 + w_2^2 + 1 + 2w_1 w_2 - 2w_1 - 2w_2$

for point x_2

$x_1 = 1$

$x_2 = -1$ then $\hat{y} = w_1 - w_2$

$e_2 = (w_1 - w_2 + 1)^2 = [w_1 - (w_2 - 1)]^2$

$= w_1^2 + (w_2 - 1)^2 - 2[w_1(w_2 - 1)]$

$= w_1^2 + w_2^2 + 1 - 2w_2 - 2w_1 w_2 + 2w_1$

mean error f^n

$$f(w_1 w_2) = \frac{e_1 + e_2}{2}$$

$$f(w_1 w_2) = w_1^2 + w_2^2 + 1 - 2w_2$$

1) sorface will be look like convex / bowl parabol 3 D (facing upward) & its local / global minima will be on first ~~son~~ quardornt

ii) along with w_1 & w_2 ~~it~~ will form hyperbola in $f(2)$ direction

iii) center point Minima Point $= (0,1)$

ie $\begin{bmatrix} w_1 = 0 \\ w_2 = 1 \end{bmatrix}$

b) Given error f^n

$$e = (y - \hat{y})^2$$

$$= (w_1 + w_2 - 1)^2 = w_1^2 + w_2^2 + 1 + 2w_1w_2 - 2w_1 - \dots$$

then $H = \begin{bmatrix} \frac{\partial^2 e}{\partial w_1^2} & \frac{\partial^2 e}{\partial w_1 w_2} \\ \frac{\partial^2 e}{\partial w_2 w_1} & \frac{\partial^2 e}{\partial w_2} \end{bmatrix}$

$$\frac{\partial e}{w_1} = 2w_1 + 2w_1 - 2$$

$$\frac{\partial^2 e}{\partial w_1^2} = 2 + 2 = 4$$

$\frac{\partial e}{w_1} = 2w_1 + 2w_1 - 2$

$\frac{\partial^2 e}{\partial w_2} = 6$

$$\frac{\partial e}{\partial w_2} = 2w_2 + 2w_2 - 2 \qquad \frac{\partial^2 e}{\partial w^2} = 4$$

$$\frac{\partial e}{\partial w_2} = 0$$

$$H = \begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$$

$\lambda - 4 = 0$

$\boxed{\lambda = 4}$

eigen value = constant