1.(d)

$$\frac{dJ}{d\theta} = -(1/n)\sum_i \{y^i(1/\sigma(z)).\sigma(z).(1-\sigma(z))(x^i)^T$$
$$-(1-y^i)(1/(1-\sigma(z)))(-\sigma(z))(1-\sigma(z))(x^i)^T\}$$

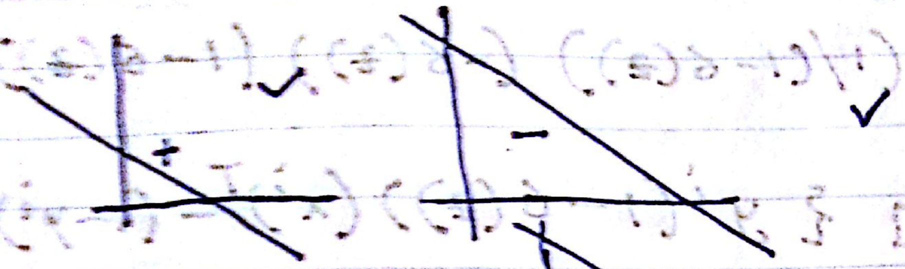
$$= -\left(\frac{1}{n}\right)\sum_i \{y^i(1-\sigma(z))(x^i)^T-(1-y^i)\sigma(z)(x^i)^T\}$$

$$= -\left(\frac{1}{n}\right)\sum_i (y^i-\sigma(z))(x^i)^T$$

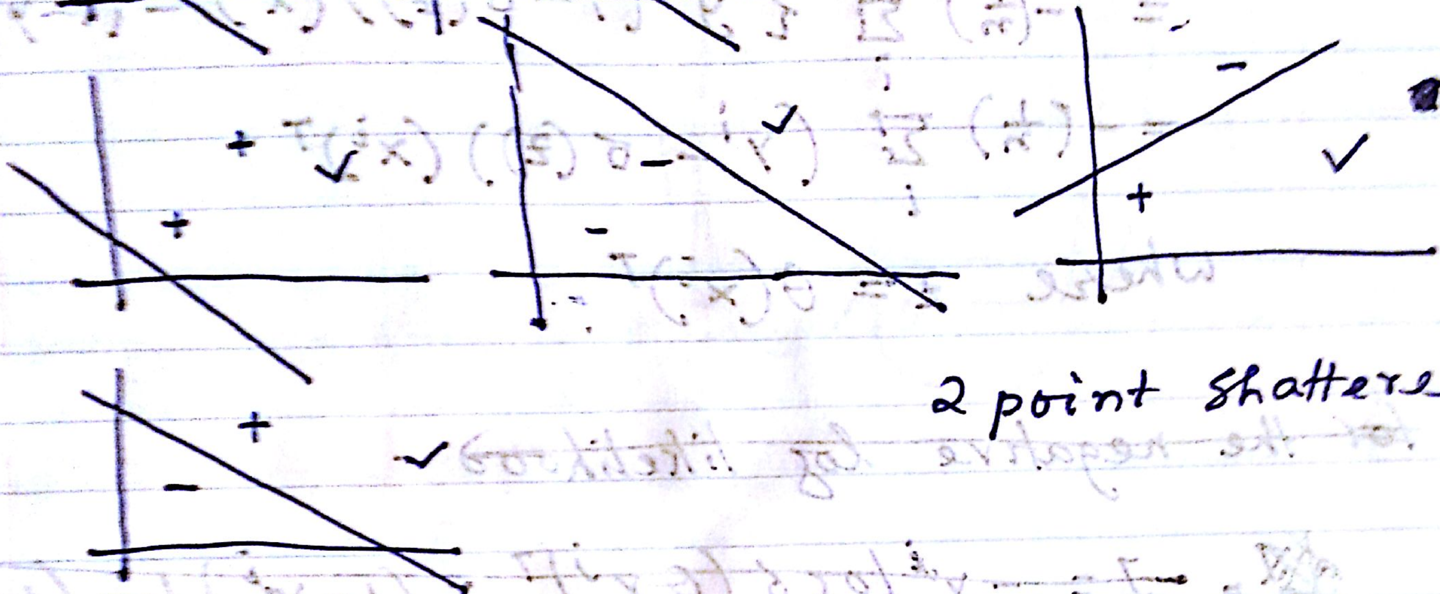
where $z=\theta(x^i)^T$.

Problem 2.

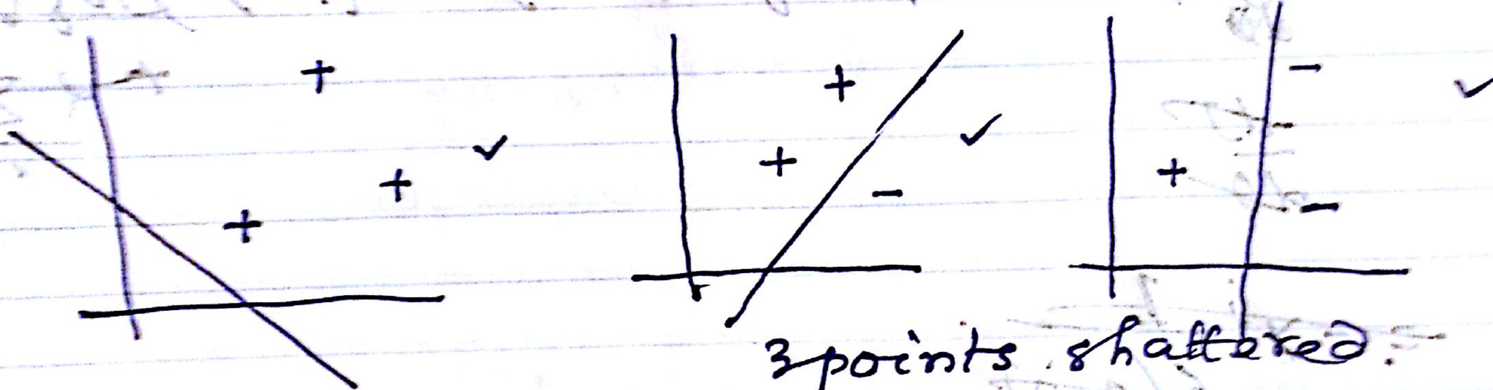
$T(a+bx_i)$



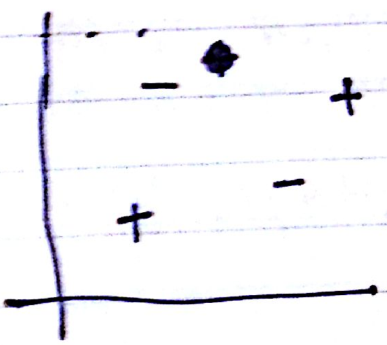
1 point shattered



2 point shattered

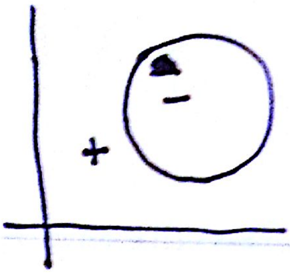


3 points shattered.



not possible $\Rightarrow$ VC dimension $= 3$.

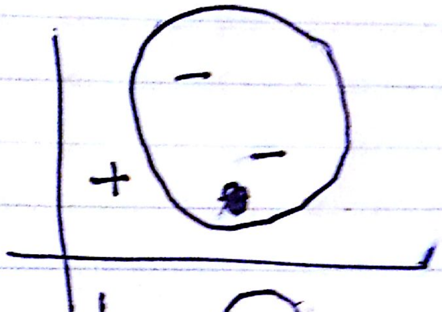
(b)



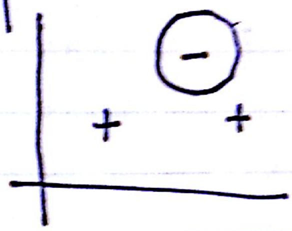
$(x_1-a)^2+(x_2-b)^2+c$

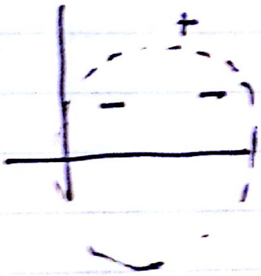
ellipse

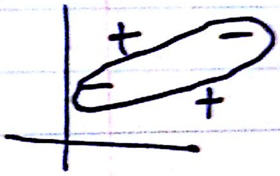
yes we can shatter 2 points as we have the flexibility of choosing a, b.

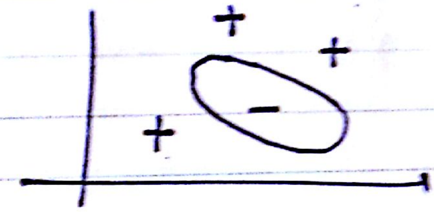


for all combinations 3 points shattered









→ ~~not~~ possible

VC dim = 4

(c) $(ab)x_1 + (c/a)x_2 \gtrless 0$

$\Rightarrow a^2 b\, x_1 + c\, x_2 \gtrless 0$

It is a hyperplane in 3-D space but goes through origin

a, b will be shattered but (c) (d) will not be shattered because we can't control the intercept as it has to go through origin.