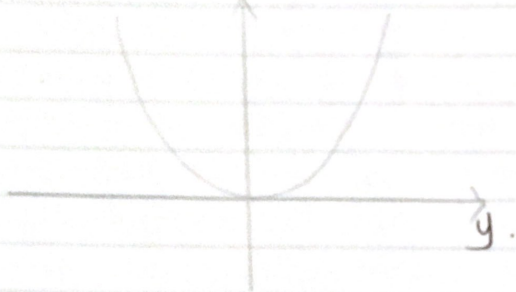
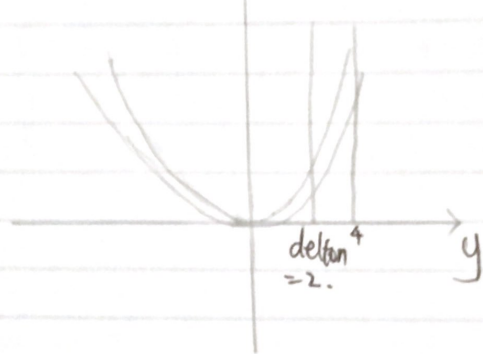


Q.1 a)

squared error loss



huber loss



$$Q1 \ b) \ \frac{\partial L}{\partial w} = \frac{\partial H_s(y-t)}{\partial w}$$

$$= \frac{\partial}{\partial w} H'(y-t).$$

$$= \frac{\partial}{\partial w} H'(w^T x + b - t).$$

$$= \frac{\partial (y-t)}{\partial w} H'(x^T w + b - t).$$

$$H'_s(a) = \begin{cases} a & \text{if } |a| \leq \delta \\ \delta & \text{if } |a| > \delta, \end{cases}$$

$$H'_s(y-t) = \begin{cases} w^T x + b - t & \text{if } |a| \leq \delta \\ \delta & \text{if } |a| > \delta \end{cases}$$

$$\frac{\partial L}{\partial w} = x^T H'_s(y-t).$$

$$\frac{\partial L}{\partial b} = \frac{\partial (y-t)}{\partial b} \cdot H'(y-t).$$

$$= H'(y-t).$$

Q2 a)

$$L(w) = \frac{1}{2} (y - Xw)^T A (y - Xw) + \frac{\lambda}{2} \|w\|^2$$

$$w^* = \arg \min L(w).$$

$$L(w) = \frac{1}{2} (y^T - w^T A^T) A (y - Xw) + \frac{\lambda}{2} \|w\|^2.$$

$$= \frac{1}{2} (y^T A y - 2w^T X^T A y + w^T X A X w) + \frac{\lambda}{2} \|w\|^2$$

$$\frac{\partial L}{\partial w} = X^T A y + X^T A X w + \lambda w \quad \text{note: } y = \|w\|^2$$

$$= 0.$$

then

$$(X^T A X + \lambda I) w = X^T A y$$

$$w^* = (X^T A X + \lambda I)^{-1} X^T A y.$$